THE COMMUNAL COMMUTE

Addressing Access to the City through the use of Public Transport Infrastructure

Bernhard van Renssen

THE COMMUNAL COMMUTE

-PURPOSE-

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

-UNIVERSITY-

Department of Architecture

University of Pretoria

South Africa

2017

-COURSE COORDINATOR-

Dr. Arthur Barker

-STUDY LEADER-

Abre Crafford

-RESEARCH FIELD-

Human Settlement and Urbanism

-SITE LOCATION-

Mamelodi East, c/o Solomon Mahlangu drive and Hinterland road

25°43'22.80"S

28°24'7.77"E

-PROGRAM-

Transport hub and Workshop facility

-CLIENT-

The community of Mamelodi

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ABSTRACT

Since the establishment of Pretoria in the 1840s, the city has expanded significantly. Businesses started to sprout which created a number of job opportunities within the city CBD. Mamelodi was established to the east of Pretoria CBD in 1860 as a settlement for black people flocking to the city for job opportunities (Nico & Walker, 1991). Since its initial establishment, it has grown as a community and is now considered as one of the denser communities in Pretoria. Because of the distance to the city center or any other place of work, a series of public transport networks developed to deal with the daily commute to and from work. These networks put tremendous strain on the public infrastructure, and has resulted in a congested community where there exists little co-existence and co-ordination between isolated public transport types.

In an attempt to address this issue of *Access to the City*, this dissertation focuses on creating a communal Architecture where the existing programs of public transport root themselves, and where passengers and pedestrians can communally start their daily commute by safely engaging with the various transport systems. It further exploits the idea of *Community* and *Access* by being true to its architectural context. Therefore, this project and its construction is focused on being a product of the community. With contextual materials and community-engaged construction, it aims to be a true manifestation of the event that is *The Communal Commute*.

For from Him and through Him and to Him are all things.

To Him be the glory forever.

Amen

ROMANS 11:36 (NIV)

For all that supported me on this journey

For my Heavenly Father, blessing me with the talent of creativity

For my mother and father, giving me all the opportunities that you do
For my brothers and sister, supporting me unconditionally

For Proff. Arthur Barker and Abre Crafford, guiding me throughout this year

For Izak and Kanda, supporting my growth as an architect

For Henry Mathews, being next to me every step of the way
For the Venter family, providing continuous support and encouragement
For Sophia, loving and supporting through the highs and lows

THANK YOU

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01

INTRODUCTION

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01.1

ACCESS

"Access is the prerequisite to using any space. Without the ability to enter or to move within it, to receive and transmit information and goods, space is of no value, however vast or rich in resources. A level of a city is in the same proportion to the capacity of its circulation." (Lynch, 1960)...

"The necessity to commute considerable distances to work is a motion that has become a ritual of everyday life for many working-class people […] and is by no means a foreign concept to the context of South Africa. For many decades, people have been traveling from their homes in informal settlements to urban city areas to seek employment and better opportunities for themselves, and their families" (Whiteside, 1997).

The term '**Pendulum Migration**' describes the **commuting patterns of a community** typically when residential urban surfaces are extended away from the economic and industrial hub, usually the city CBD. These conditions cause a large group of people to travel to the CBD in the morning hours, and return to their neighbourhoods in the afternoon, resulting in a **one-way flow of traffic** to and from work (Mansell, 1985).

This concept of Pendulum Migration informs the investigation of this dissertation, namely to address the issue of **Equitable Access** (access to the city and its workplaces) by providing a **platform for choice** of transport mediums, public and private, for the daily commute of individuals.

As a spatial investigation, the need for a **communal hub** where commuters gather before and after their daily commute is considered as a public space that stimulates interaction between different public transport users and stakeholders and, in doing so, feeding an array of sub-programs such as informal or formal trading. Through studying the current level of accessibility, this dissertation argues the case for a **combined hub as a platform to improve ease-of-access to safe and affordable public transport**. The facility is envisioned as a dock for the public transport networks already prevalent on site, including public buses, taxis, trains, and the introduction of a new Non-Motorized Transportation hub (NMT-hub) for human-powered transport such as bicycles and battery-powered bicycles.

Through place making, this dissertation will further look at combining **multiple activity generators, social spaces and existing conditions** to create a **functional public space** that can **allow for adaptation** and extension over time, weaving together even more spaces that would normally stand in isolation from one other.

Figure 01.1: (Cover page) Phomolong Informal settlement (Author 2017)
Figure 01.2: Informal trading at public transport nodes (Author 2017)
Figure 01.3: Informal infrastructure for car washing facilities (Author 2017)
Figure 01.4: Bicycle-spare and repair shop found on site (Author 2017)

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01.2

SITE OVERVIEW

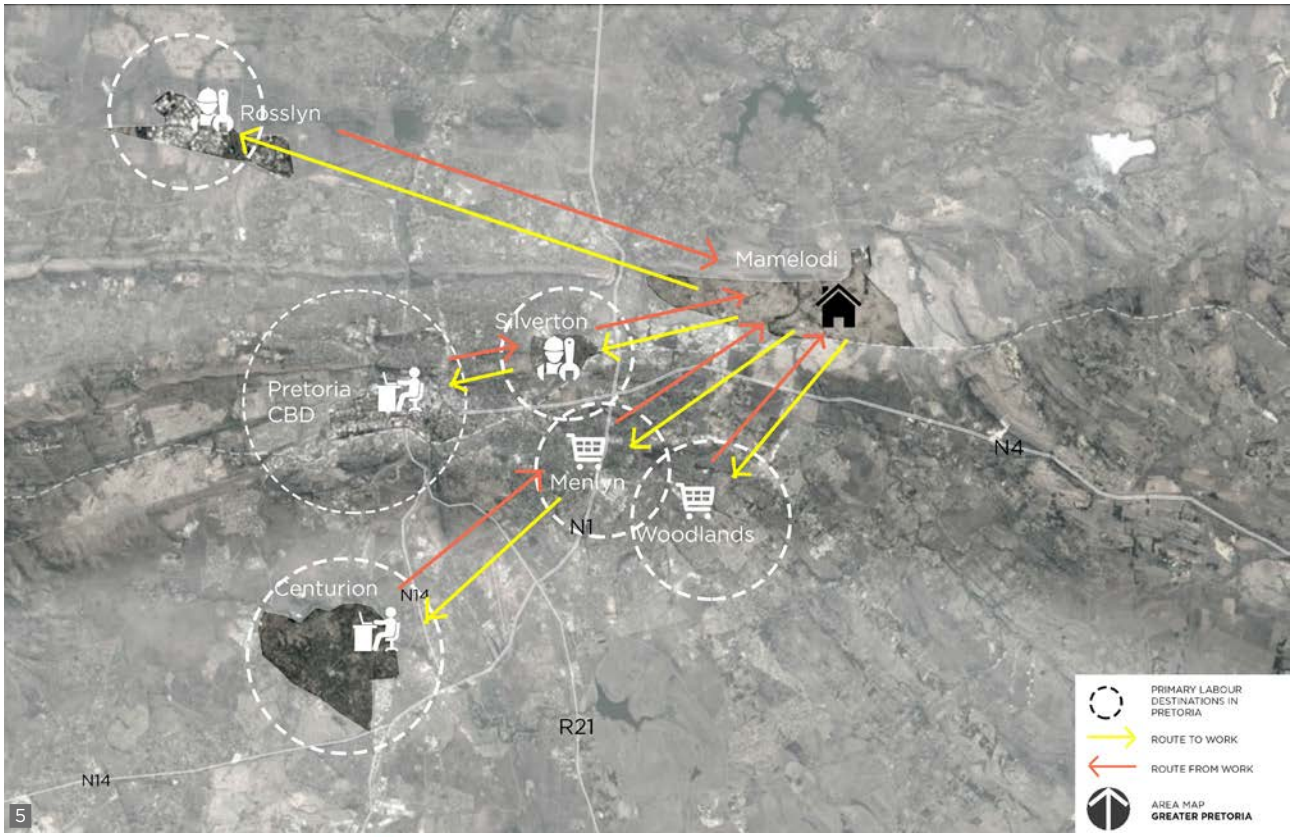
Since the establishment of Pretoria in the 1840s, the city has expanded significantly. Businesses started to sprout which created a number of job opportunities within the city CBD. Mamelodi was established to the east of Pretoria CBD in 1860 as a settlement for black people flocking to the city for job opportunities (Nico & Walker, 1991).

Population in the settlement was ever-inclining and it was formally declared a 'Black Township' in 1950. Since then, urban sprawl and rising population within Pretoria caused the township to grow between its geographical boundaries towards the east (mountain ranges on the North and South) (Clarke & Pause, 2005). This growth in population **increases the pressure** of the community population **to find work** within the city, as pendulum migration drains the energy from the community resulting in a **dormant neighbourhood during the daytime** where little job opportunities exist.

Facilitating this mass daily commute to and from work, several networks of public transport formed **organically** through the years. These transport networks are argued to be one of the most vital networks in any community (Kostof, 1991, pp. 37-38).

Upon considering a potential site for the proposed intervention, an investigation of **existing unformalized transport networks** within the area is important to find an ideal location where a high frequency of transport nodes exist, as well as potential (could also be already existing) trading opportunities that can strategically benefit from the proposed transport dock.

Looking at the eastern extensions of Mamelodi **(Figure 01.8)** where several different income classes and living typologies exist, this area becomes an ideal area for the hub, with its **large amount of condensed existing transport nodes** and **close proximity to the main transport artery** leading in and out of Mamelodi (Solomon Mahlangu drive). A big open site to the east of the road offers a great platform to start the investigation on, as a great number of locals set-up their informal trade stalls **between several taxi and bus stops** all within **close proximity** of one another.



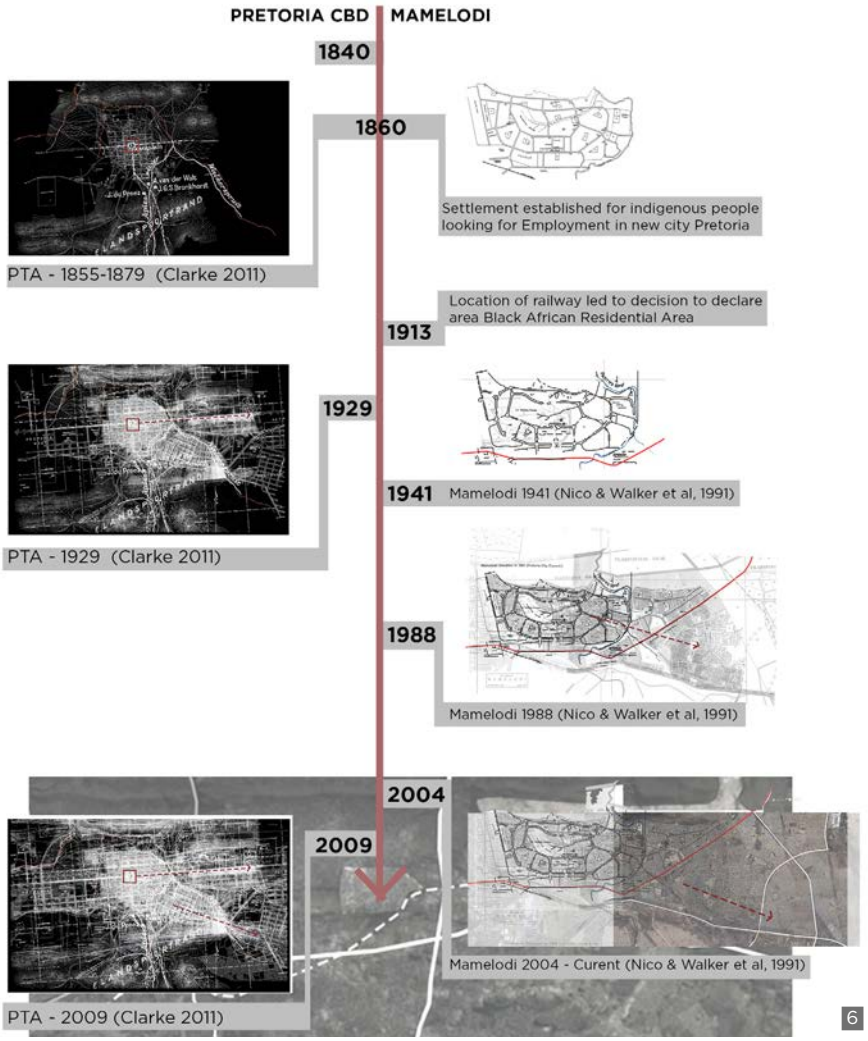
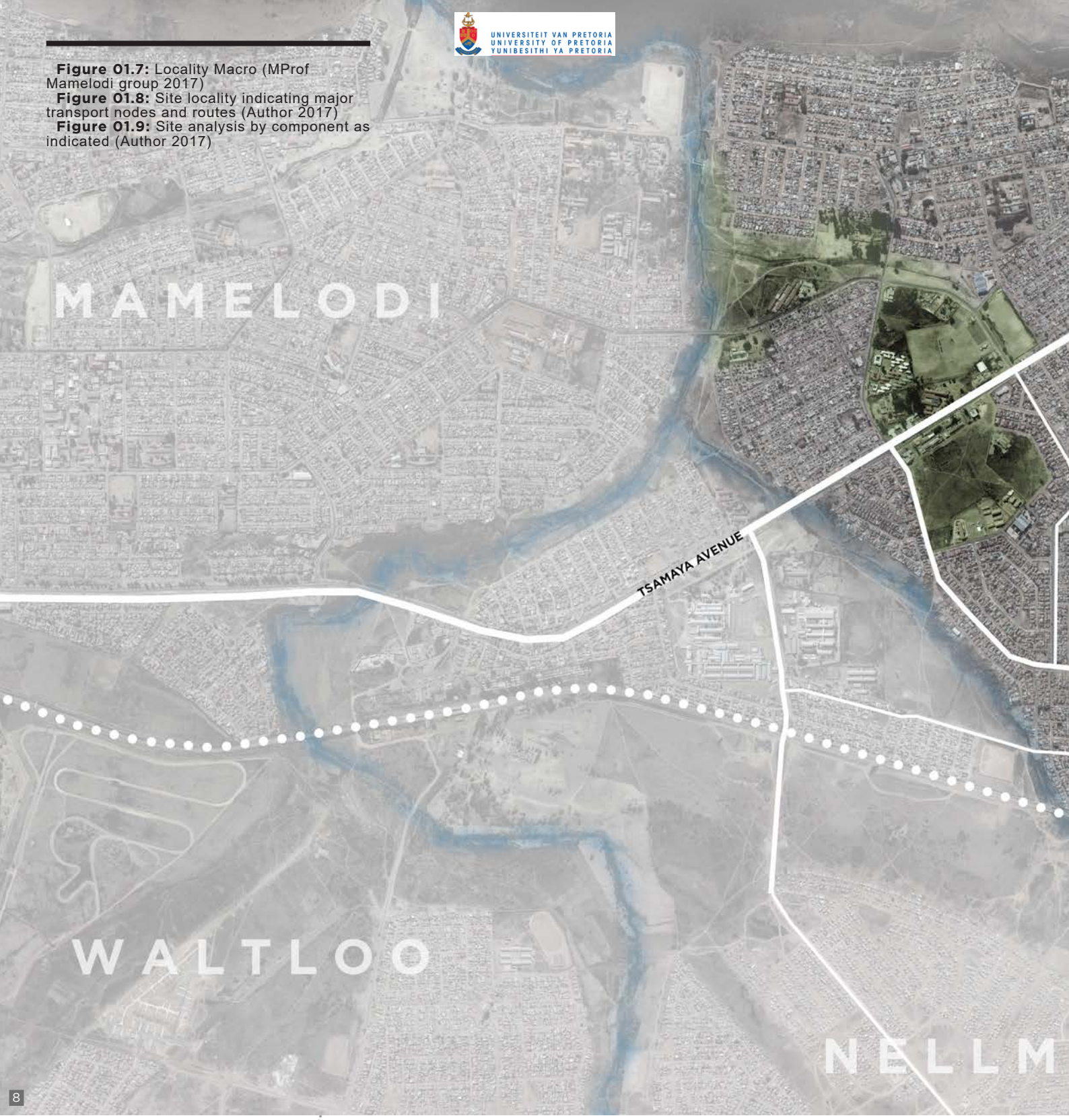


Figure 01.5: Pendulum migration to and from primary work destinations in Pretoria (Author 2017)
Figure 01.6: Historic Spatial development of Pretoria compared to Mamelodi (Clarke 2011)(Nico & Walker 1991)

Figure 01.7: Locality Macro (MProf Mamelodi group 2017)
Figure 01.8: Site locality indicating major transport nodes and routes (Author 2017)
Figure 01.9: Site analysis by component as indicated (Author 2017)



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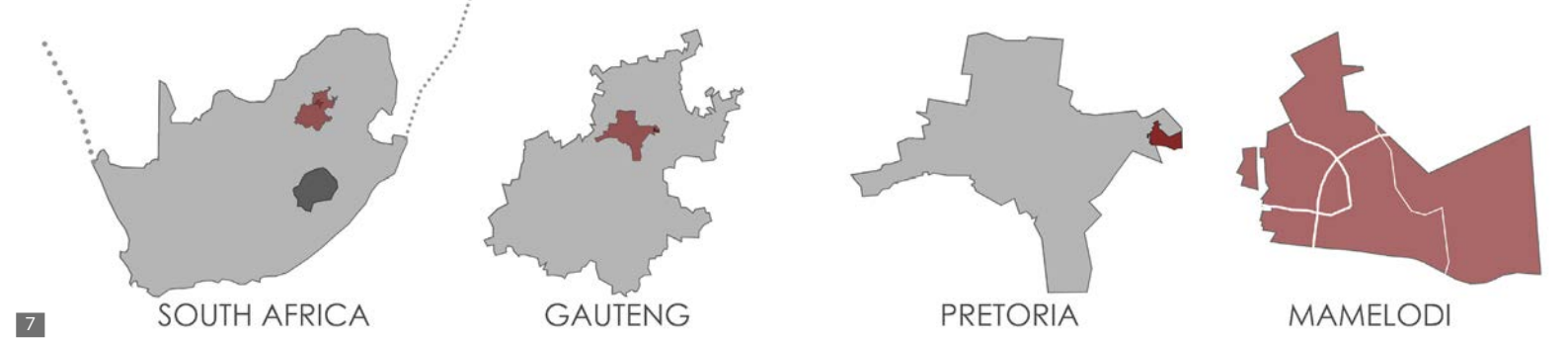

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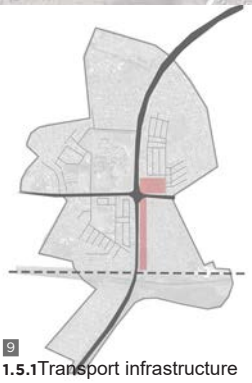
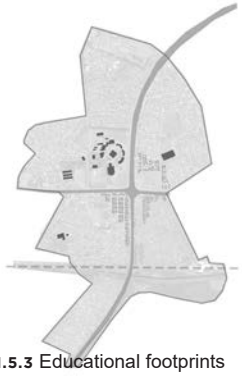


1.5.1 Transport infrastructure

1.5.2 Open public space

1.5.3 Housing footprints



1.5.3 Educational footprints

01.3

ISSUES

-GENERAL ISSUE-

As a result of pendulum migration, **access to the city** is the biggest issue amongst residents of Mamelodi east. **High public transportation costs** result in an average of 20% - 40% of residents' total monthly income is spent on their commute, while other issues include the **total traveling time**, as commuters often have to take subsequent means of transport to and from the main public transport node (Bechstein 2014)

A more extensive argument on this topic is made in the academic paper on page 27.

-URBAN ISSUE-

Figure 01.10 illustrates the growth of both Mamelodi and Pretoria CBD as a result of urban sprawl: where cities grow **bigger and not denser**. The spread-out city conditions formed as a result of private vehicles being the main means of transport, causing a condition of **over-emphasis on vehicular roads**. Pedestrian needs such as **sidewalks and cycling infrastructure** is often **neglected** due to this condition.

-ARCHITECTURAL ISSUE-

Nodes of public transport formed sporadically as Mamelodi extended towards the east. Different nodes formed organically within the boundaries of the internal community networks, with sub-nodes such as trading and other economic opportunities **spawning in proximity** to these nodes. A **lack of coordination** between the informal transport nodes causes **major congestion** on the main intersection between Solomon Mahlangu and Hinterland road as different transport types **cross** from one side to another to load and unload passengers. Pedestrians also cross **between traffic** to get to the informal trading happening on the periphery of the residential neighbourhoods, resulting in a zone where vehicles, traders and pedestrians **compete** for the same space, rather than **sharing** the infrastructure for mutual benefit.

PTA - 1855-1879 (Clarke 2011)

PTA - 1929 (Clarke 2011)

PTA - 2009 (Clarke 2011)

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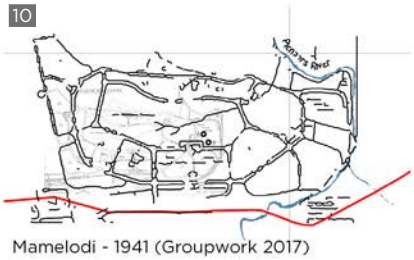
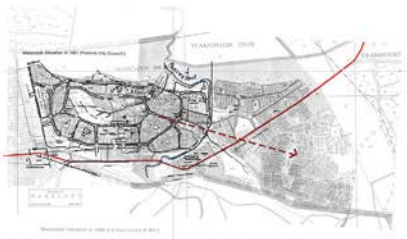
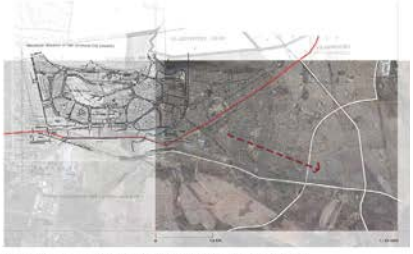


Mamelodi - 1941 (Groupwork 2017)



Mamelodi - 1988 (Groupwork 2017)



Mamelodi - 2004 (Groupwork 2017)

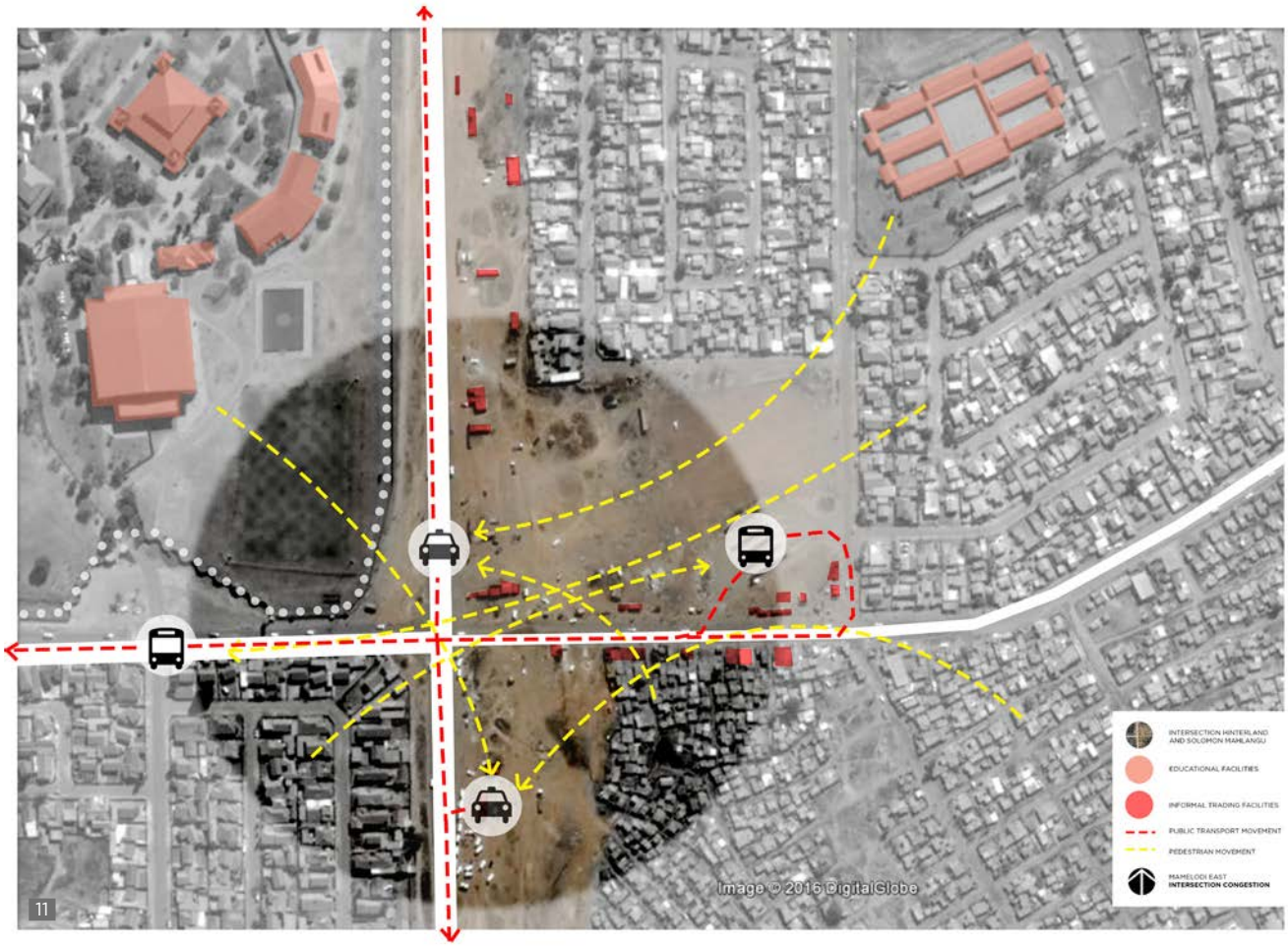


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Figure 01.10: Growth of Mamelodi compared to that of Pretoria CBD as a result of urban sprawl (Clarke 2011, edited by Author 2017)

Figure 01.11: Pedestrian and Public vehicle intersecting the crossing of Hinterland road and Solomon Mahlangu drive (Author 2017)

01.4

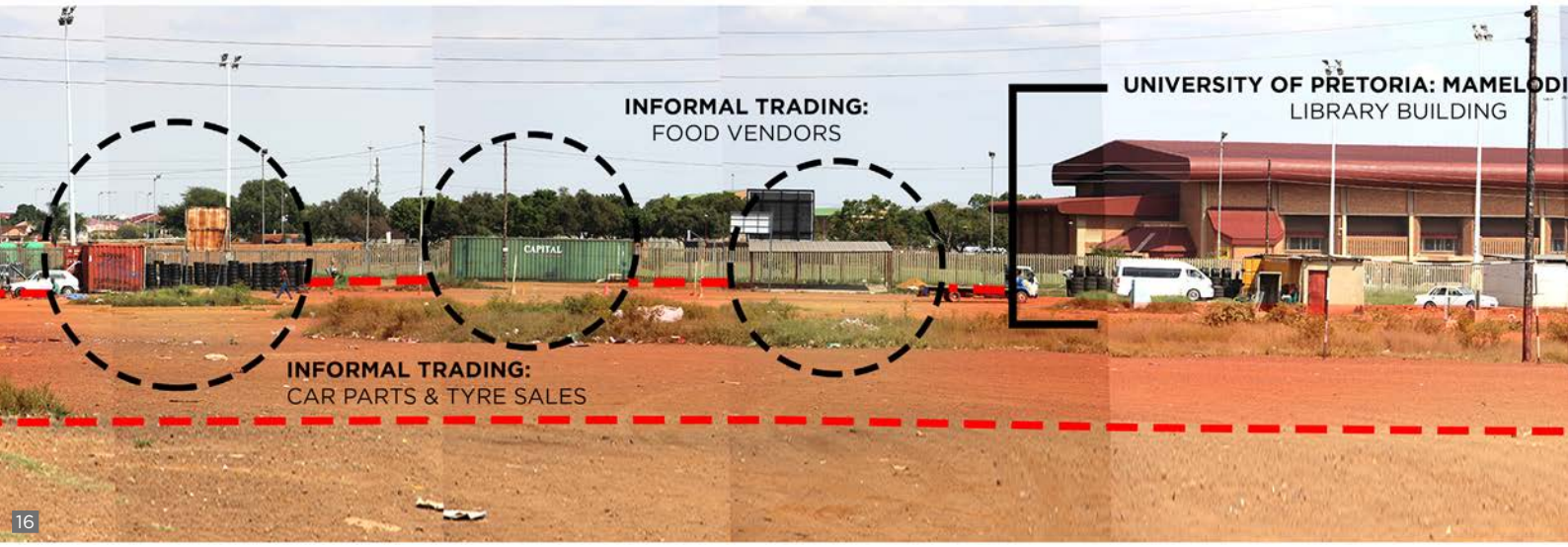
RESEARCH PROBLEMS

1. The current condition of public transport within Mamelodi does **not support** the argument of **equitable access** to the city (as defined in the research paper). With the informal nodes only providing a **portal** to locations within the city, **subsequent trips** are needed for locals to buy essential resources, adding to their monthly transport cost.
2. With the vast amount of **resources and time** spent on the daily commute, the potential of the **concentration of energy** that the currently isolated transport systems induce at a single location is **under-utilized**, and could be exploited more for social and economic **benefit** to the local community and its members.
3. Private and state-owned public transport owners are in **competition**, creating isolated pockets of energy within close proximity of one another rather than forming one combined location for users that **share** the same objective of their daily commute. This could further benefit traders and entrepreneurs in the area by increasing the number of potential clientele.

RESEARCH QUESTION

How can architecture play a meaningful role in **formalizing** an **already existing** array of transport-nodes for mutual social and economic **benefit** of both the **community as the client and stakeholder,** and address the issue of equitable access to the city by introducing infrastructure for additional programmatic development that **allows for adaptation** over time?

Figure 01.12: Informal Car Wash facility set-up at the current taxi rank (Author 2017)
Figure 01.13: A variety of informal trading facilities live off the energy that the current public transport nodes offer (Author 2017)
Figure 01.14: Bus nodes unused after rush hour peaks (Author 2017)
Figure 01.15: Isolated Taxi node (Author 2017)
Figure 01.16: Panorama photo looking West towards Solomon Mahlangu drive, showing different informal vendors and their stalls in front of the University campus



01.5

LIMITATIONS & ASSUMPTIONS

Although a **broader precinct vision** is included for a holistic view for **future** spatial and programmatic development in Mamelodi East, the design will be focused on the **transport-interchange** node as a point of inception for the precinct to best illustrate the response to the proposed research problems.

The Tshwane Development framework plan of July 2013 as proposed by the City of Tshwane (City of Tshwane, 2014) **Figure 01.18** suggests several new **nodal** and corridor developments to the city CBD from Mamelodi East. This framework is assumed in conjunction with plans for a new Gautrain station that terminates in Mamelodi East, speculated to be built as shown on **Figure 01.19** (final position not yet confirmed)

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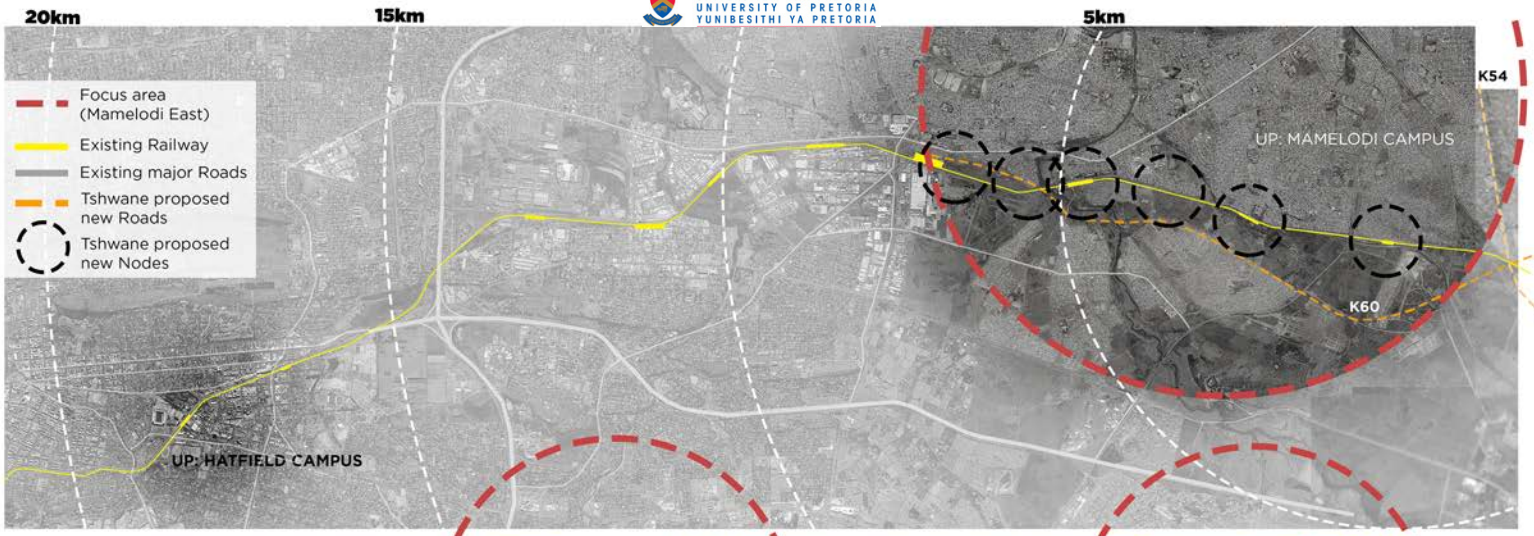
Figure 01.17: Precinct vision visual collage of spatial interaction and sharing of infrastructure between transport nodes (Authro 2017)
Figure 01.18: Planned framework development as proposed by the City of Tshwane, showing elements considered within this project's precinct vision (Author 2017, adapted from TSDF 2011)
Figure 01.19: Gautrain and BRT visions as per stakeholders' development plans (Author 2017, adapted from COT 2015)



TSHWANE SPATIAL DEVELOPMENT FRAMEWORK

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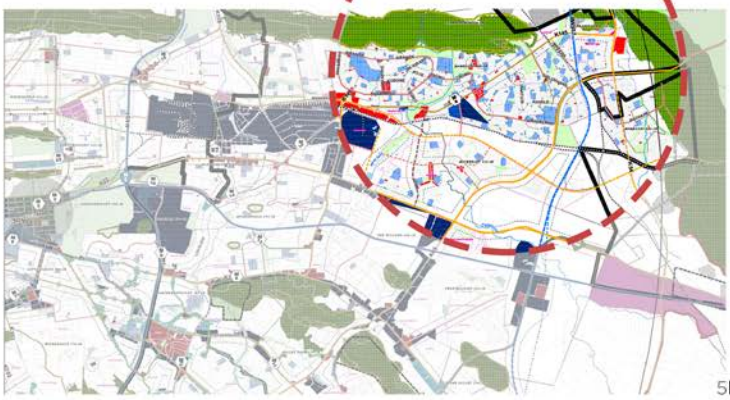

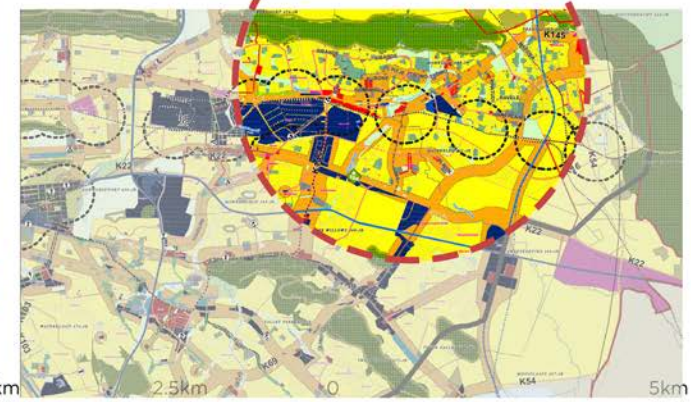

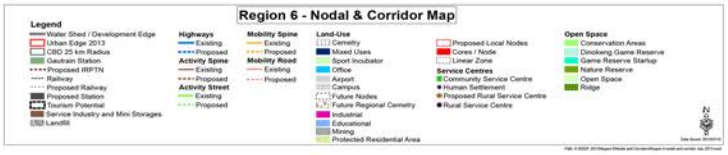

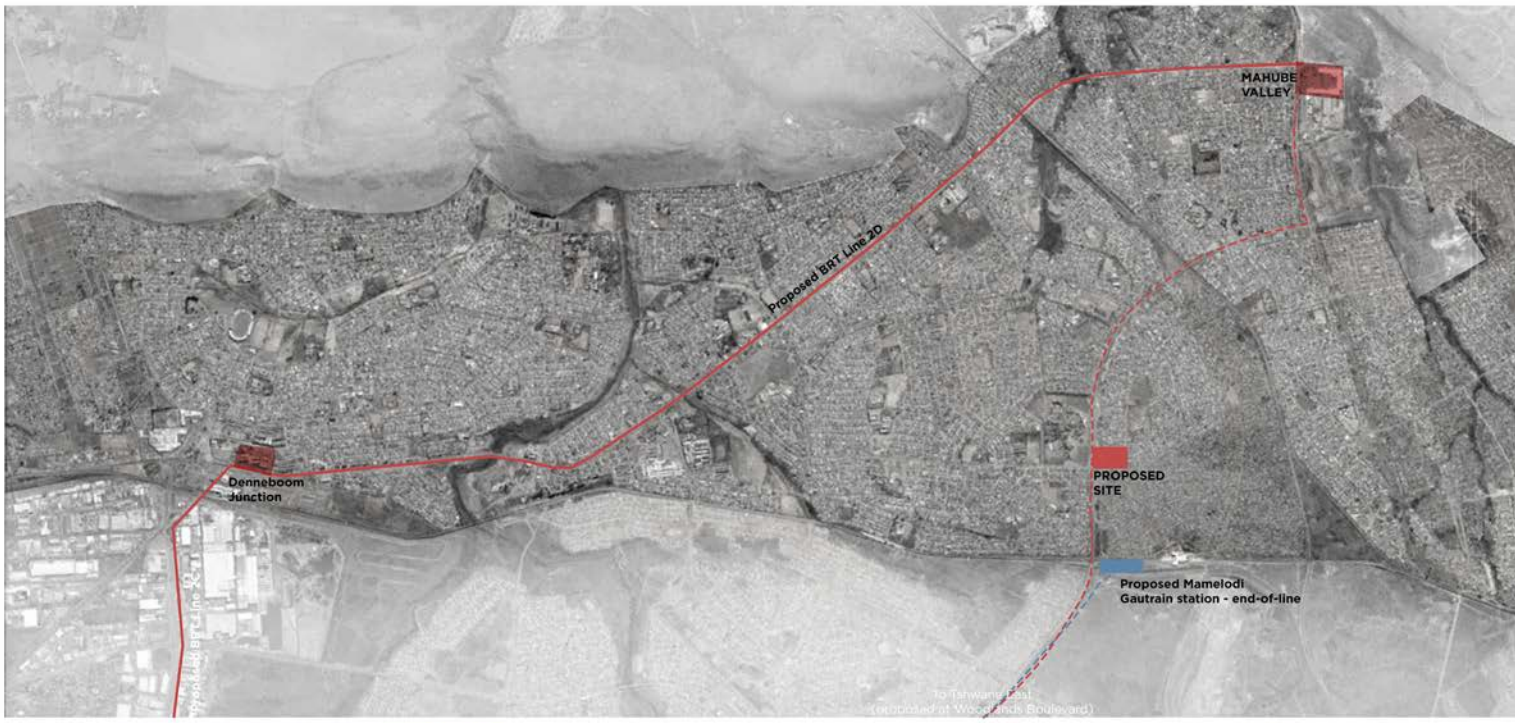

PROPOSED GAUTRAIN ROUTES

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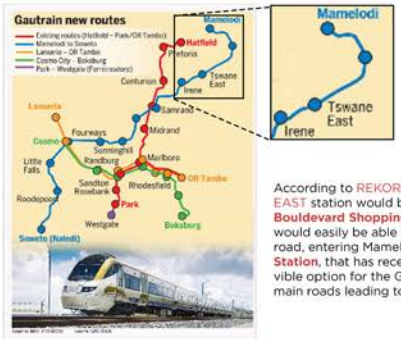


IMAGE: 'Gautrain: Our Journey to a Better Gauteng' - KPMG report, November 2014

MAMELODI STATION

It is still **unclear** where the train station will be built.
The proposed position of this station will thus be determined on speculation and interpretation of facts.

The image on the left shows that the BLUE line will stop at IRENE, and then in TSHWANE EAST.

According to REKORD of 25 April 2016, the station TSHWANE EAST station would be situated close to the **Woodlands Bouldevard Shopping Centre**. This means that the railway line would easily be able to run **adjacent to Solomon Mahlangu** road, entering Mamelodi in close proximity to the **Greenview Station**, that has recently been upgraded, and could thus be a vible option for the Gautrain Station, also easily accessable via main roads leading to and from Mamelodi.

PROPOSED BRT ROUTES

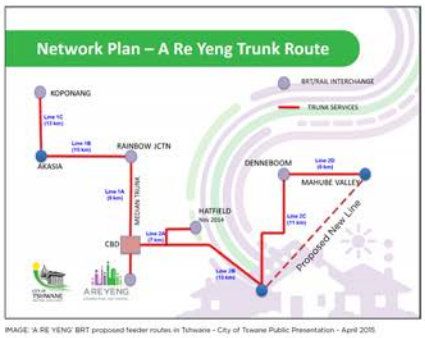


IMAGE: 'A RE YENG' BRT proposed feeder routes in Tshwane - City of Tswane Public Presentation - April 2015

MAHUBE VALLEY

Connecting the CBD to the east, city of Tshwane is already in the process of developing line 2B that runs from Loftus all the way up to Menlyn and Woodlands, via Atterbury road (Van Zyl in Pretoria East Rekord, 12 March 2015). Plans are then to **expand** this route to **Denneboom Junction** in Mamelodi, and then all the way up to **Mahube Precinct** which already has an existing bus terminal in Mamelodi East.

Adding to this, I **propose** that this route loops **back to Hazeldean**, via the vibrant Solomon Mahlangu road, which runs **past my proposed site**.

01.6

METHODOLOGY

"The formal process begins with an understanding of the persons for whom the site is planned. […] Next comes an analysis of the situation: a study of the whole [design] and its technology […] [from which] a final design is created – a form that the project will be given to fulfill the program"

(Lynch, 1980, p. 4).

To ultimately develop an appropriate architectural response to the proposed problems, the following methodology will be utilized:

-UNDERSTANDING THE PERSON-

SETTING THE THEORETICAL SCENE

An academic paper that contains the **theoretical backdrop** to the project's intentions initiates the architectural investigation. It serves to **argue the contributions** this project makes to architecture in South Africa through investigation of the **current context**, theoretical discourse in the **continuum of architectural thinking**, relevant **precedents** and **programming of spaces**. As a stand-alone element, this paper pens down the **aims and objectives** for the design to follow

-A STUDY OF THE WHOLE-

DESIGN DEVELOPMENT AND ITERATION

From the theoretical benchmarks, a **base design** is established as derived from the programmatic spatial requirements set as a platform to work on. In parallel to the development of the paper, the design will be influenced by the theoretical arguments, and **iterated** upon as the development process continues. This ultimately leads up to the final spatial design, which will then in turn form the base for the technical investigation

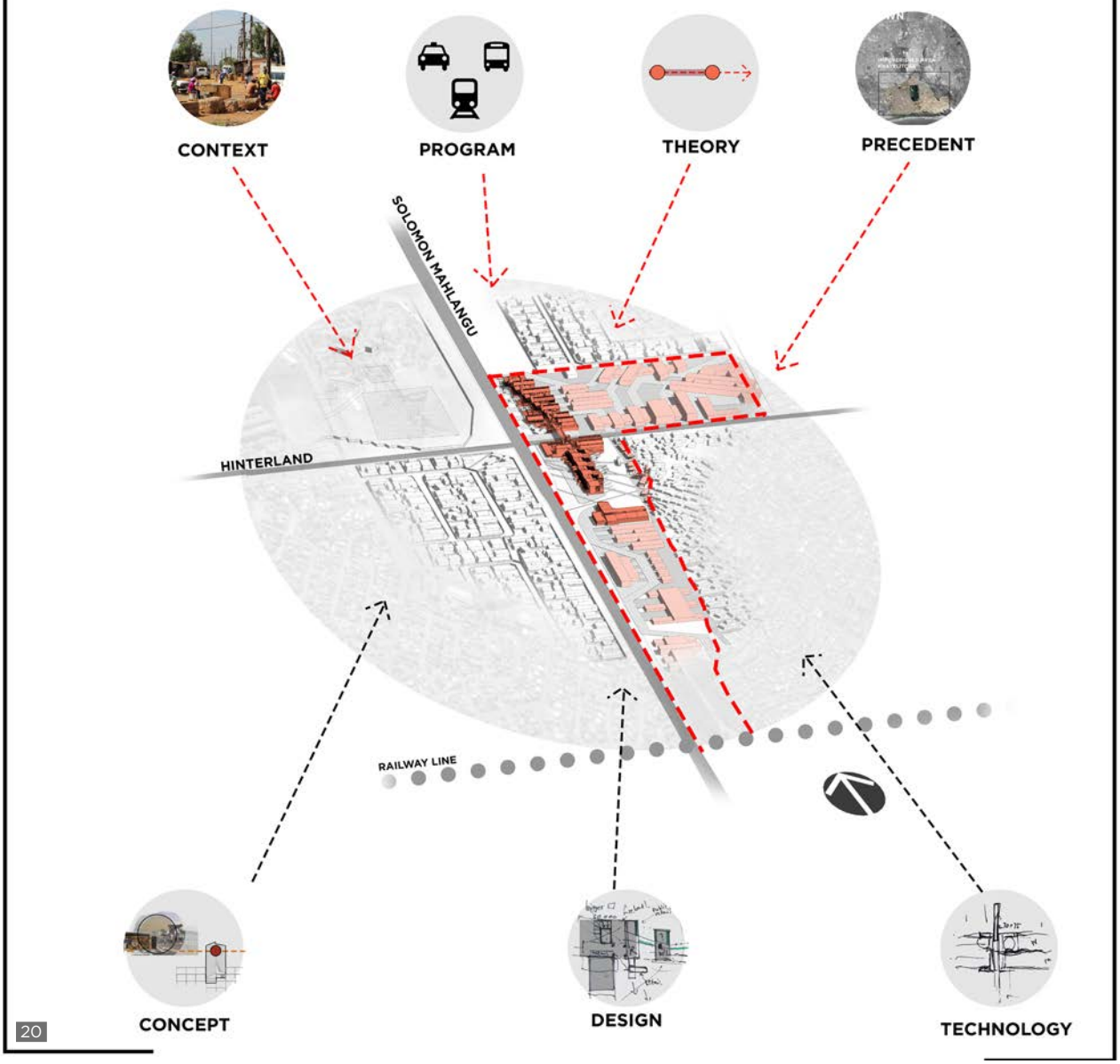
-AND ITS TECHNOLOGY-

DETAIL DEVELOPMENT AND ITERATION

Following the establishment of an architectural design that **complies** to the criteria set out in the **research problem** statement and question, a technical investigation is launched following the same intentions that the theoretical paper puts down, which then ensures that there is a **correlation between concepts** of **design** and **technical** resolution. As the design process is one of loops and cycles rather than a linear one (Lynch, 1980, p. 3), technical resolutions may cause further design iterations to be made.

Figure 01.20: Elements influencing the design process, with theoretical elements on the top and practical elements on the bottom
Figure 01.21: Conceptual sketch of practical elements influencing one another in the cyclical design process

INFLUENCES ON DESIGN



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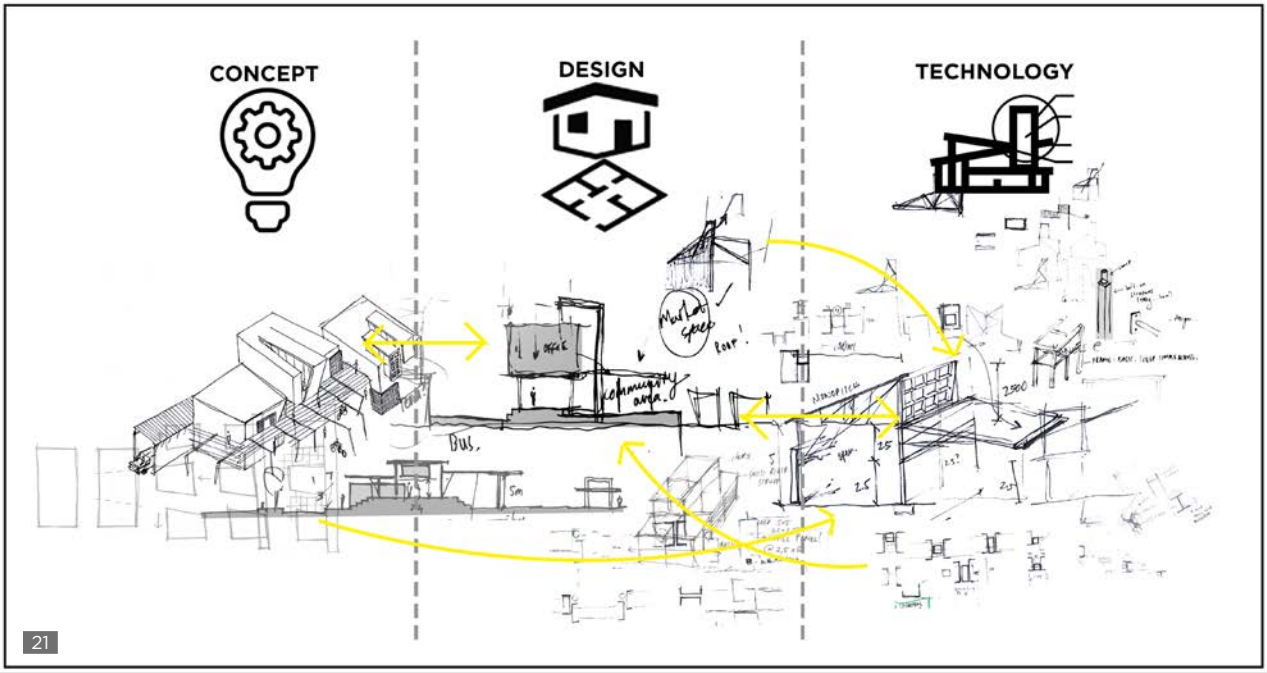

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02

THE COMMUNAL COMMUTE

-A Transportation hub for the City and its Commuters-

Bernhard van Renssen

THE COMMUNAL COMMUTE: A Transportation hub for the City and its Commuters

Working in the community of Mamelodi to the east of Pretoria, this paper looks at how architecture can facilitate currently existing transport nodes in sharing resources, as well as exploiting the energy created by the proposal of a transport hub to address the issue of access to the city. In addition to this process, a small-scale blueprint for large-scale urban upgrade in infrastructure and connection of the city's CBD and its displaced neighborhoods is investigated through application of urban theory, precedent, adequate programming of spaces and contextual architectural interventions.

The value of a city is determined by the ability to access it. Any of its resources or opportunities, however valuable, are irrelevant to the user that cannot interact with it (Cass et al, 2005). Within this paper, 'accessibility' is treated as a normative concept focusing its attention on conditions of poor accessibility and the importance of improving this condition especially for disadvantaged[1] groups. This term of 'accessibility' is therefore indicative of a particular person's ability to reach a range of destinations within the city, to be able to partake and interact with the resources on offer. Employment, education and social services like healthcare, as well as cultural and recreational activities like visiting friends are among some of the opportunities that are considered central to human participation in everyday life (Stanley, 2009).

Rode, Kandt and Baker (2016) argue that 'uneven distribution of accessibility is reflective of a society's patterns of privilege and disadvantage.' This poor accessibility is not only an outcome of disadvantage, but further indicates and reinforces inequality by limiting access to a city's social and economic opportunities. Ultimately, a lack of access to a city caused by its transport network prevents full participation in the opportunities on offer (education, employment etc.), all necessary preconditions to work against social inequality and disadvantages.
The user is thus socially excluded from full participation in society, not necessary due to poverty, but rather due to several transport and land-use conditions which limit the user's access to these events. By highlighting 'exclusion', it is suggested that the issue at hand is not as much the lack of opportunities to a community, but rather the ability to access these (Farrington 2007). As defined by Church et al (2000), seven types[2] of transport related exclusions exist that limit its use. These factors ultimately form the foundation to the programmatic requirements of an architectural intervention that addresses the issue of equitable access.

Within a local context, the township of Mamelodi[3] was historically established to the east of Pretoria as a settlement for black people seeking job opportunities to live in, as the apartheid regime governed that black people were not allowed to live in the city itself (Nico & Walker, 1991). After the settlement was established

1 Groups or individuals that are limited in their abilities to access public transport systems for any reason
2 Physical exclusion, geographic exclusion, exclusion from facilities, economic exclusion, time-based exclusion, fear-based exclusion and space exclusion
3 At that time and until 1958 known as Vlakfontein Farm

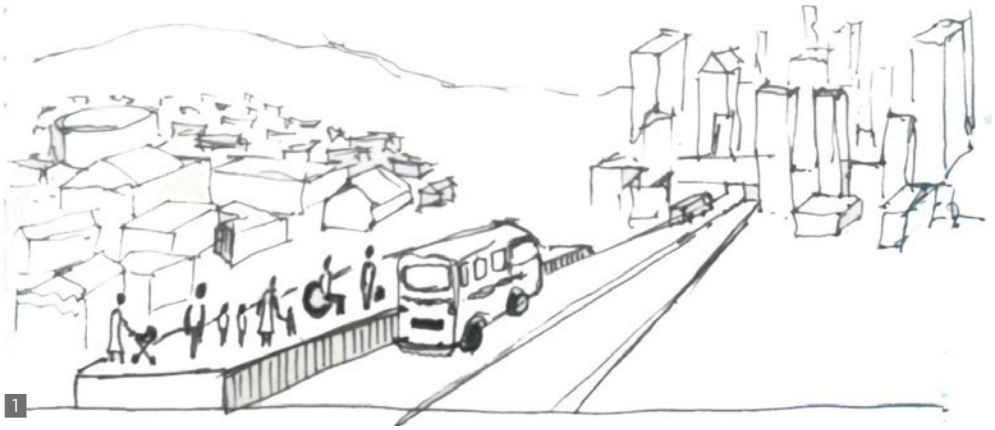


Figure 02.1: Equitable access to the city (Author 2017)

as a formal 'Black Township' in 1950, its population rapidly inclined as more and more job seekers flocked towards the city seeking meaningful employment. Due to the expansion of both Pretoria CBD and Mamelodi, the distance required to commute to and from work on a daily basis, stretched to approximately 25km. Public transport as a medium to access the city has become a vital part of everyday life for the community, resulting in users spending on average between 20% - 40% of their monthly income on their commute (Bechstein 2014). With the problem that this displacement caused, opportunity rose as government and individuals realised that transport could provide income. Internal transport within Mamelodi grew with its expansion to the east, and sporadic public (buses, trains) and private (taxis) transport nodes popped up as places from which workers can commute to their daily workplaces.

Private independent developers also realised the potential and need for transport within Mamelodi, and companies like the Gautrain and A Re Yeng have revealed plans for more transport opportunities to the city and beyond from Mamelodi East (REKORD EAST, 2016). While opportunities that these different transport entities offer could allow for better access to locations further away from their homes (Rosslyn, Midrand, Johannesburg, Soweto…) it does not increase general access to and within the city itself. Increasing methods of access does not imply improved access if the user's ability to access is obstructed. This simply means that elements causing the user to be excluded[2] from transport use will not be solved by increasing transport methods if basic issues such as cost, time, reliability and safety of the commute (any issue currently preventing the use of public transport) is not addressed.

Taking into account the already large number of pockets that exist from which the daily commute in Mamelodi East commences as well as the new proposed locations for the above mentions private transport systems, a significant amount of energy[4] is spread across all these pockets. This energy could potentially be of significant benefit to the community if utilised. Looking at the Denneboom Transport hub in Mamelodi West, the City of Tshwane developed and built a transport hub linking multiple transport modes with retail opportunity. The injection of energy at a single point caused numerous new businesses within the hub to benefit financially, and community members welcomed these retail shops as it saved them a trip to destinations off-route to buy groceries and other consumables (James, 2015). No public trading opportunity is however incorporated in the design, thus local spending leaves the community, benefiting only the external investors who capitalised on this formal trading opportunity.

With already established bus and taxi nodes close to the Denneboom train station, this hub aimed to improve access into the city. It thus became the end point to many transport routes, as taxis operating internally in Mamelodi stop at this hub, from where the commuters change transport means before leaving the area for their final work destinations. It is successful in its function as a hub for transport networks, yet its location is practically half way between Mamelodi East and the city CBD, in close proximity to medium density houses whose residents mainly commute by private cars. Subsequent modes of transport often have to be taken between Denneboom and residents' houses, especially to those living in the informal settlements to the far east of the city. As seen from this precedent, if access is to be improved, addressing the combination of the separated transport nodes in the East should be the point of departure, as this is where most of the residents live who are commuting via public transport (Bechstein, 2014).

In summary, the problems being addressed would thus be:

1. Several pockets of energy exist within close proximity of one another, all serving the same purpose of transporting workers to their daily workplaces through different modes of transport, but have little or no interaction with one another, often because of competition between stakeholders. No infrastructure is shared between transport modes.
2. Public transport modes do not work together because of this competition, and are mostly isolated from one another resulting in energy of users being spread across these isolated transport nodes.
3. Access to the city is limited to most of the residents of Mamelodi due to the cost of their daily commute.
4. No human-powered[5] alternative is present within this precinct and current infrastructure does not encourage this.

This paper will look at how these problems could be approached functionally, spatially and formally to benefit the community through the design of a public transport hub, which ultimately also serves as a precedent to other communities who are faced with the same predicament.

4 Refers to the amount of people using public transport within a certain area
5 Walking, Cycling or any other method of transport without a combustion engine

Continuum of architectural thinking

To highlight the relevance of the architectural issues, a theoretical 'common ground' is established as a foundation for the paper's contents. If the ultimate issue of improved access to the city is to be addressed, analysing the condition in which these networks came into existence should provide insight into why the networks work the way they do.

Research done by Hart and Padayachee (2014) places South Africa's economy under the lens of national capitalism[6] to understand the role that capitalism has played since the post-apartheid era in economic development. They compared the country's economic indicators from competitiveness agencies to that of 142 other countries to determine South Africa's development profile since the end of the apartheid era.

"South Africa's detailed profile is extreme. The country scores near the top ten on a range of indicators related to business, and near the bottom on human development indicators and labour productivity" (Hart & Padayachee, 2014). What this means, is that South Africa has a 'world-class' business sector surrounded by human misery. This dualism could easily have been understood two decades ago when the apartheid regime benefited the 'whites' but with an increasing economic inequality while third world living conditions are getting worse, the corporate capitalism[7] in our country is evident (Tupy, 2004).

The result of this incline in corporate capitalism is that the private sector is taking over government sectors, like public transport. Private individuals identify the need for mass-public transport, and act on this by introducing corporate controlled means of public transport (e.g. Uber and Gautrain). While additional modes of transport are provided in this system, the negative impact that these capitalist controlled transport industries have is that the capitalist sector takes the clientele from the working locals that run the taxi system in their community, thus taking money out of the community rather than contributing positively towards its economic circumstances. A secondary issue that this capitalist system reveals, is the fact that "public transport […] is fragmented, and not co-ordinated" (according to Jack van der Merwe, chief executive of the Gautrain Management Agency). Organisation and communication between private and public-sector transport, as well as between different transport modes could be the key to improved and affordable public transport, rather than the current "…ramshackle mishmash of unreliable timetables and vehicles" (Oxford, 2013). If resources and infrastructure could be shared between government and corporate sector rather than compete for them, it would be a huge step in the right direction for public transport, giving the users choice and ultimately leading to better access to the city.

As architects, we are often on the designing end of a project that corporate private sector companies want to implement. Opposed to this is the ethical responsibility we have when designing for the public, as spatial interventions in a public space can have a positive or negative social effect (Jubany, 2011). Designing for both sides of the scale can make contributions towards the architectural profession. On the capitalist end, projects often challenge our technological approach, and could stimulate new ideas and advancements in the technological fields while on the community end, design can lead to new ideas on how our everyday living should be, stimulating humanistic design in architecture and urban planning. Rather than differentiating between the private and public sector, a proposition is made to integrate both sectors within the proposed transport hub, drawing benefits from either ends (as mentioned in the above paragraph), and potentially establishing a platform of contact between the sectors. This on its own can make a positive impact in dealing with access, as opportunities previously only available in the private sector are then starting to become more publicly accessible.

Looking for an ideal location for this transport hub to manifest itself spatially, identifying already existing infrastructure will be the ideal place to start. As part of a growing South Africa, President Paul Kruger engaged with Mozambique in talks of a railroad that would run from Pretoria to the East, up to Delagoa Bay which was completed in 1895. This track running eastward from Pretoria CBD became the direction of growth that Pretoria followed, as it provided access to the city centre as well as prime location for industrial activity (job creation) like brick and steel factories that could use the railway line for exporting purposes. Many of the residents of Mamelodi found jobs in these industrial activities, and so the railroad became their primary mode of transport when the first station was built in Mamelodi in 1904 (Anon, 2012).

6 An economic system typical when the state undertakes commercial activity, and signifies the idea that property always remains in state rather than individual hands

7 An economic system used to describe a capitalist marketplace dominance by bureaucratic corporations

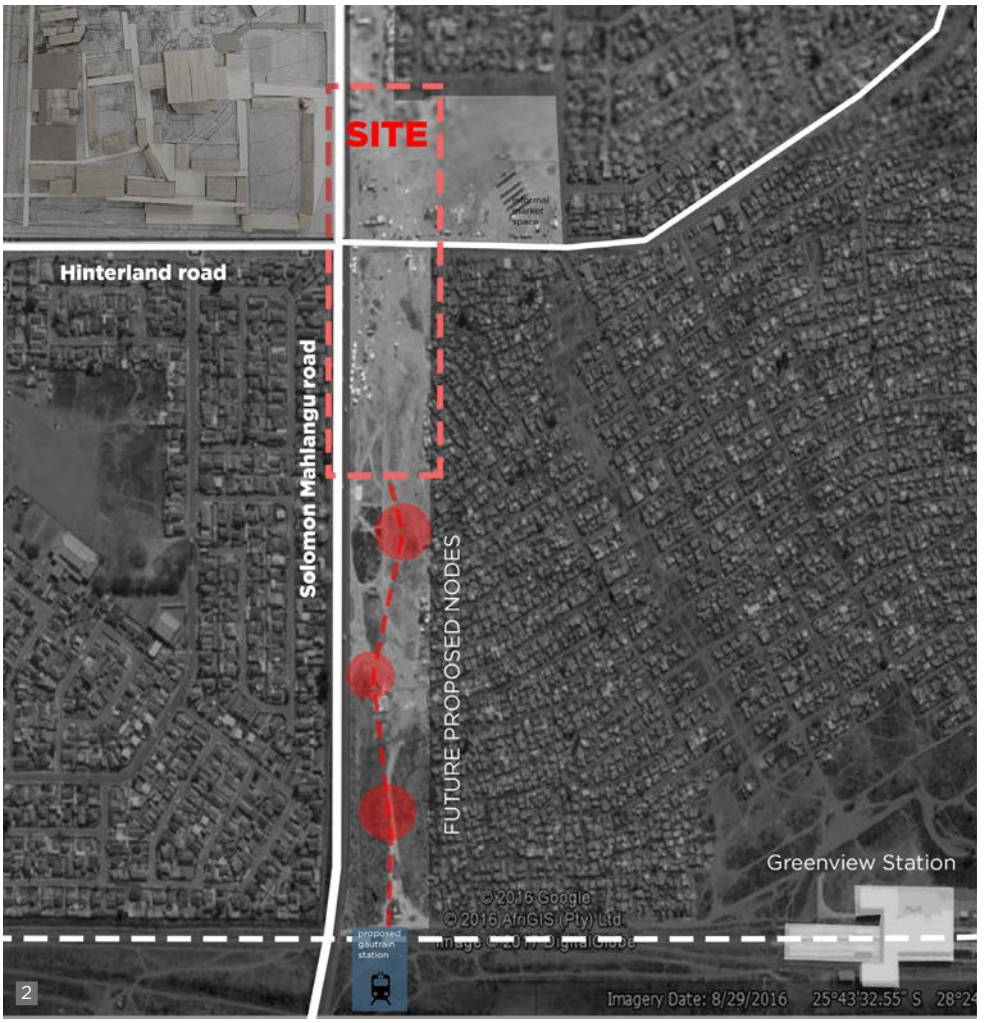


Figure 02.2: Micro site location showing possibility of future nodes within the precinct, developing to the south up to the proposed new Gautrain station

CONTEXT

With the expansion of Mamelodi since 1904, 2 more railway stations have been introduced within the suburb, and the track is now mostly used as a method of commuting for work.
It would thus be logical to use this existing transport network as a location for a transport interchange. With the track acting as the southern boundary to the township, it could be seen as the theoretical border between first and third world communities. On the northern side, Mamelodi as a third world community (Heart & Padayachee, 2014) while on the southern end the extents of Hazelwood and Silver Lakes as first world communities. Evident from the typical commercial developments, a distinct differentiation can be seen between the two types of communities. On the one hand, Mamelodi has a strong influence of informal trade along roads and energy nodes such as shops and busy intersections, while the first world community typically encourages larger destination-type developments[8] that draws the public to a single location.

Acting as the separator between the two ends of the scale, the railway line would thus not only provide the ideal location for a transport interchange programmatically, but also by providing opportunity for an intervention that starts to bridge the gap between the two extreme suburbs through the design of a space that allows for private investment to manifest itself mixed with local opportunities for economic development (by providing areas where locals could run their own business and capitalise from the energy that the transport interchange would provide).

Towards the east of Mamelodi, Solomon Mahlangu drive presents the only entrance to this side of the township. Bridging the railroad near Greenview Station, this North-South axis of Pretoria east connects Mamelodi to the N4 running to the CBD, as well as other major East-West arteries such as Lynnwood, Atterbury and Garsfontein road. This single entrance and exit is then also the reason for major congestion happening in peak hours[9], adding a significant amount of time spent on commuting per day. The northern extensions of Solomon Mahlangu drive runs past the University of Pretoria Mamelodi campus, and a great number of existing taxi-and bus stops that form the isolated energy pockets mentioned earlier. Running from the southern entrance of Mamelodi alongside Solomon Mahlangu drive, for approximately 400m in the northern direction, a part of the land (approx. 90m wide) has been cleared next to the road in 2012 as an incentive to control the boundaries of Phomolong, (Figure 02.2) an informal settlement within Mamelodi, as well as to provide for infrastructure upgrade widening of Solomon Mahlangu drive in the future (City of Tshwane, 2014).

This strip of land provides a clear axis from the University of Pretoria's Mamelodi campus to the railroad where (according to the Gautrain Newsletter of 17 October 2013) the proposed new Gautrain route from Naledi and Roodepoort will terminate in the proposed Mamelodi station (located

8 Destinations that house multiple activities and shops within one building, typically shopping malls such as Menlyn Park or Brooklyn shopping centre.
9 According to the Mamelodi MProf group of 2017, typically between 5am and 7am in the morning and 4pm to 6pm in the afternoon, Monday to Friday

at the crossing of Solomon Mahlangu and the existing east-west railroad near Greenview Station). This thin long strip of land is chosen as the site for the architectural intervention because of its availability of already existing and planned new transport nodes, its close proximity to the UP Mamelodi campus and its energetic location: an existing main transport route used by most commuters within the township.

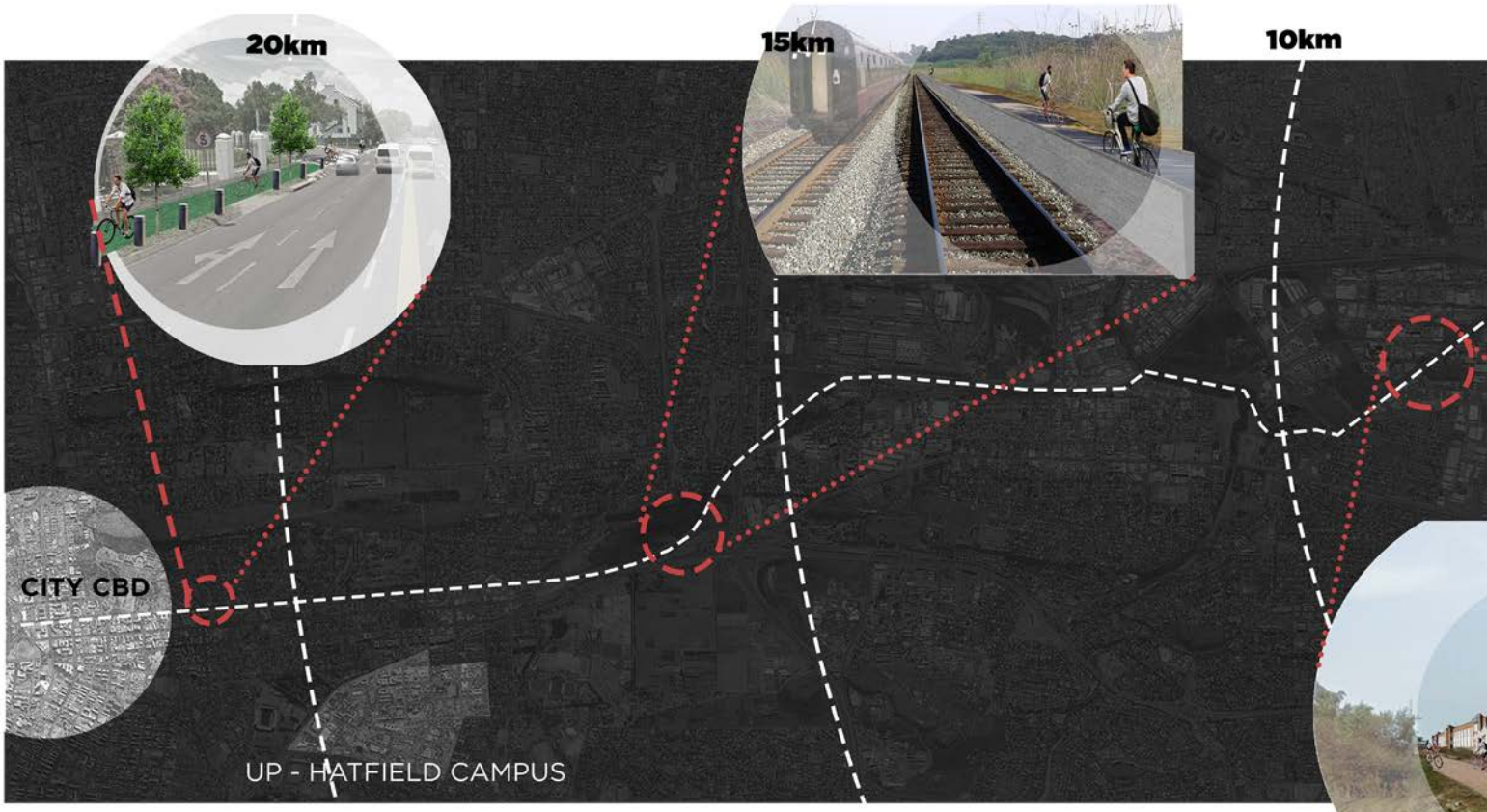
As a physical context, the site is embedded by the following: On the eastern perimeter, Phomolong informal settlement has an organic texture to its development with typical shack-type housing, low and flat built on the ground with small pedestrian roads flowing though the shacks up to the currently fenced border adjacent to the proposed site. In contrast, the northern border fences a linear planned medium density housing suburb of medium income, typically 1 storey high. Across the road on the western side, this medium income-type housing continues, but several multi-story houses rise to give the neighbourhood a texture to its horizon, particularly with the UP Mamelodi campus forming the edge condition on the northern end of the western edge. Being the highest building adjacent to the site, the campus introduces some verticality to the site between vast open spaces fenced off with permeable concrete fences on all sides.

Being situated between these extremes of building typologies post several challenges as well as opportunities in dealing with a spatial response. Having the informal settlement on the east of the proposed hub as a more public and open environment (no fences around yards, houses built around courtyards where most of the residents' living takes place), the existing informal trade units could benefit from its injected energy induced by having a formalised space (like market-type stalls) which can facilitate their trading. Residents would benefit through selling their goods/services, while the commuters using the space would be able to buy groceries or other essentials en route to their homes/final destinations.

On the opposide end, the fenced medium-density homes to the east of the road as well as the already fenced university campus, less publicly permeable, would be a better scene for bigger private investors to locate their businesses, as the fenced area provides secure backing for the new programmes to be manifested against.

The linear site adjacent to the main artery road through Mamelodi (Solomon Mahlangu drive), will benefit from the public access that the road provides along its longitudinal axis. A penetrable interface looking westward towards the road would thus be a logical response for a public building that is defined by its accessibility for its users, and ultimately accessibility to the city.

Urban Theory: Beads-on-a-string
Dealing with this lengthy yet thin site on its own also requires a coherent approach. A single structure spanning 400 meters in length and 80 meters in width, roughly 36 000m² in total would contradict the contextual approach



SITE AND ENVISIONED CYCLING CONDITIONS
city scale traveling from Mamelodi to CBD

that is expected in a mostly-residential community. As the building deals with several types of transport, these types can possibly act as separate nodes that in its collective form the whole of the building. Breaking up the whole into sub-categories would be beneficial to the building as a public intervention, allowing for more permeable spaces in between nodes as well as creating opportunities for better-planned public spaces.

Investigating this type of approach, an urban theoretical approach known as the "Beads-on-a-string" theory has been successfully implemented in parts of Cape Town. Priemus and Zonneveld (2003:169) defined this concept as "bundles of infrastructure that define two or more areas". This concept is derived from the century-old concept of 'corridor development', which was used as a popular city-planning theory when concentric industrial cities took shape as linear models. Typically originating along transport routes, this concept facilitated a variety of transport facilities, mixed land uses and usually attracting a high concentration of people (Warnich & Verster, 2005).

The Cape Metropolitan Council (2000) adopted this as a framework for the City of Cape Town's development framework. Within the framework, it is stated that although the basic principles of Corridor development (as defined in the previous paragraph) is followed, the corridor "…is not an elongated node. The primary and overriding characteristic of a corridor is that it is a continuous link between two or more metropolitan nodes that provide a focus for public transport services. This is the corridor reduced to its most basic and important elements" (Cape Metropolitan Council, 2000).

The term "string of beads" is used as a conceptual approach where major activity nodes are spaced along a central spine (or 'string') that acts as the conveyor of energy through the system. These nodes (or 'beads') are strategically planned as points of major development, allowing the in-between spaces to be filled by infrastructure for economic opportunities to develop. The idea is to let the public make use of this in-between space, systematically growing the nodes closer to one another. The space in between the nodes, known as Activity Corridors (City of Cape Town, 2002), provides various opportunities which ensure the existence of necessary thresholds to sustain its operations. This also allows for a high intensity economic activity along the corridor. Providing for adequate social and economic activities to be generated within the corridor, quality of life for the community will be enhanced. In order to realise this, these corridors are arguably the best way of planning for an integrated community, clearly implying higher levels of accessibility to its users and the city at large (Warnich & Verster, 2005).

According to Warnich (2005:345): "…a number of elements should be present for an activity corridor to function effectively. These include: Major transport mode, linkages between nodes, human interaction on the spine, and investment opportunities both

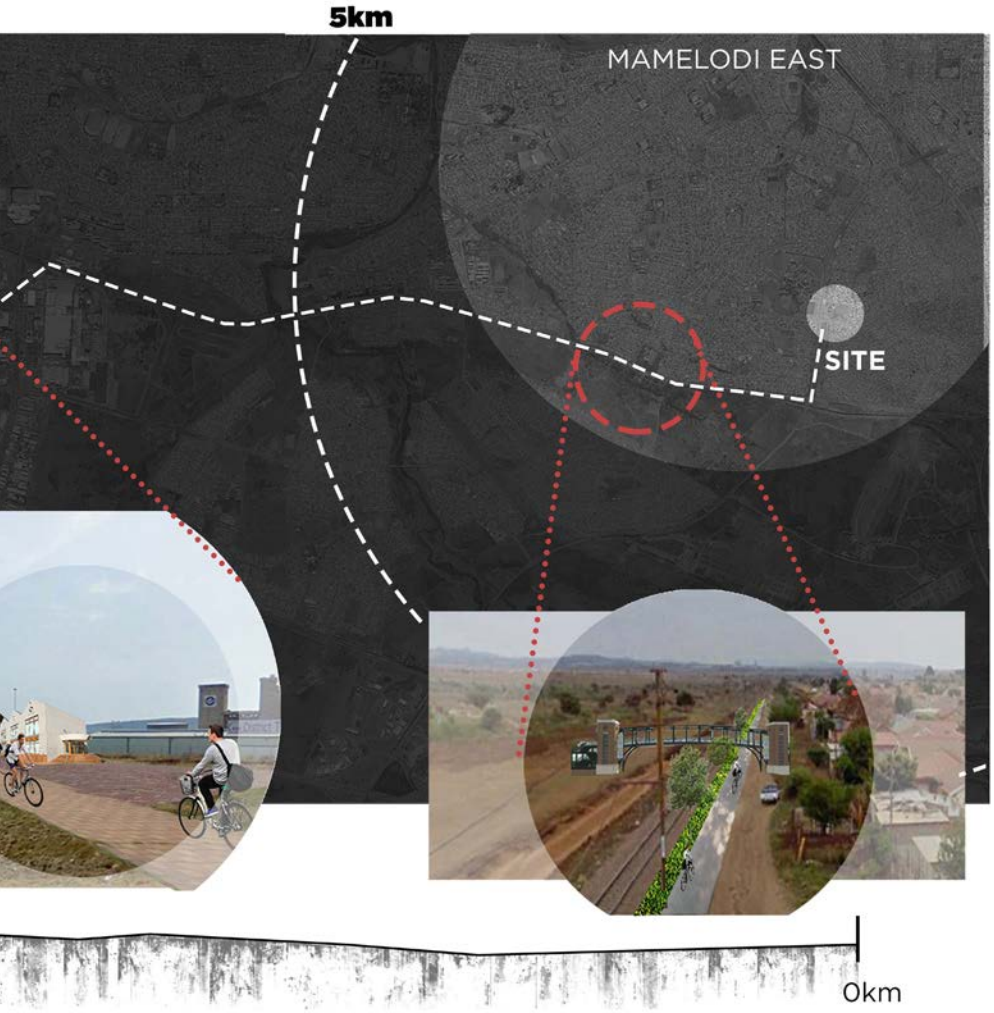


Figure 02.3: Urban city framework showing the proposed cycle road from Mamelodi to the city CBD, with its different conditions shown along the way (Author 2017)

public, and from external developers." Moving from an urban scale to a smaller architectural scale, if the elements need an activity node to function effectively (as defined by Warnich), I would argue that this same theory could be applied to an architectural intervention on a local scale through using the proposed transport interchange as an example to achieve similar results of an integrated accessible precinct.

Starting with the existing public transport nodes on site, by designing infrastructure for these to manifest themselves formally as a transport dock[10], each transport node would form a node within the transport hub that becomes the string-of-beads precinct. These primary points of energy would provide a platform for major investor opportunities to latch onto, and benefit from the injected energy on that point (bigger retail opportunities or offices for example). As the users move through the precinct to their connecting form of transportation (e.g. from a bus or train terminal to a local taxi terminal) or to their point of exit from the precinct (home, university, school…) the route would take them past locally owned small businesses such as food or small grocery units in between the bigger nodes. The idea is then that upon leaving or engaging in their commute, the users could buy items they need. In this organisation of space, the users gain access to goods they have to otherwise buy at separate destinations, while the traders (both bigger external investors and local entrepreneurs) benefit by having direct access to the injected energy from the transport nodes.

Precedent

To fully understand the extents of this theory in practice, it would be worthwhile looking at the City of Cape Town, where this concept was first introduced into practise, as a precedent to identify the positive and possibly negative impact it has on the site. Contextualising the scene, Figure 02.6 (right) expresses the relationship between Cape Town: the precedent, and Pretoria: the desired site. In both instances, the impoverished area has shifted to the east of the city centre with a radius of ±25km. Even though the reason for the displacement of Khayelitsha is different to that of Mamelodi[11], the similarities in conditions between the two areas make this precedent an ideal example to investigate and analyse.

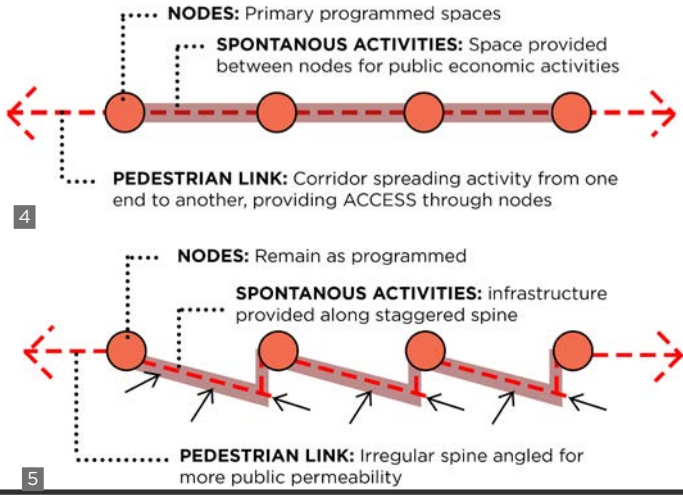
Upon analysing the application of the theory in Cape Town, the urban conditions are first contextualised as issues from an urban level, followed by the results of the application on a smaller plan scale. Discussing the issues both on urban and plan level, a comparison between the two cities can be made and discussed.

Starting with the bigger urban scale, the spatial inequality legacy that South Africa's past had on both areas is of a high degree. With most of the economic opportunities located within the city centres, both Khayelitsha and Mamelodi residents sustain high costs in accessing these opportunities. Beyond this, both communities are also further disadvantaged by the fact that little money is retained within their precincts due to the limited opportunities within. As a result, poverty and unemployment due to poor access lead to further demise of these peripheral communities. Instead of addressing this issue of access, government further invests in low income public housing projects in both areas, stimulating and increasing the polarised pattern[12] that these major cities are undertaking (Turok & Watson, 2001).

A further urban similarity is the congestion that these densely populated areas cause to the infrastructure of the city. Comparing the report of Bechstein (2014) (Pretoria) to one done by CoCT (2006) (Cape Town), the time it took to travel to work over an average of 25km takes more than an hour. Due to the South African pre-occupation with the 'suburban dream' of living in a house enclosed by a private garden means that cities rapidly experience urban sprawl. These suburban homes limit the growth of the urban poor areas, causing them to become even more dense. Where most of the suburban owners drive private cars, it is the city's infrastructure that further experiences strain and congestion.

This spatial structure that promotes mobility over

Figure 02.4: Left Top: Basic Activity corridor intersecting nodal interventions diagram (Author 2017)
Figure 02.5: Left Bottom: The activity corridor with its axis bent open to allowing more public access (Author 2017)
Figure 02.6: Right: A comparison of the conditions in Cape Town as a precedent to similar conditions on the proposed site (Google Earth 2017)
Figure 02.7: Space bridges diagram (adapted from Dewar and Louw, 2003)
Figure 02.8: Space integrator diagram (adapted from Dewar and Louw, 2003)



10 A platform for passengers to embark or disembark from the means of public transport
11 A brief political history of Khayelitsha's move to its current location can be read at: Cape TownZA.com, The history of Khayelitsha, [online], Available at www.travelcapetownsouthafrica.com [Accessed 20 June 2017]
12 Referred to as an urban pattern where the city has its urban poor (where he highest population growth is taking place) moved to the peripheral edges of the city.

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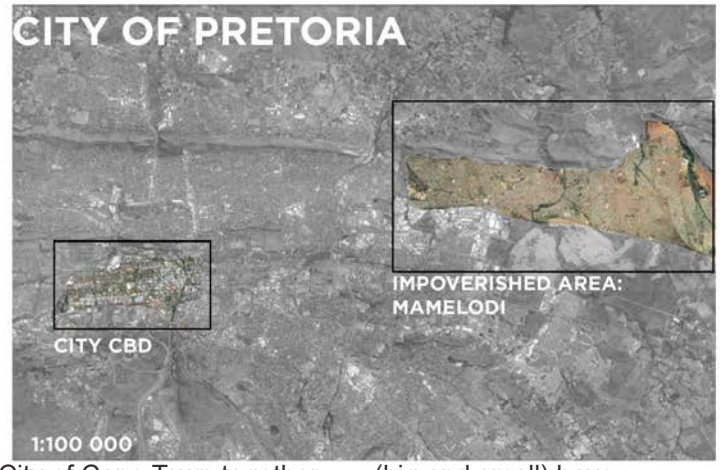
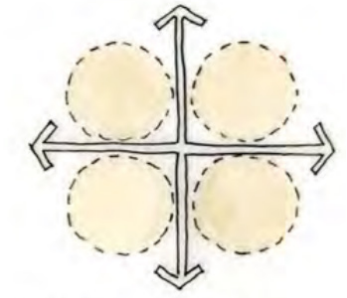


accessibility (Dewar, 2000) also reduces income-generating businesses opportunities through local market-type interventions, by not aggregating enough purchasing-power within a demarcated area to generate vibrant small-scale business sectors. Dewar (2000) further argues that "self-generated income can only be possible through intensive local markets, which are more viable at higher densities rather than suburban neighbourhoods".

In addressing the issue of urban sprawl through the idea of densification of the city, urban corridors are thus well suited as an approach as its main goal is to enhance social equity through spatial integration between the city peripherals and its CBD. In developing these corridors, a well-defined city structure could be created as they "offer a means to integrate those parts of the metropolitan area with no coherent and integrated structure into the larger urban environment" (Lotz, 1999).
Where the current context of South African neighbourhoods follows a typology of 'inwardly facing cellular structure' (L'Etang, 2013), urban corridors could fulfil the function of space-integrators as opposed to the current movement structure of space-bridgers (Figure 02.7). Where space-bridgers limit access by connecting nodes on a few select points, space-integrators (Figure 02.8) accommodate a stop-start movement between nodes on a linear route (Dewar &



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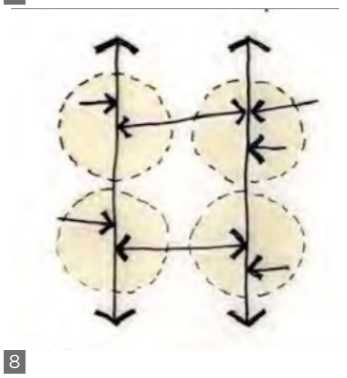

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Louw, 2003). This module of development promotes the resilience within South African cities as once the linear movement system is established, activities can immediately benefit from locating themselves to this system. As further growth occurs, activities would naturally extend along the route, directing the urban growth towards density rather than sprawl (Dewar & Uitenbogaardt, 1991).

Implemented in 2003, the City of Cape Town together with N+M architects and urban planners applied the beads-on-a-string theory starting at the edges of the impoverished areas (Khayelitsha), connecting to the western part of the city CBD. This near-linear link became known as the Klipfontein Corridor (formerly Klipfontein Road). The above-mentioned issues became the informants to the development of this corridor, creating a safe and efficient environment which could provide round-the-clock access to its users as well as destinations where they could utilise the created recreational spaces (Warnich, 2006, p. 92). The corridor currently connects 19 major nodes amongst which sub-corridors intersect these nodes on regular intervals. This project first introduced the BRT-system in South Africa, drawing its inspiration from the city of Bogota where this system was first introduced.

Although the full impact of this corridor would only be seen in a few decades (Fieuw, 2016), the corridor has already had major successes in terms of its use by commuters from Khayelitsha to Cape Town. Conditions along the route have not only seen major effects in terms of its infrastructure-upgrade, but a number of businesses (big and small) have claimed success since its implementation. The original aim of upgrading neighbourhoods' socio-economic condition along the corridor has successfully been reached, as neighbourhoods immediately started to densify around the intersecting corridor, where a number of investment opportunities rooted itself between the nodes. Socio-economic growth has been rising since the start of this project, and public transport became utilised to such an extent that increased public transport measurements had to be implemented[13] due to over-use of the BRT-system through the corridor (Warnich, 2006). The following could thus be taken from the Klipfontein Corridor on an urban scale:

- With the use of the space-integrator rather than space-bridger system, an increase in the use of public transport is detected which clearly illustrates better access not only from the city peripheral (Khayelitsha) to the CBD, but to the in-between nodes as well.
- An increase of planned nodes between the extremes of the route resulted in an upgrade of socio-economic conditions within the neighbourhoods along this line.

13 Bus as well as taxi frequencies increased drastically since 2003 along this route, along with metered taxi services and a non-motorised plan that was introduced to promote access for people walking and cycling to their destinations.

- More accessible nodes increased the level of safety along the route, creating opportunities for safe non-motorised travel (walking or cycling).

Moving from an urban scale to a precinct scale, the link between Khayelitsha and Mitchelsplein through Washington Square and Tembani neighbourhoods have been analysed (Figure 02.9), as this link demonstrates how strategic infill development and planning in existing neighbourhoods can be restructured to increase its internal accessibility. The precinct's spatial design also illustrates how its internal integration as well as with its surroundings can achieve desirable urban conditions for small self-generating business to develop.

Julia L'Etang (2013) explored the notion of 'Blocks and Superblocks' in her thesis: "Spatial Design for the Lansdowne Road Corridor" as a vehicle to achieve these desirable urban conditions within a neighbourhood. She concluded that within these superblocks, three principals are addressed as points of transformation within these neighbourhoods:

- Hierarchy of movement systems through the neighbourhood and its associated public spaces and facilities
- Greater range of choices within residential typologies and retail spaces
- Improving of the pedestrian permeability and integration with surrounding neighbourhoods

Figure 02.10 (right) illustrates the notion of how superblocks are divided into smaller fragments, and the hierarchy that the transport systems within these blocks undertake. Vehicular public transport is limiting the edges of the superblocks to limit the number of big intersections. The superblock is then divided into smaller segments which become pedestrianised corridors, in turn creating smaller public nodes where they intersect with one another.

Applying this concept on site, Figure 02.11 (far right) shows how the Lansdowne precinct has been divided to create these hierarchies of movement and space. A 'civic heart' has been located in the centre intersecting the main movement axis, with social services and adequate public space filtering down from this centre alongside the main transport route. Other clusters such as the schools and learning centres (libraries, adult learning centre) have been grouped together on a node forming a sort of educational campus. The rest of the neighbourhood mainly consists of residential-type housings, which has been divided into superblocks with public access to each sub-block through smaller pedestrianised lanes. Variation in movement within this precinct requires that the nature of each street differs according to the activity that it accommodates. (L'Etang, 2013).

From this precedent on a precinct level, the following points are noted:

- By using the concept of 'superblocks', movement space is divided into a hierarchy of nodes and movement systems, allowing for public transport to cut through the neighbourhood at a central node with pedestrianised streets feeding onto this link from the more private residential zones. Hierarchy of movement is thus co-ordinated and in relation to the hierarchy of spaces that exists within a precinct.
- Using a hierarchy of movement from a public transport route down to a pedestrian-only (cycling or walking) route, the number of intersections is greatly reduced, reducing the amount of vehicular-caused congestion with it.
- By placing the most public buildings on the most public streets, the programmatic hierarchy translates into spatial hierarchy when looking at the precinct in section. Higher buildings adjacent to wider streets allow for easy orientation towards the centre of the precinct (civic heart).

It can thus be concluded that accessibility is improved through hierarchy on three distinct levels of this precinct-scale precedent: Programme, Space and Movement. Arguably these elements should follow the same line of hierarchy, locating the highest value of each of the three elements together. To demonstrate by example: the busiest street (movement) intersecting through the site should be supported by the most important, most publicly accessible buildings (programme), and should by design be the tallest or most prominent (space). By merging the two precedents, where the urban corridor promotes accessibility through nodal interventions on a spine, the precinct corridor intersects the main connecting node and promotes access through a hierarchical organisation of movement, space and programme. Bigger businesses, typically private sector investors, would thus benefit more from linking to bigger nodes, while smaller home-based businesses would in return benefit from attaching to smaller nodes, where they could serve their community and take advantage from the flow of energy from people moving down their precinct corridor to their respective destinations.

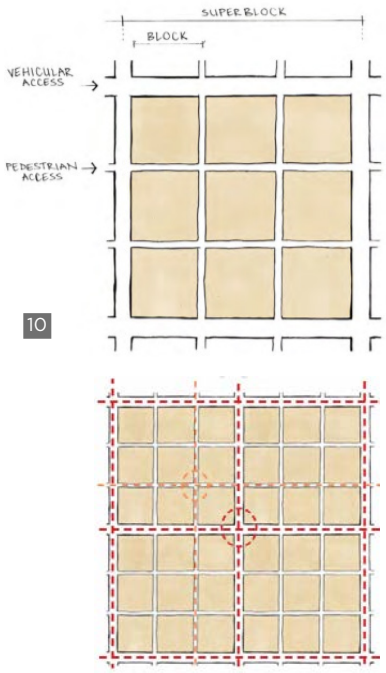
Figure 02.12 illustrates the proposed plan for this nodal corridor along the railway line connecting Pretoria CBD to Mamelodi. With the new K60-route planned to run parallel to the railway, it would be the ideal space to initiate this nodal corridor-concept in Pretoria, as proposed in Figure 02.13. Different modes of transport infrastructure then connect the outskirts of Mamelodi to this city CBD, and form a link upon which precinct-nodes could intersect and connect the private owned 'first-world' sector (as discussed earlier in

Before

After

this paper) southern side of the link to the community side to the north.

Moving to an architectural scale, arguably the best intervention for the initiation of such a corridor would be the with the development of a transport-interchange hub as proposed. Developing this project within the same string-of-beads format would not only be ideal for the site conditions (mentioned earlier), but also as an example of the potential of this system as a catalyst for the intermediate precinct scale, and ultimately the urban city level as a whole. Working from a small scale upwards, thus allows the concept to be evaluated and adjusted as it is introduced into the overall picture, and would also be ideal as small-scale investments in single nodes at a time are more viable to a community that does not necessarily have the financial capabilities of big-scale interventions. This specific project will thus be a manifestation of the theory on the smallest architectural level, but with the same goals in mind of improving the community's accessibility to the rest of the city.



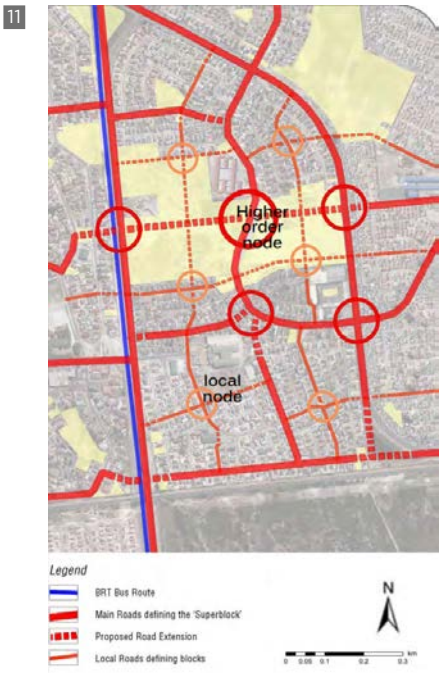
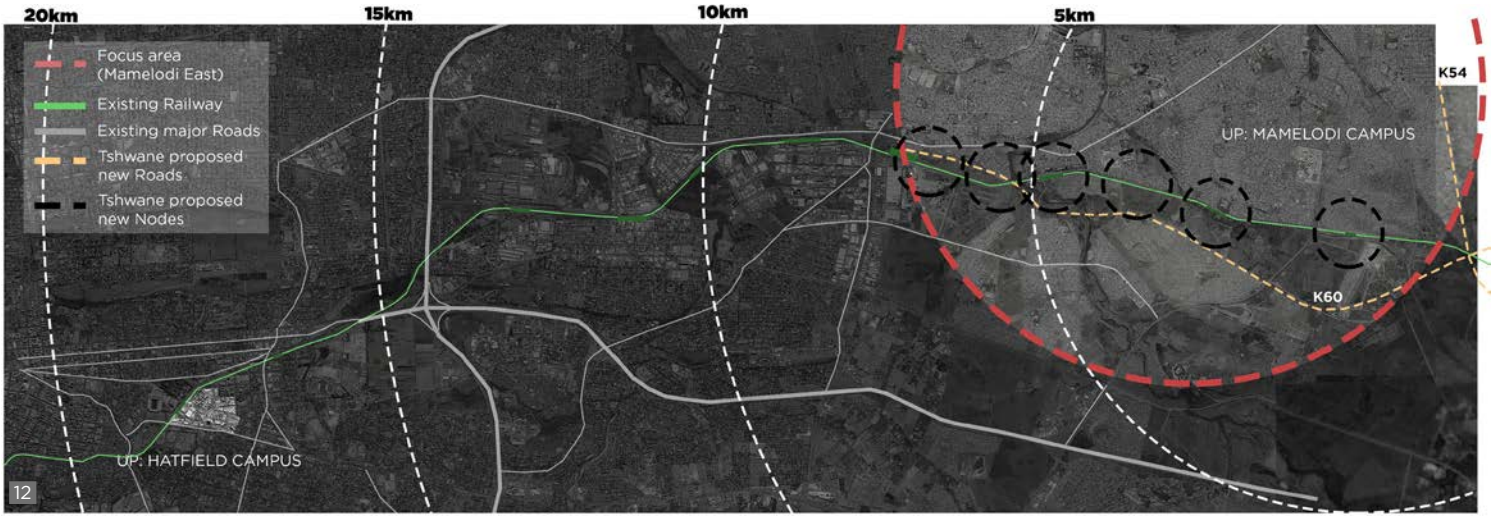
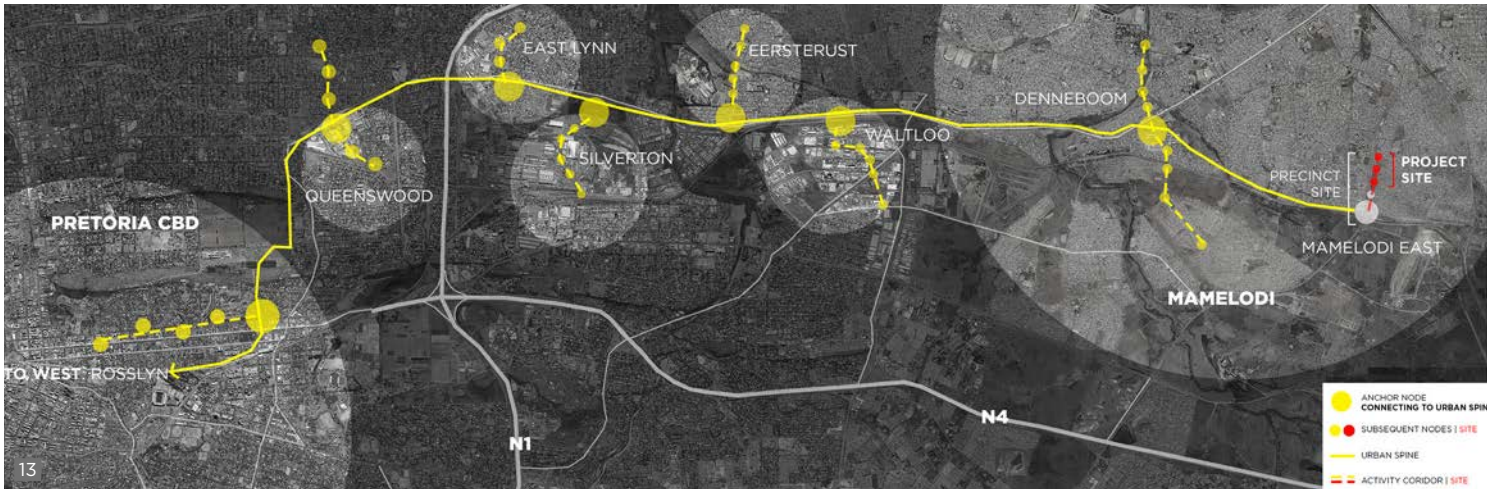


Figure 02.9: Khayelitcha and Mitchelsplein conditions before and after intervention (Author 2017)
Figure 02.10: Middle Left: Diagram showing movement hierarchies within a superblock (Adapted from L'Etang 2013)
Figure 02.11: Top Right: Spatial design for the Lanesdowne Corridor (L'Etang 2013)
Figure 02.12: Below: Tshwane Spatial Development Framework (Adapted from the official TSDF-plan)
Figure 02.13: Bottom: Application of the nodal programmes along the urban spine in different communities (Author 2017)





Program

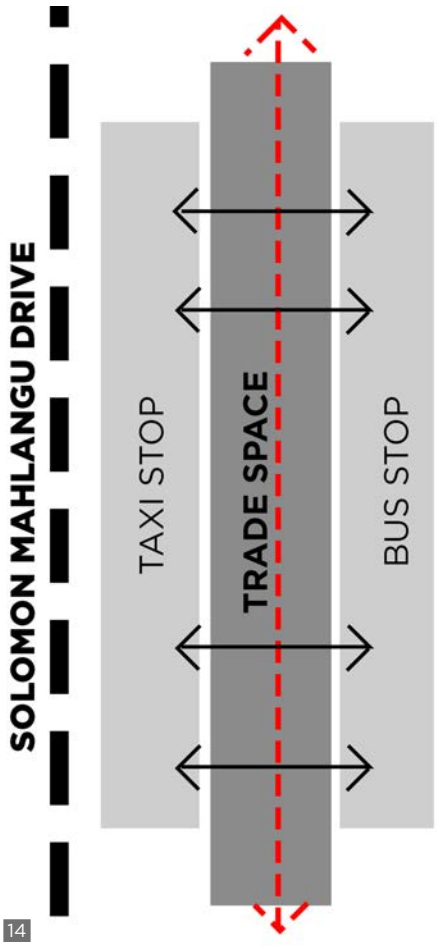
The applied theory makes it simple to effectively place the spaces within this intervention. Starting with the central node of highest value[14] (bridging the Hinterland-street that intersects Solomon Mahlanhu drive), the main hub contains all the currency-exchange related programmes including bus ticket offices, ATMs, banks and a post office - which is planned to become a dispensary for social grants in the near future (EWN, 2017). A pedestrian bridge links the two parts of the project together, with vertical circulation shafts on both ends down to ground floor level. Furthermore, this central node divides the project into two: The southern end being the transportation-hub and interchange between taxi and bus (energy generating programmes), and the northern end with more formal retail area as well as the non-motorised transport (NMT) hub-and development centre. A new entrance to the university on its eastern boundary is suggested that physically links the projects to the University grounds

Starting on the most northern end, (A), the centre for development of NMT becomes the anchor point of this intervention. This centre consists of an entrance foyer with exhibition space that could open to the public. Several private offices serve administrative purposes as well as offices for lecturers. A series of co-lab design spaces link the exterior with the interior that could be utilised as a meeting point between the students and community when not in official school use. In support of this, a technology research facility (B) links the private northern node to a public space central to the northern half of the project. This facility includes a library as well as computer labs where research and study-space is provided, not exclusively for the NMT-development centre, but also as a semi-public space that gives limited access to the public who want to use it. The tertiary education centre (A) facilitates the advancement in NMT, and includes two workshops. The first one (C) being a workshop for major bicycle conversions such as converting bicycles into battery-powered bicycles, and the second (D) facilitating the creation and attachment of different bicycle accessories to improve the comfort and safety of cyclist-commuters and professional or aspiring professional cyclists (e.g. from simple things like comfortable seats to intricacies like electronic gear-shifting). The educational node would be the most private one, acting as an extension of the (also private) adjacent university. The programmes then taper down hierarchically to the south where the workshops contain community participation elements as well as in-between garages where community members can start their own enterprise in conjunction with the two workshops (1). Individuals could be taught the skill of fixing and maintaining their bicycles, equipping them to start their own business as an example. Workshop facilities are thus not only exclusive to the students, but rather shared by public and private, under supervision of the latter.

Connecting all these facilities to the main southern node (of the half north of Hinterland Road), a linear link filters people through from the street edge to the spaces. Within the link, adaptive structures are provided to facilitate trade and storage to the traders. The southern-node (E) offers formal retail space, providing the opportunity for sales of created and adapted bicycles or accessories within the project. These retail elements spill out into a public square (F) that defines the public edge as a square where columns provide infrastructure for informal trading (already existing on site). Defining the street edge and the anchor point for the northern part of the project, a water tower will serve the public ablutions below (G) while signalling the point of entrance with its verticality. A vertical circulation shaft and ramp allow access to the bridge over Hinterland road as well as the Post office on the first floor (H), with private secure vehicular access on the bottom for cash-in-transit and post deliveries and collections.

A similar public node (J) frames the road intersection on the southern half of the site with the same public-trade column structure. This square however becomes the public egress to the first floor as large expanded stairs host a series of rectangular plinths that can be used for seating or informal trading. The edge of this square is covered with a permanent roof while adaptive steel structures provide infrastructure for temporary roofs to be hung inside of this public egress. Bus ticket-offices (K) further define the public entrance on ground floor, with the banks and ATMs (L) on first floor linked with an internal staircase form the entire currency-related nodes.

From this main node, another circulation link runs down to the southern end of the site, serving multiple purposes beyond just circulation. Being the median (M) between the taxi drop-off facility (N) on the western street edge and the bus stop to the east (O), this link becomes a point of public intersection that draws the energy collected by both the transport nodes. Being the space where the public will move through the most, it becomes the ideal location for primary informal trade to happen (Figure 02.14). Boxes that provide storage (2) and trading facilities that could be hired are provided for at intervals along this axis for bigger informal trading, whilst the same column-like structure provides space for less established lower-class informal trading along this route. For the taxis on the western edge, small



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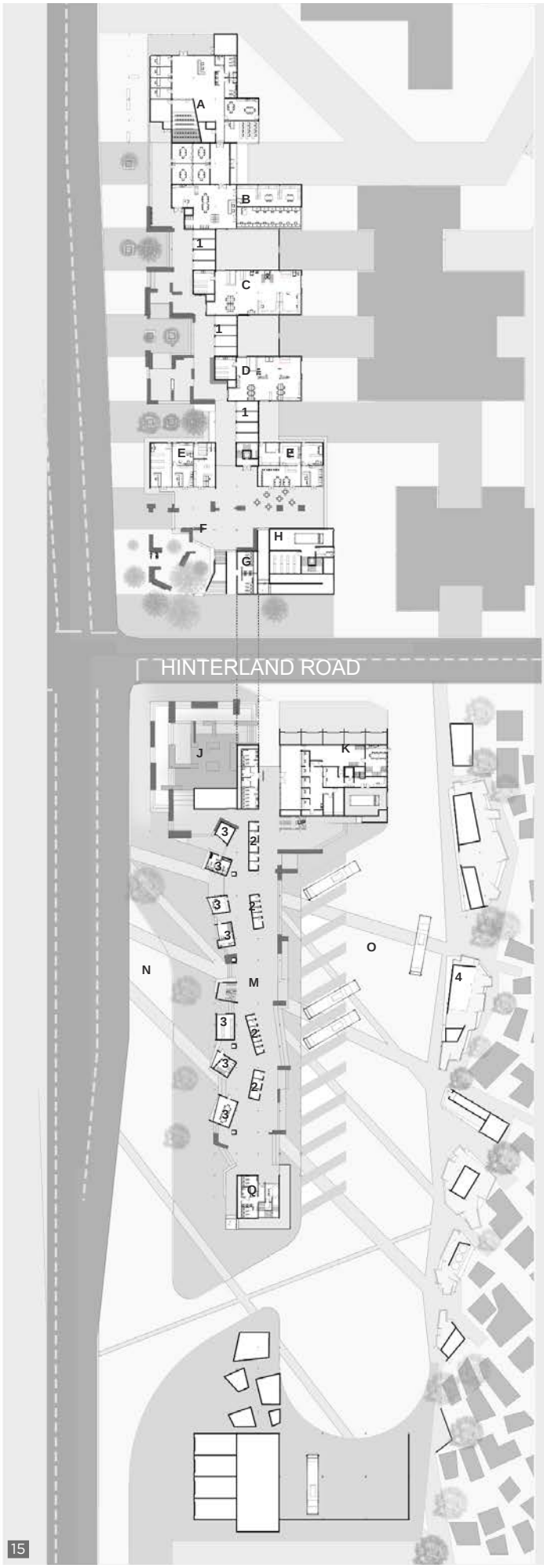
14 The point on the site where the biggest flow of energy would be spread around



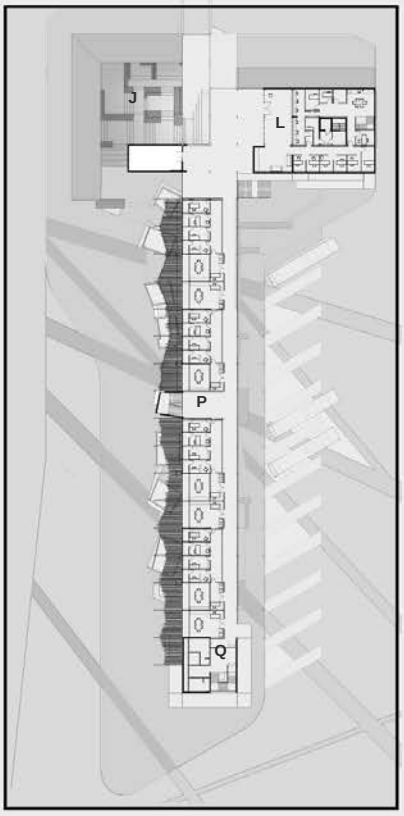
15

GROUND FLOOR PLAN

GROUND FLOOR
A NMT-development centre
B Technology research facility - IT centre and library
C Bicycle conversion workshop
D Bicycle accessory workshop
E Formal retail facilities
F Public square
G Public ablution facilities
H Post office entrance on Ground Floor to deliveries and pickups, public entrance on First Floor
J Public square becoming egress to First Floor
K Bus ticket offices
L ATMs and Banks
M Public circulation spine
N Taxi public transport node
O Bus public transport node
P Rentable office space
Q Vertical circulation and public ablution facilities

1 Informal trading rentable garage space
2 Informal trading rentable units
3 Taxi facilities (ablutions, kitchen, meeting rooms etc)
4 Facilities for Phomolong community

DIAGRAM PLAN OF PROGRAMMES
Not to scale



FIRST FLOOR PLAN

Figure 02.14: Left: Diagram illustrating the public trading space zone between two transport nodes (Author 2017)
Figure 02.15: Right: Overall site plan with programmed spaces on Ground and First floor (Author 2017)

meeting, resting and ablution spaces are provided to the back of the trading stalls. (3)

On the second level of this linear axis, office space (P) is to be rented out to the public, with multiple vertical access points along the axis. This could then serve as infrastructure for any larger private investor to establish themselves within the community as a point of interaction. The office axis terminates in a node of vertical circulation with stairs and a ramp, as well as providing public ablution facilities on both levels (Q).

Connecting the southern half of the programme to the existing Phomolong informal settlement, the eastern edge of the intervention would consist of public spaces that serve the community of Phomolong (4). Water collected on roofs and the paved bus terminal surface is filtered and used for new shared ablution, bathing and gardening facilities that structurally spill into the previously undefined edge of the settlement. A very organic spatial approach weaves the new built transport facility into the edges of the informal settlement.

Contribution to Architecture

Nodal development along a predetermined spine not only weaves the internal typologies and spaces within the physical built environment together, but also creates a precinct that could link to bigger-scale corridors, improving accessibility to the city and beyond. This model could thus be seen as a micro example of and catalyst to the bigger problem which is equitable access to all, which according to Lynch (1960:203) means adequately addressing: "…the diversity of things given access to, the equity of access for different groups of the population, and the control of the access system."

On the urban scale, the proposal of the NMT-facilities and city-scale plan of combining the city's proposed K60 route along the railroad with a dedicated cycling lane which connects to key work-and social destinations the city's CBD, not only opens up new choices of transport, but improves the current systems through having a direct public transport-dedicated route connecting the east of the city to the west.

The proposed project could be seen as a single node on the route, as it intersects the main line of transport, and is defined as a single precinct even though on a smaller scale it is divided into sub-nodes (as explained in earlier in Figure 02.13). Along the urban east-west route, nodes similar to this can be implemented to filter the energy of this city-scale spine into the respective suburban areas it flows through, and in the same way as in Mamelodi, addressing the socio-economic issues along with the problem of equitable access of each of these neighbourhoods.

Focusing on the architectural or precinct scale, this type of spatial organisation along a spine is a simple strategy to stitch spaces related in programme together, while simultaneously opening up an otherwise enclosed public space. Figure 02.16 demonstrates this concept. The spatial-planning strategy is also contextually appropriate, as nodes can be developed incrementally when funding is not available for the entire project all at once. This method opposes the current *status quo* of development - big enclosed precincts like malls that are located on an isolated space within the city, becoming a destination to travel to, often inaccessible to the urban poor due to transportation costs to this secluded[15] location. Programmes could expand without difficulty as well as be added or removed as needed.

Besides the adaptive programmatic response, this smaller nodal approach to an otherwise large programme in its totality is arguably the best contextual response to a community with a big variety of typologies on its edges. Ranging from small shacks to the large enclosed private university campus, the size and edge condition to each node could be adapted to its immediate context through addressing the typology and type of space that is required, weather it is a public, semi-public or private space.

In-between the linear links running parallel to the road in a strict grid-structure, the nodes are designed to spatially relate to the existing typological context. In its architecture, the planned buildings located next to the Phomolong informal settlement on the southern end of the site spatially respond to the informal and organic organisation of the informal houses by mimicking the rather 'hap-hazard'-like 'design' of small shacks[16] – small in footprint and in stark contrast to the strict grid of the adjacent linear road. In addition to relating to the context in programme (small trading storage units and taxi facilities). The result: a series of small blocks placed apparently 'at random' along the contrasting linear north-south circulation axis, preserving the *Genus loci* of the Phomolong informal settlement.

To the north, the same approach of a typological response within the main grid-structure is used. The immediate context here however, is a much more formal suburban footprint with larger houses responding to the linear layout of the roads that run in a strict grid. These nodes thus respond spatially with slightly bigger buildings footprints on the street periphery, spaced farther away from one another, while functionally it allows for more permeability into the site.

Addressing the functionality of this beads-on-a-string concept, this system allows a large flow of energy to taper

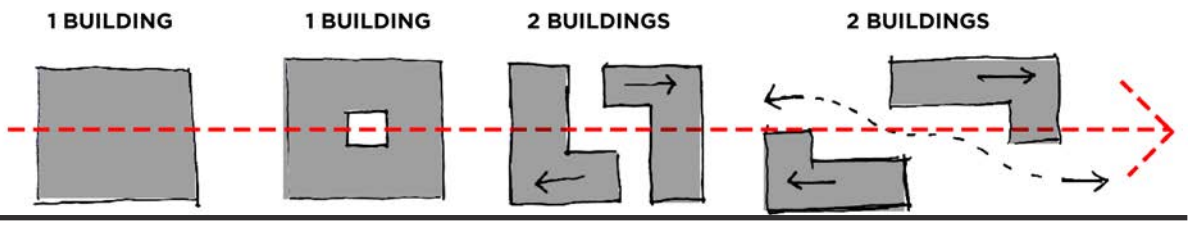


Figure 02.16: Spatial organization along a spine illustrating the way the building opens up into multiple single-programmed spaces (Author 2017)

16

15 From the perspective of the urban poor, the destination becomes secluded to them as they have to travel to a destination far off-route from their daily commute at additional transport cost; thus, the destination becomes more inaccessible to them.
16 Referring to the way shacks are built with no visible formalistic approach in its footprint, but rather an organic and function- and available material-driven response

down through a hierarchy of spaces, from the main city transport spine down to the small pedestrian streets of informal settlements. The precinct spine thus gathers this energy at a point, and spreads it out in all directions along predetermined routes or spaces. With the infrastructure and energy provided, it then becomes an easy task to benefit from the amount of people that move through the spine, through the establishment of facilities for local small-and medium trade. This approach thus functionally relates and responds to the immediate socio-economic needs of the community it is built within, as incremental growth is stimulated through the provision of infrastructure for the above-mentioned trading in between major nodes.

All of the mentioned architectural contributions are rooted within a well-grounded formalistic approach. The materials chosen reflect the position that the intervention responds to as mediator between different typologies. The temporality of the corrugated iron sheet-clad walls and roof of the inter-nodal structures, speak of the adaptive abilities that this design allows for, while the permanent brick-and-concrete plinths that the nodes are designed upon roots the building's more permanent features. A distinct base of patterned brick paving also clearly demarcates the flow of energy from the bigger nodes down to smaller ones, cutting through the adaptive trade-buildings along the spine, which allows these facilities to draw from the traffic on this paved surface.

As a public building, the architecture primarily speaks as an architecture of floors and roofs. Responding to one another, these two elements drive the linear logic of the whole design, raising and dropping in response to the spatial hierarchy that pans out from its central core. An array of columns with responding base-designs articulate the rhythm of the design on the linear grid and connects the roof to the ground, whilst the programmed spaces are built as boxes within this structure, rather than as part of it. In section, the roofs move up and down as the hierarchy of public space varies. The big transport nodes are accompanied by high roofs that taper down towards programmes on the edge of the residential areas, which allow for more human-scale structures to respond to this context.

Conclusion

"Vibrant urban activity and the conditions that nurture small-scale livelihood strategies are only possible when variety and intensity occur, which can only be achieved through the promotion of more compact and rich urban environments." (L'Etang, 2013).

Where the value of a city is determined by the ability to access it, the public transport industry certainly plays a vital role in communities where residents rely on it for their daily commute. By building on this already established network of public transport in a way that participates with the community, integration between the public and the proposed transport hub is accomplished in parallel to the integration between the city and its users on an urban scale.

The architecture, although formally responding to the informants of site and its existing context, has a much bigger responsibility than simply giving form that fits the environment. It addresses the inequality of access as primary function, by being an architecture of infrastructure to the existing nodes on site. Formalised transport nodes linked by corridors that stimulate local economic growth through facilitating trade on different levels makes this intervention programmaticly relevant, as it transforms the potential energy currently spread across unrelated transport nodes into usable energy that the community can benefit from.

This precinct intervention also serves as a small-scale model to urban corridor development with the proposed node serving as an anchor point to the city's planned transport corridor to its CBD. Using the string-of-beads theory as a driving concept, the effectiveness of this theory is manifested in the ability of the nodes to grow and adapt as needed. This would then be directly applicable on the urban-scale, an efficient tool for the city to weave its rapidly expanding borders back to its centre. The accessibility of this node thus becomes a manifestation of accessibility to the city, not only by providing the platform for multiple types of public transport to share resources, but by also including new means of public transport to the city through the development of new NMT infrastructure. New layers of choice in transport for the commuter allows for better access to the city and its resources, thus improving the city's use to its people.

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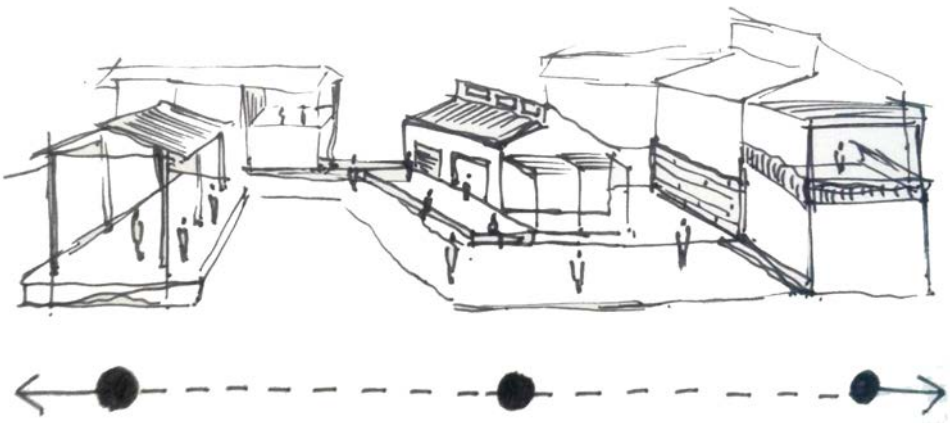
03

CONCEPT



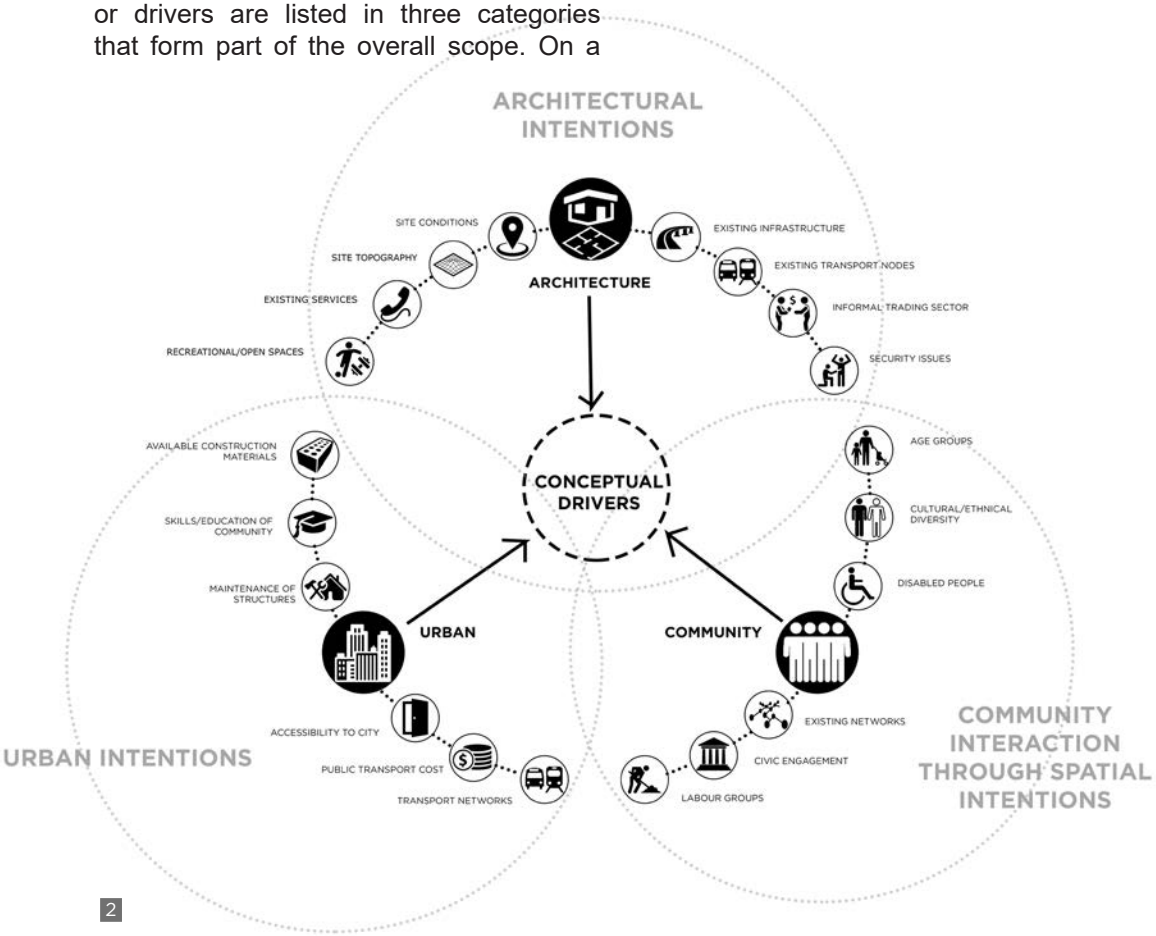
03.1

The overarching concepts used in this project were generated through investigation of **programmatic requirements**, the **context of the site**, and context of the **conditions within the community**. This chapter will start by listing the project intentions, where after several design ideas are discussed as concept **generators**, finally leading to the **final concepts** derived from the ideas, and the application thereof on the design.

PROJECT INTENTIONS

Stretching over 360m in length, this project running adjacent to Solomon Mahlangu drive aims to **collect energy** that already exists next to the busy road, and then through the intervention **spread** it past all its programmes that will as a result benefit economically. This economic benefit can then assist with the immediate peripheral community's socio-economic upgrade.

Occupying a space that is **central** within the heart of the community, the intentions or drivers are listed in three categories that form part of the overall scope. On a **Social** level it should deal with the different social groups and networks to existing site interventions by the community. From an **Architectural** side, it intends to manifest itself within different typological conditions, and on an **Urban** level, it intends to make the city more accessible while serving as a set-out point to an improved public infrastructure. **Figure 03.1** demonstrates the specific component of each level as well as the relationship it has with one another.



2

-COMMUNITY INTERACTION INTENTIONS-

THROUGH SPATIAL INTERACTION

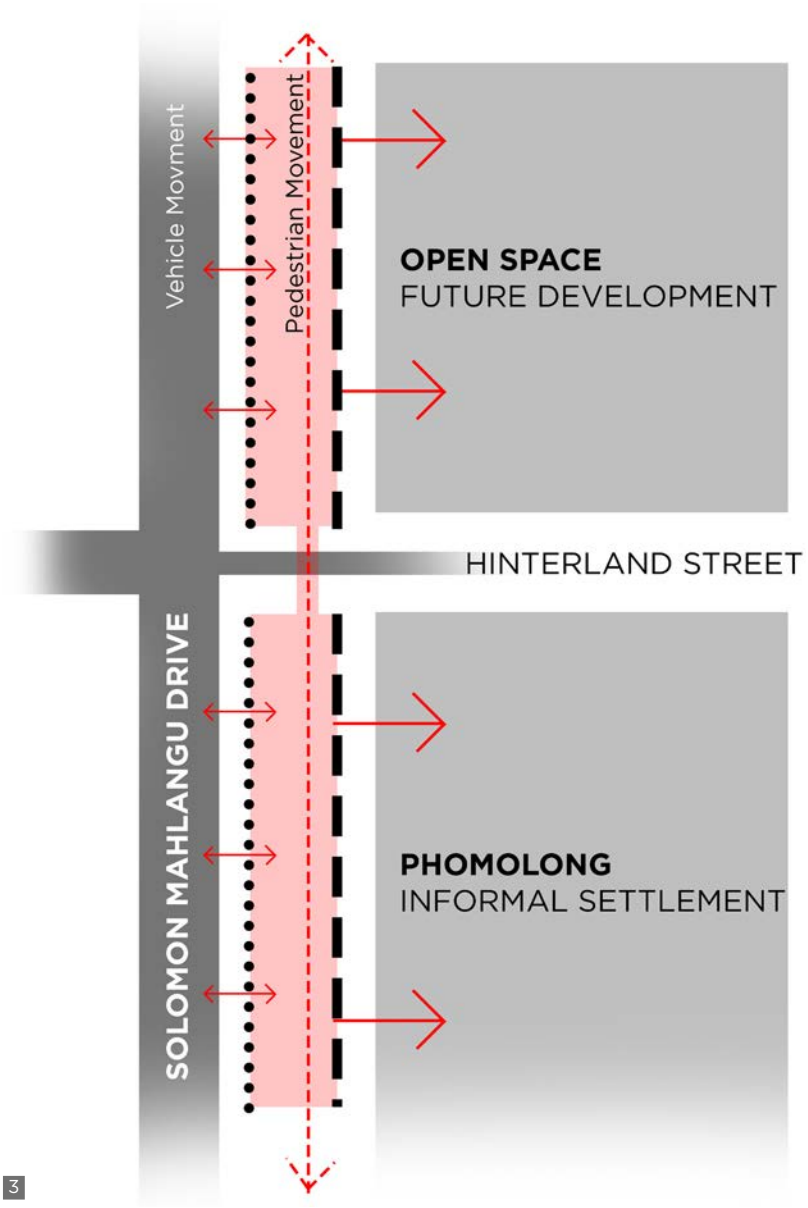
"The threshold does not only concentrate on the boundary between the public interface and production, but includes the possibility of creating a passage from one to the other"

(Eliade 1959: 18-25).

Given the location of the project, spanning across a road as well as running alongside another, the most important spatial intention would arguably be the **definition and reaction to the street edges**. The design intends to **split** the vehicle movement from the pedestrian movement, providing a safe and vibrant public walkway between the public transport nodes.

A **permeable** front (facing Solomon Mahlangu drive) will allow pedestrians to filter through to the central walkway throughout the entire project, and lead them past the respective project nodes, in turn providing these nodes (e.g. informal trade stalls) with the clientele they require. The design should thus spatially **open-up to the public** front (the road) throughout its entire length, and provide an apparent pedestrian walkway parallel to road that **connects** every node within the project.

Figure 03.1: (Cover) Informa
trading in Phomolong (Author 2
Figure 03.2: Diagram illustra
the different prevailing compon
to be dealt with on site, and the
relationship it has to Architectu
Socal- or Urban intentions
Figure 03.3: Edge condition
and relationship that the propos
intervention should demonstrat
towards the existing

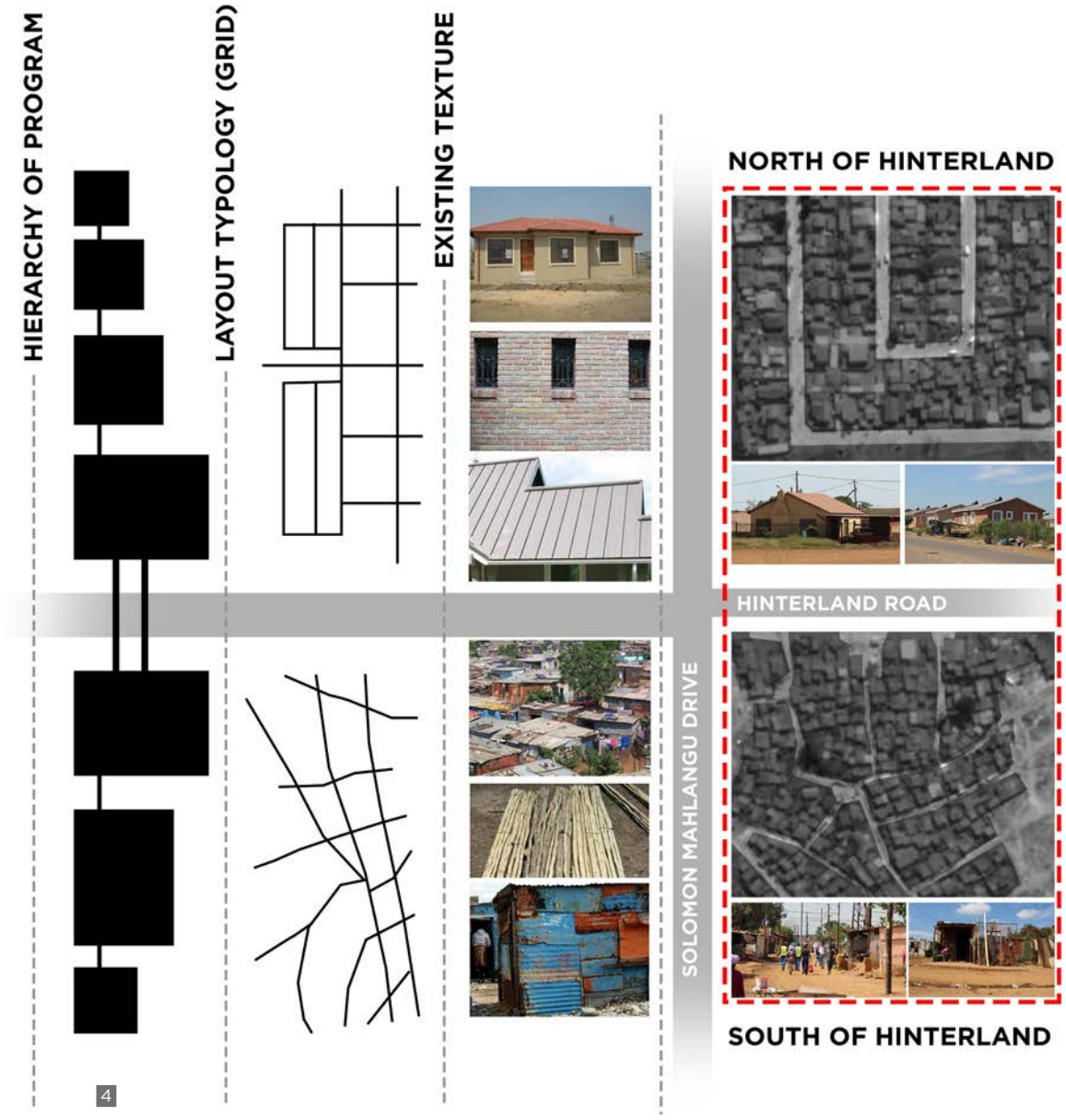


3

-ARCHITECTURAL INTENTIONS-

Bisecting the urban fabric: to the South East of the site, the informal settlement of Phomolong where small informal housing developed in an organic organization with cheap materials like timber poles, clay and corrugated steel are **juxtaposed** to the North-East where small suburban brick or concrete block houses that form internal neighbourhoods of their own are built in a rigid grid-like organization, with no interaction towards the busy street. This **dualism of texture** is one that the project needs to respond to sensitively, to ensure that the building **fits its genus loci**. A **seamless merging of the typologies** is of primary concern when dealing with the architecture in terms of material use, size, and layout of the individual nodes.

Dealing with the **variety** of programmatical needs, as the nodes are arranged in a **hierarchical** sequence (refer to page 37 in the paper), the architecture **should follow suit**, responding with a similar hierarchical order. Structures that carry a more important role, should thus be highlighted as such. Having the most public spaces and programmes central to the project on either side of Hinterland road, these buildings respond architecturally being elevated above the rest of the structures. From here on out, the elevation tapers slightly downwards towards the two ends.



-URBAN INTENTIONS-

The urban statement that the project makes as a **catalyst to further precinct development** between the University on the north and the proposed new Gautrain station on the south, makes it paramount that a **fluent** and **adaptive approach** is used when dealing with future growth. A structure for the central walkway is therefor considered that can easily be extended in any direction where growth occurs.

On a larger scale, the issue of access to the city should be addressed, which is the primary reason for the **inclusion of a NMT-hub**. In addition to the proposed bicycle route to the city CBD, the public walkway should also cater for cyclists, providing **access to all cyclists** when catering for any pedestrian movement.

These intentions summarize the requirements for a successful architecture, that will be used in the design phase to test and evaluate the outcomes against. From this base, project ideas could be drawn from that form the conceptual generators of this intervention.

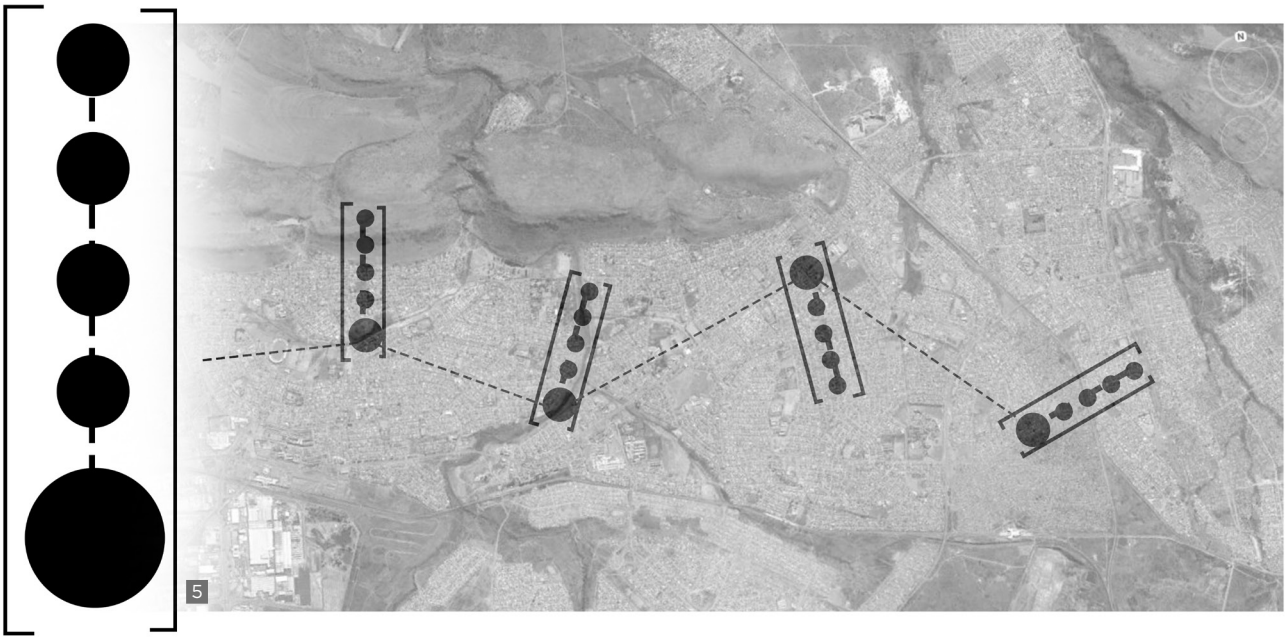
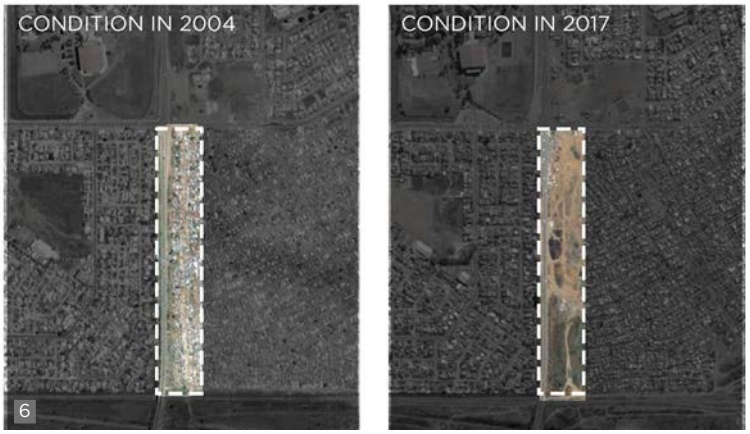


Figure 03.4: Diagram of the Architectural intentions illustrating the difference in texture and typology between the neighbourhoods to the north and the south of Hinterland Road, as well a diagram indicating the hierarchichal intentions from the centre tapering outwards (Author 2017)
Figure 03.5: The Urban nodal intentions as a catalyst to future implementations in different neighbourhoods (Author 2017)

03.2

PROJECT IDEAS

-EXISTING CONDITIONS-



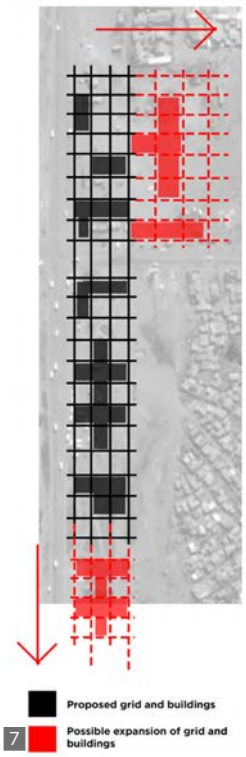
When looking at **Figure 03.6** from Google Earth 2017 compared to that of 2012, it is evident that constraints have been put in place to the growth of the informal settlement. Members of the community have been relocated due to the regional boundary in place for the informal settlement as per the Tshwane Spatial Development Framework published in 2013 (City of Tshwane, 2013). This open space adjacent to the main road thus created space for the proposed programmes (transport and trade), which form the programmatic base of the proposed intervention as per the Mamelodi Group Spatial Framework (MProf 2017 – strengthening existing nodes). The site however is **stretched** alongside the road on this cleared area, making it difficult for a **single condensed** building to be developed. The programmes are therefor broken into smaller spread-out nodes (**Figure 03.7**). In relation to the beads-on-a-string theory that supports the design, these spread-out programmes should be **interconnected** with one another to maintain continuity in the design. This 'spine' connecting the nodes should not only be a physical connector, but also carry the role of **distributing energy** and other resources throughout the intervention.

Considering the **surrounding context**, the **visible dualism** of housing typologies between the Northern and Southern parts of the site (Figure 03.4 on previous page) is seen as a concept **generator**. With the **private and educated** community members on the one hand, compared to the **public and mostly unskilled**/ uneducated community on the other, the project becomes the **mediator** between two opposing conditions.

Working adjacent to Solomon Mahlangu drive as the North-South axis, this major artery is the **main** (and only) point of entrance to Mamelodi East from the south, which makes it a congested route in peak hours for public transport (taxis and buses) to exit and enter Mamelodi. It is thus logical that public transport nodes develop **along** this road where many commutes start and end each day. These nodes attract a number of **informal traders**, resulting in a **series of informal nodes** that feed off one another. The existing nodes thus become the primary nodes to the programme, whilst creating infrastructure for secondary nodes to latch onto as a method of intervention that preserves the sensitive role these nodes play in the community network. **(Figure 03.9)**

-ADAPTIVE NEEDS-

As a **catalyst** to further development of this 'string-of-beads' framework, the proposed intervention forms the **first stage** of development, and not as a completed environment in itself. The idea is that **future incremental growth** is facilitated for, and encouraged. The main 'spine' that runs through the project is designed in such a way that it allow for future continuation, by **adding** additional programmes to it as becomes necessary. An **adaptive approach** is thus vital throughout the entirety of the project, allowing for as much as possible options for **future extension**, not only through the spine itself, but also through the structural integrity of the nodes themselves. It is not adequate to see this 'adaptability' simply as a **sustainable extra** to the design, but rather as a **fundamental driver** of the project, making it a key conceptual generator in its nature **(Figure 03.10).**



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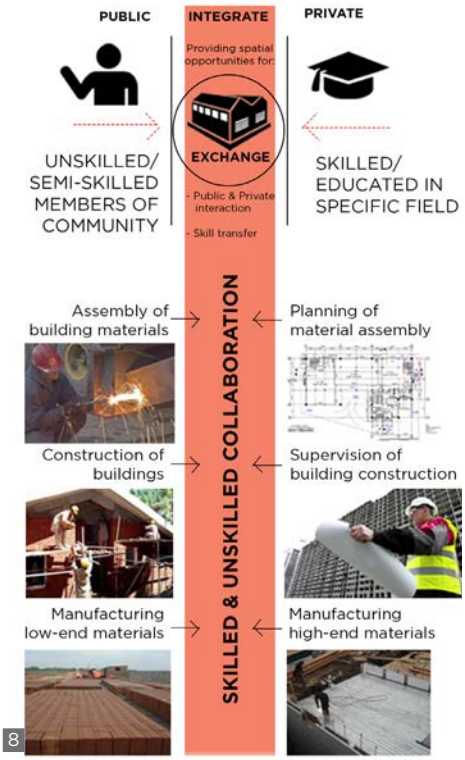

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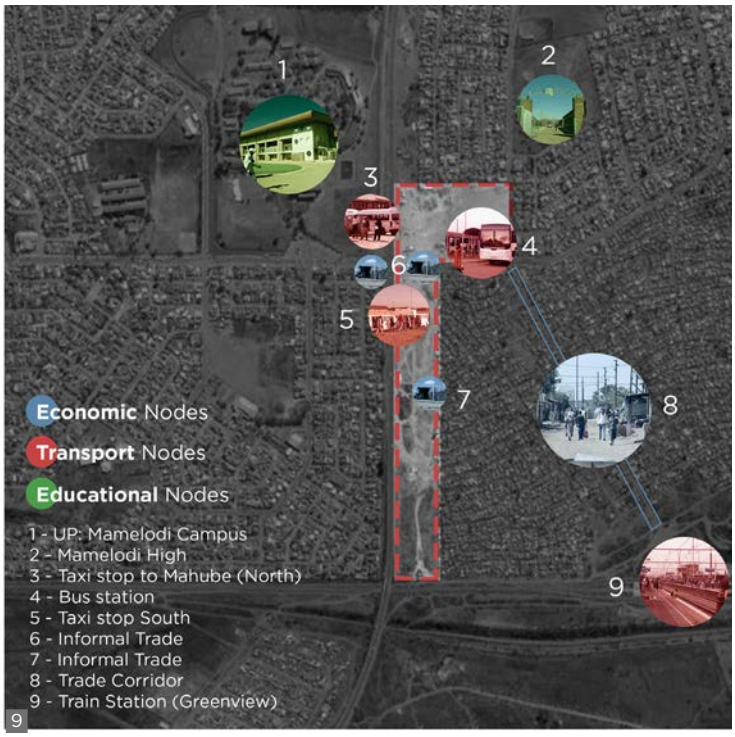

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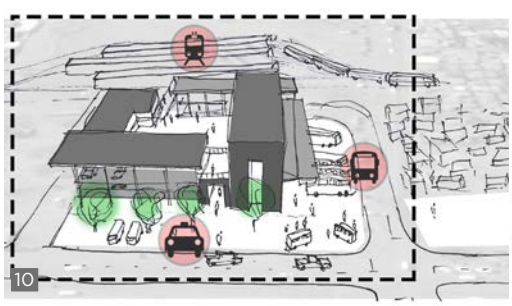
Figure 03.6: Comparison of site conditions in Mamelodi East in 2004 compared to 2017 (Google Earth 2017)
Figure 03.7: Illustration of intention to break up programmes in smaller spread-out nodes rather than one single condensed node(Author 2017)
Figure 03.8: Diagram illustrating the intervention as mediator between public and private communities (Author 2017)
Figure 03.9: Existing nodes on site (Author 2017)
Figure 03.10: Expansion of existing nodes on the grid within boundaries of the precinct vision (Author 2017)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03.3

FINAL CONCEPTS

Having outlined the intentions of the project in its respective genres, these will be used to assess the validity and appropriateness of the concept along with the extents to which it will impact on the design. Where the design **intentions** drive the outcome and **validity of the design**, the project **ideas** are considered the starting point or **generators of conceptual scenarios**. These conceptual scenarios drive the design decisions, from the overarching and apparent **large scale** through to the **tiny details**, ensuring that a **coherent** and uniform thought process is applied in every scale and detail of the project.

With the design ideas pinned-down, these created several conceptual scenarios that formed the foundations for the concepts used in the project. These are summarized as the following:

1. **The site as a mediator between different or opposing conditions in typology (texture) and level of education or efficiency in skills**
2. **The idea of breaking up a whole into separated programmes as a small-scale illustration of the 'beads-on-a-string' theoretical framework in which the project is grounded**
3. **Connection of the programmes through a central axis that directs the services and energy (people) through the site**
4. **Future-proofing the project, for short- and long-term adaptation through continuation of the programmes along the central spine, as well as adaptability of the current buildings through designing in a way that allows for future upgrade or extension.**

From these ideas, **two separate concepts** are derived that embody the four listed ideas, and which are validated through the design intentions on all platforms to drive the design decisions. They are:

-SPINAL INJECTION-

Stitching together elements of the whole with a **central spine** that provides the programmes with their services (electricity, water, etc) as well as **injecting the life**, being the **energy** of pedestrian traffic provided by each of the transport nodes.

This spine thus runs on the longitudinal axis of the project (**Figure 03.11**) from the Northern anchor through to the South, with the idea that it can simply continue in the same fashion and structural integrity when a new node is developed. An **open modular framework** allows passing pedestrians and commuters to be **drawn into** this main spine to further move within the axis, passing by main nodes and secondary formal and informal traders along the way. (The integrity and structural design is covered in the technical chapter).

The second concept runs perpendicular to the longitudinal north-south axis which is the spine:

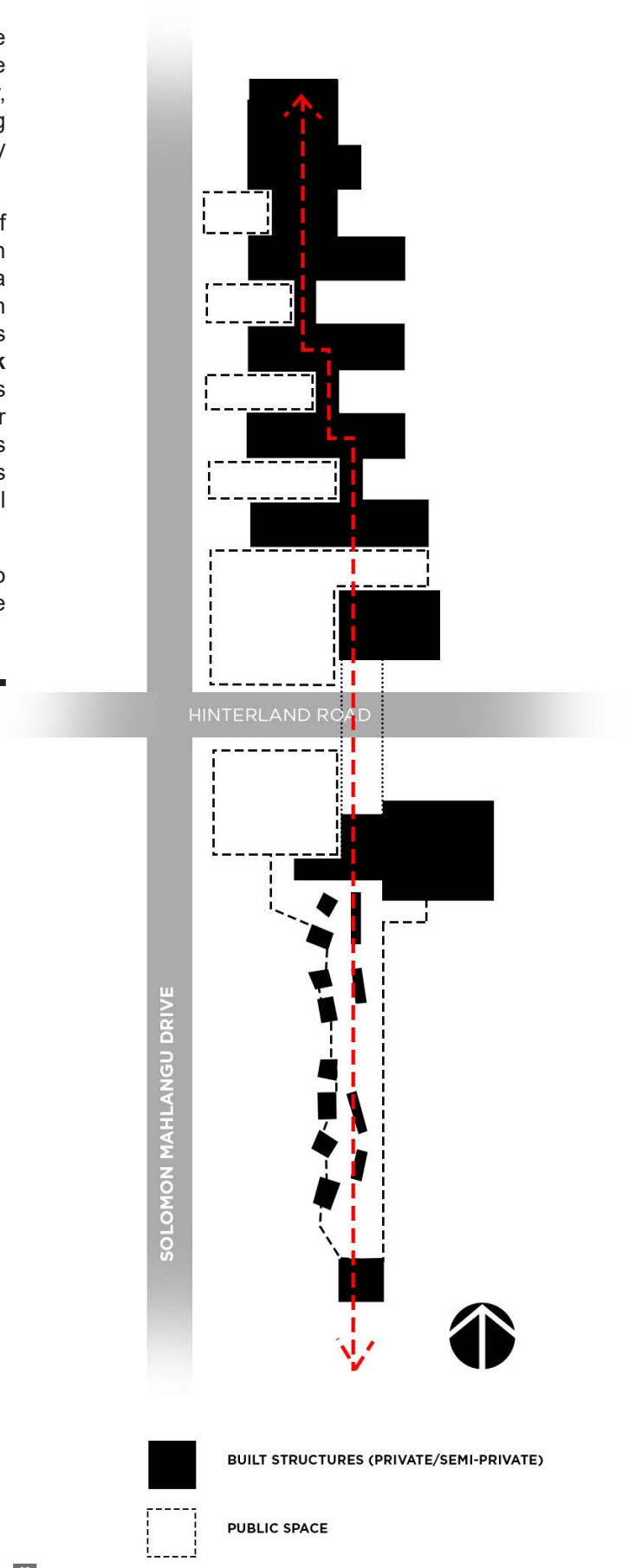


Figure 03.11: Concept: Spinal injection

11

-INTEGRATED EXCHANGE-

This concept addresses the different **contrasts** on the site: the dualism between income groups, level of education/ proficiency in skills, and the texture of typologies that exists between the informal settlement vs the 'medium class' income group (**Figure 03.13** - next page)

The concept is applied in the design on each platform or programme catered for. The idea is that, as illustrated with **Figure 03.12**, a space is created where knowledge or physical **exchange** happens between the two contrasting parties. This is a metaphysical space where integration can happen, for example, a space where skilled bicycle-builders can teach an unskilled individual how to fix or repair bicycles, equipping him/her with a particular skill that he/she can then use to start an informal business of bicycle repairs. Although this action is not one that architects can ensure, the **space is provided** for in every programme for this exchange between the skilled and the unskilled, the teacher and the learner, the master and the apprentice.

Each component of the project has a **spatial connection** between the private members of that programme, and the public pedestrian that walks by where this interchange can take place. In support, trade storage units are located adjacent to all the exchange programmes that provide a platform for the individual to start/expand their acquired skill into a business model as illustrated by **Figure 03.12**.

On a more architectural platform, the integration between opposing housing typologies is reflected within the **texture of the architecture**. Small irregular-shaped structures correlating with the organic texture of the informal settlement are facing the public street on the southern end of the design, compared to the rectilinear buildings that dominate the northern part of the site. The play between the rigid and organic grid contrasts one another, but respects and recognizes both textures in a spatial attempt to integrate the two contrasting conditions with one another, thus also creating a space where both communities can relate with in terms of its architecture. On an aesthetic level, the project is seen as the **mediator,** and plays the role of a spatial negotiator between the two typological scenarios. (**Figure 03.14** - next page)

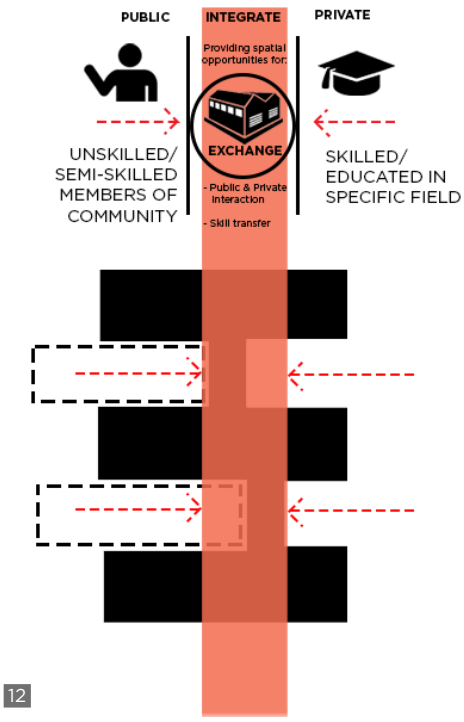
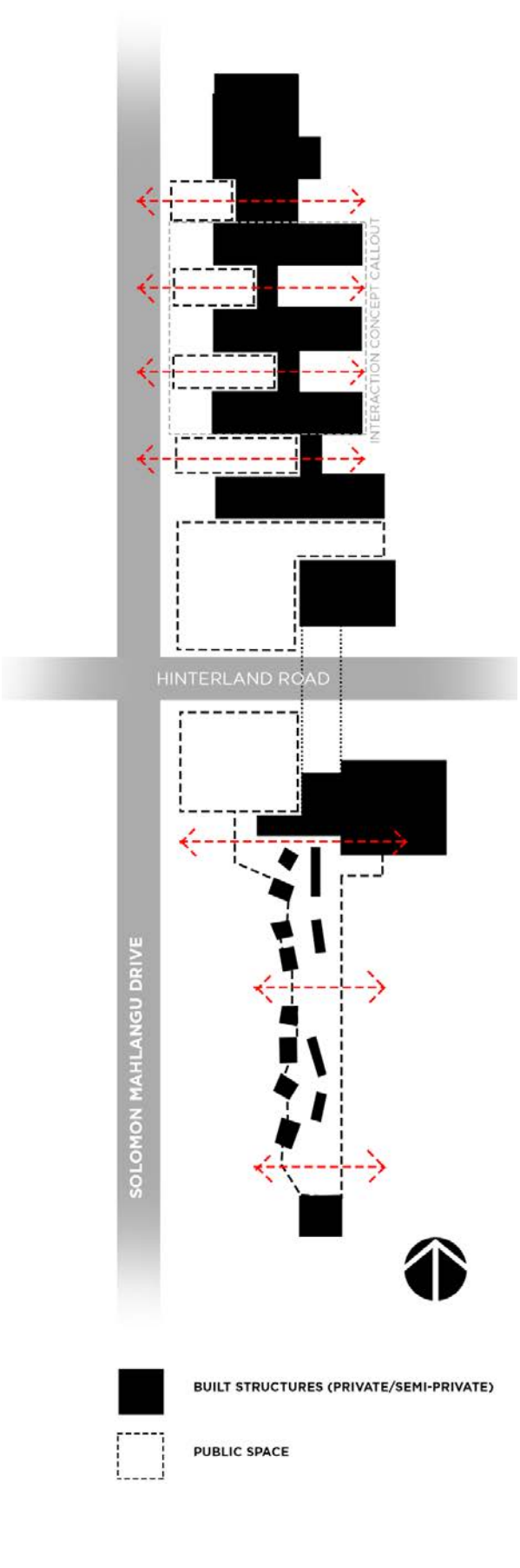


Figure 03.12: Application of the concept on the diagrammatic plan
Figure 03.13: Concept: Integrated Exchange.
Figure 03.14: Diagram illustrating the application of contextual influences on plan
Figure 03.15: (Over Page) Conceptual sketch illustrating the relationship between the application of concepts in the Design and Technical sections of this dissertation



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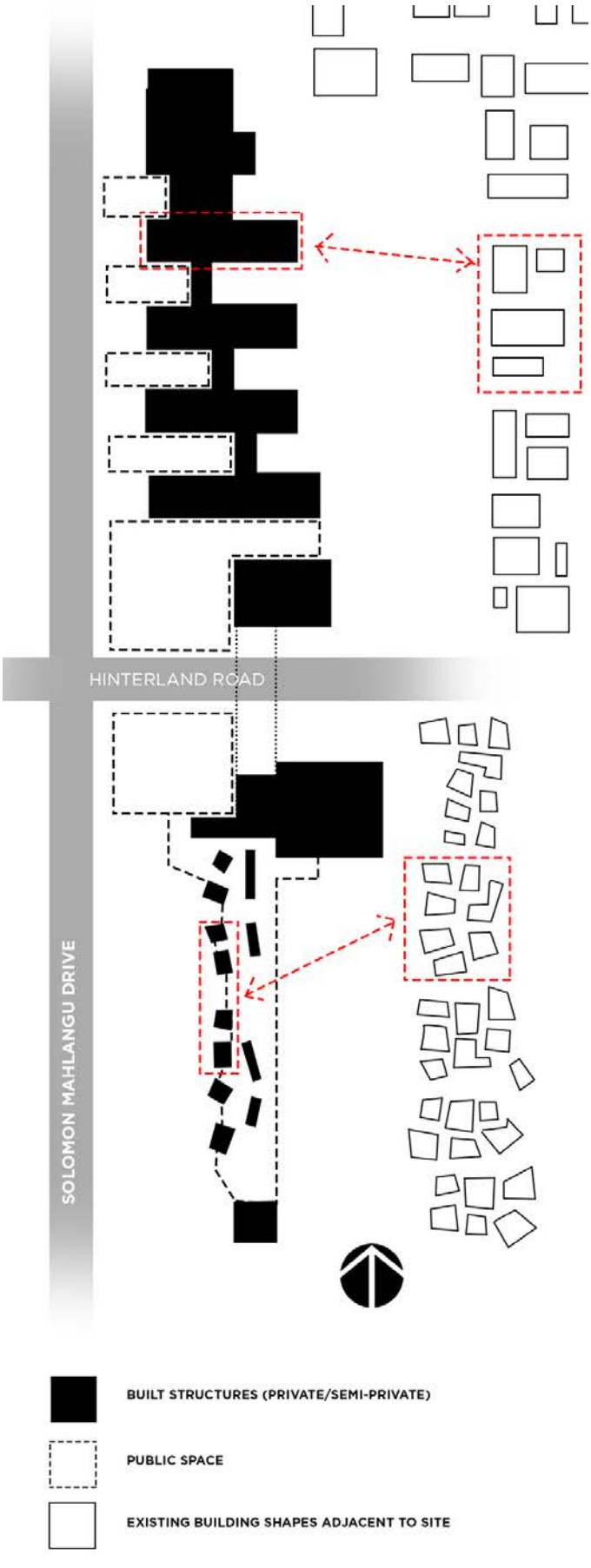

14

DESIGN CO

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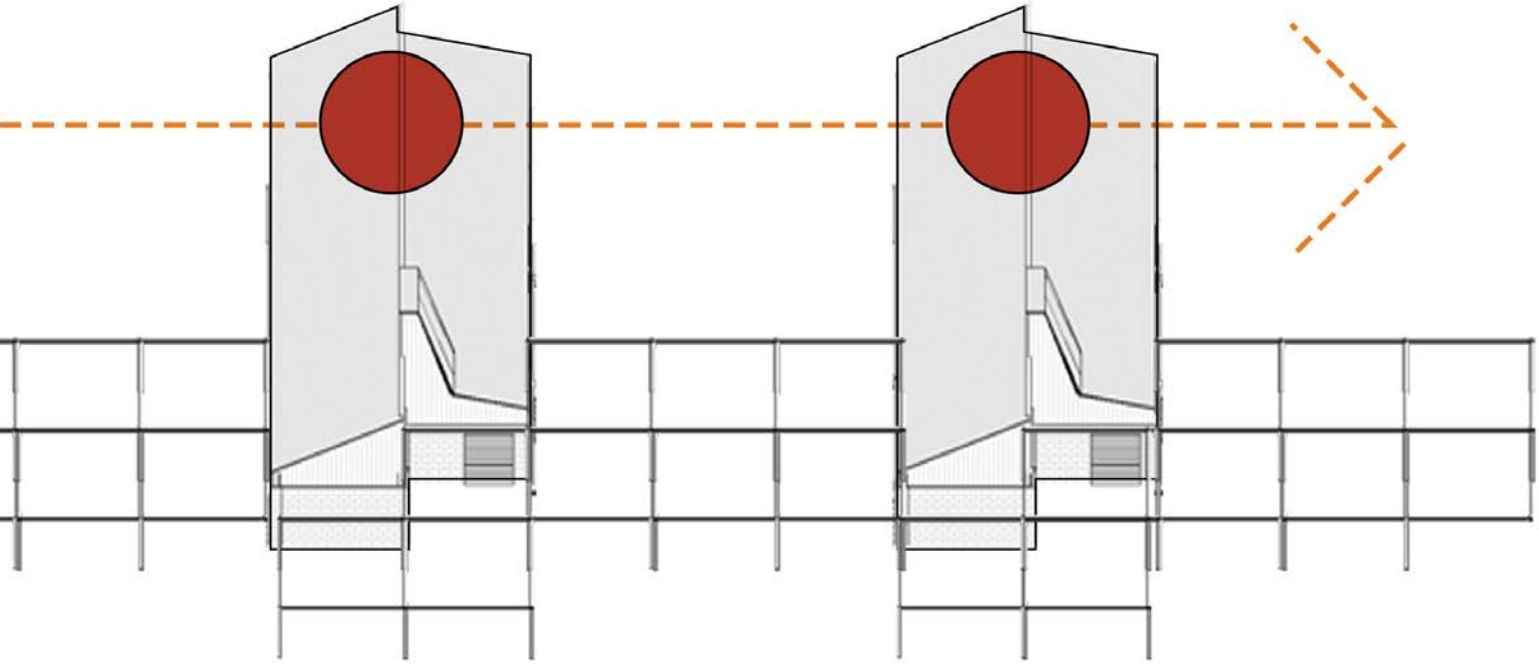
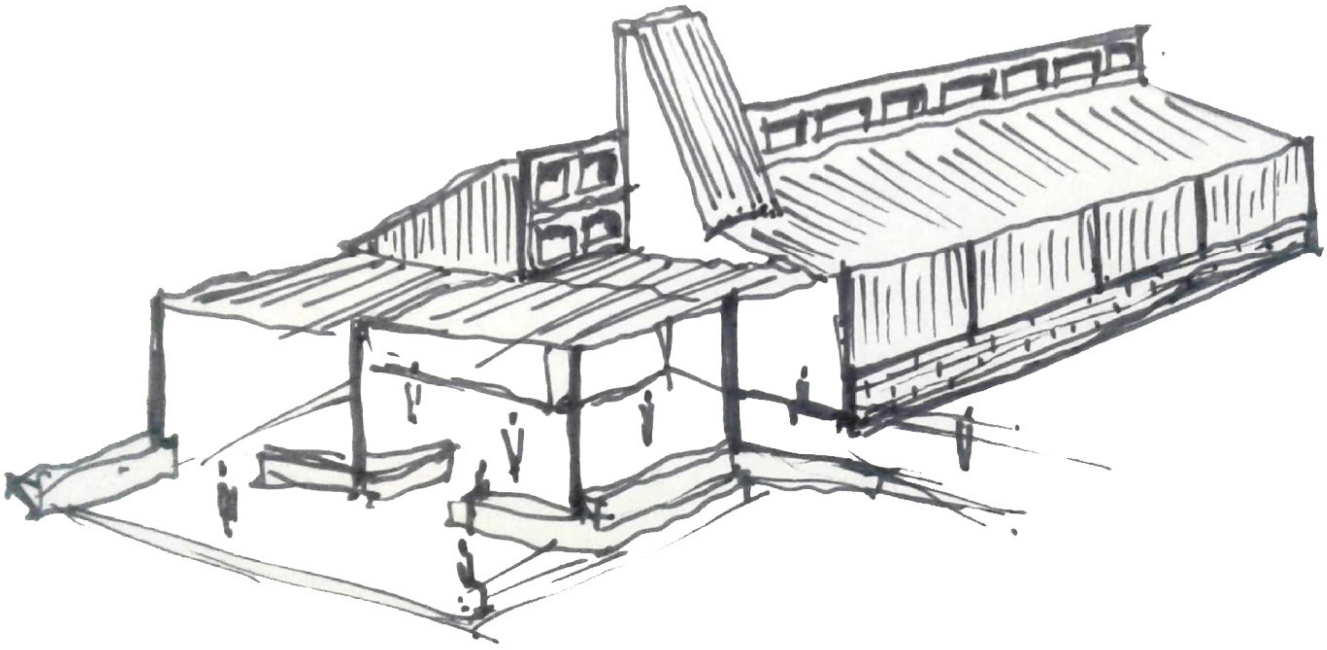
ECHNOLOGY CONCEPT



04

DESIGN



TECHNOLOGY CONCEPT

DESIGN CONCEPT
Nodal development of Programs on a spine causing an **activity corridor** to grow sporadically between the main Nodes which provides **infrastructure** for local informal or formal **trade** to attach to

DESIGN CONCEPT

1

04.1

PRECINCT VISION

In parallel to the concept development, a manifestation of the programmatic requirements into a spatial design **initiated** with a precinct development **framework**. This allows for a greater understanding of the design in its envisioned **context**, and to understand how the different programmes work in a whole.

The initial programmatic manifestation on site was successful in terms of its breaking-up of the whole, where the different transport nodes were separated as per the conceptual framework. Programmes were **grouped** in terms of its **use,** having the transportation nodes adjacent to the public road, the workshops to the northern road which had less energy in terms of pedestrian use, and the centre management to the east as an anchor point to the greater vision.

From this layout, several observations should be considered to inform the next phase:

2

Figure 04.1: (Cover) Design concept (Author 2017)
Figure 04.2: Model and analyses of first block precinct development on the empty land (Author 2017)
Figure 04.3: Illustration of pedestrian crossings on the proposed block precinct vision (Author 2017)

-PUBLIC TRANSPORT ACCESS-

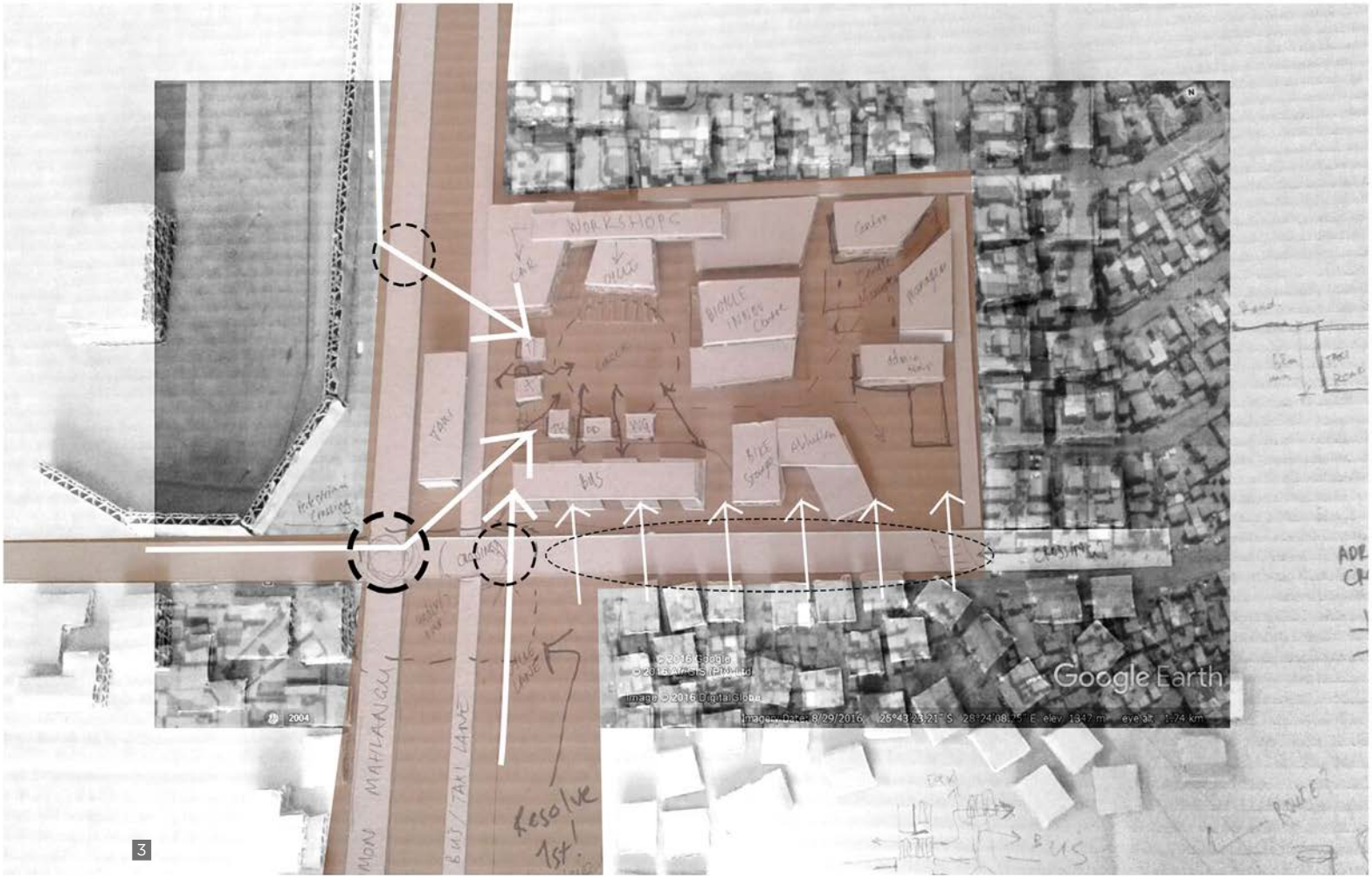
To ease congestion, a separate public taxi/bus lane has been proposed. This however creates complexities on the already congested intersection between Hinterland and Solomon Mahlangu drive. The vehicle **routes** should thus be considered a **priority**, and preferably **all** be located adjacent to Solomon Mahlangu drive, eliminating the need for extra turns and crossings as they could simply slip in and out of their stops then.

-PEDESTRIAN ACCESS-

A big concern of this layout, is the number of **pedestrian crossings** evident as seen in **Figure 04.3**. The greatest number of users are from Phomolong informal settlement, which all have to cross the street (which is the current situation, thus no improvement has been made on this level). Big numbers of pedestrians also arrive from the North and West, which will all have to cross the busy Solomon Mahlangu street.

-STREET EDGE-

Where the main spatial intention is to define the street edge, the current layout rather **turns its back** on the edge, creating an **internalized courtyard-type** layout rather than one that **relates** to the street. Opportunities to interact with the vast amount of pedestrian energy prevalent along the edge is lost, **disregarding** the current **informal traders** that are dependent on the energy flow.



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-INTEGRATION OF PROGRAMMES-

As opposed to the concept of creating a platform for exchange of knowledge and interaction between schooled and unschooled users (Integrated Exchange Concept), this layout **removes** the school element from the actual use. Illustrating per example (**Figure 04.4**), a dedicated car workshop is provided for to the north, **removed** from the taxi/bus hubs rather than **attached** to them, which opposes the idea of an integrated exchange platform.

4

The final precinct plan was developed next as an answer to the above criticism. In addition to this, it was also deemed important to **include the railway** as a public transport method. Where previously a link to the Greenview station was indicated on the plan, a more direct link is considered in the final plan which connects the site to the proposed Gautrain station rather than that of Greenview.

As the adaptive concept developed, the precinct buildings took form in a similar **grid-like structure**, interpreting this concept on an urban level as **Figure 04.7** illustrates. Buildings in the precinct plan follow the same proportions as that of the design itself, supporting the idea of **resilience** in **future adaptation** or growth as needs and spatial requirements change within the community.

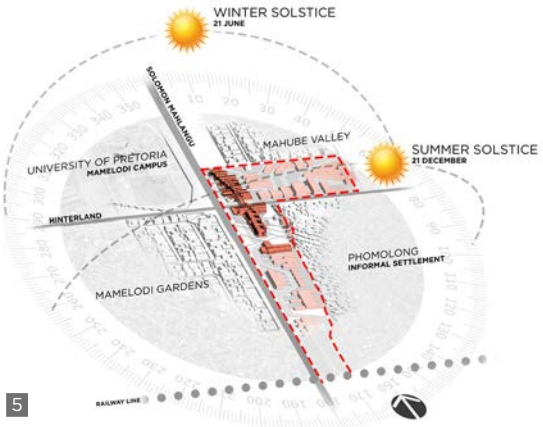

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Figure 04.4: Initial programs for the first block precinct (Author 2017)
Figure 04.5: Precinct location within neighboring communities and orientation of the longitudinal axis to sun solstices (Author 2017)
Figure 04.6: Precinct plan Iteration based on previous criticism (Author 2017)
Figure 04.7: Final Precinct plan design (Author 2017)

04.2

DESIGN OPTIONS

-EXPLORATION ONE-

Following the design of the block precinct as a framework for the architecture, the **first design iteration** was developed through spatially designing with the following informants:

1. Framing of the **public square** across Hinterland
2. Pedestrian **movement past** the nodes
3. **Orientation** of nodes to the street edge
4. **Separation** of the public **transport types**
5. **Integration** of **public and private** space where knowledge exchange could take place
6. Interplay between **permanent and temporary** elements that could form a structure for future adaptation

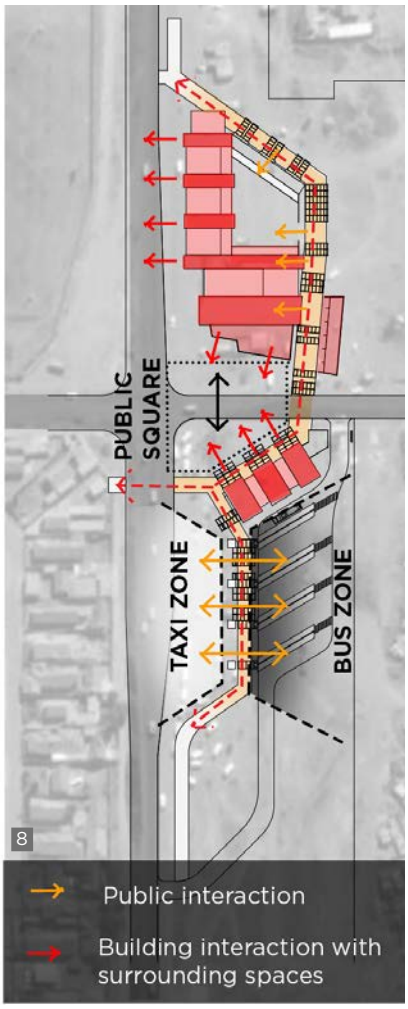
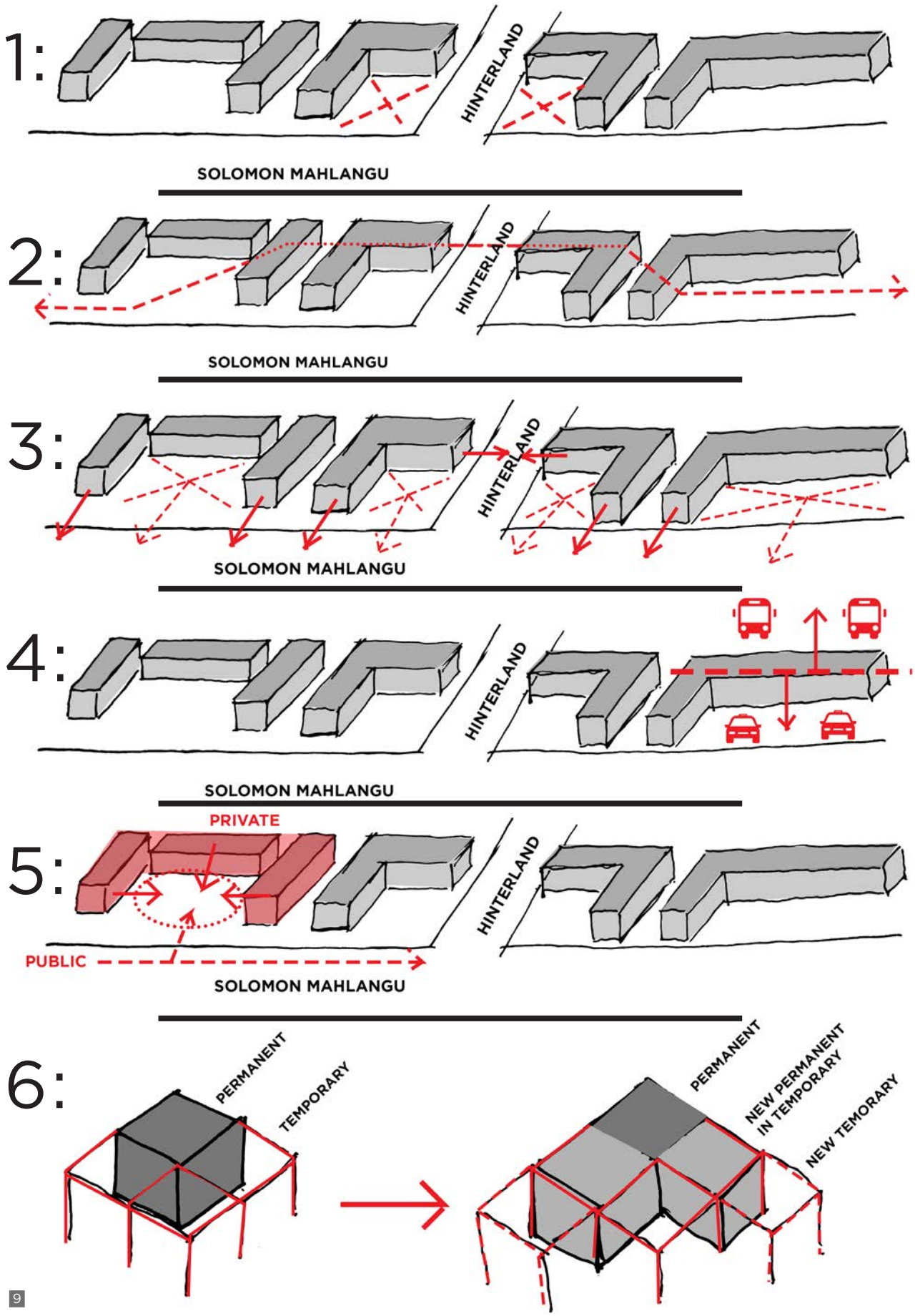


Figure 04.8: First zoning and plan layout (.1) with 3D shapes forming to the north (.2) and south (.3) of Hinterland road (Author 2017)
Figure 04.9: Diagrams illustrating the design informants as listed in the paragraph above (1 - 6) (Author 2017)



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Even though the response was simply a **manifestation of the programmatic requirements** with block-shapes, it did create a solid platform for further investigation. The public meander bisecting the nodes works much better on the southern part than it does on the north where the pedestrians are directed away from the nodes. Setting back the central buildings was effective as a public space generator,

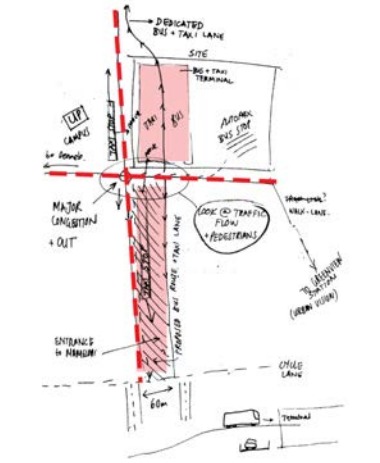


Figure 04.14.1 Spreading site across along Solomon Mahlangu road

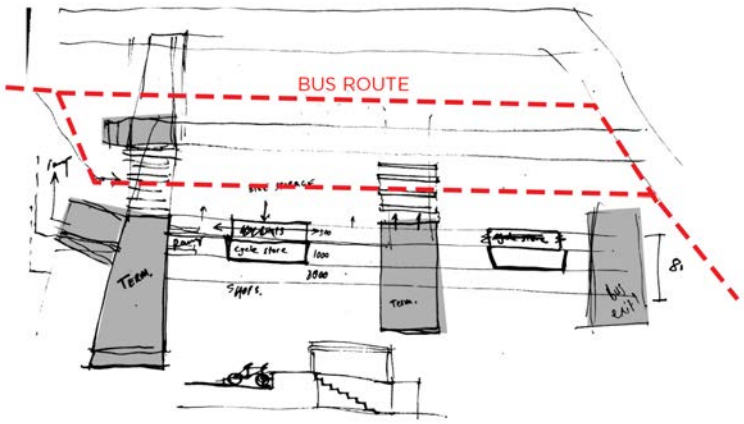


Figure 04.14.2 Bus terminal development: a linear design spread along the longitudinal axis of the road as opposed to a singel block element

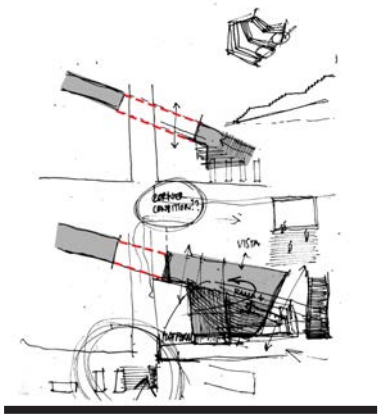


Figure 04.14.5 Development of link across Hinterland road, with public stairs egressing from the street edges

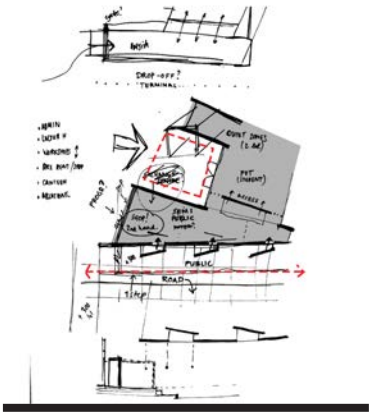


Figure 04.14.6 Development of building typology on the Norther part of the design, with cut-in public spaces in between the buildings

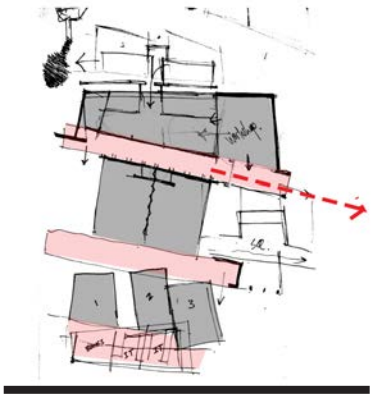
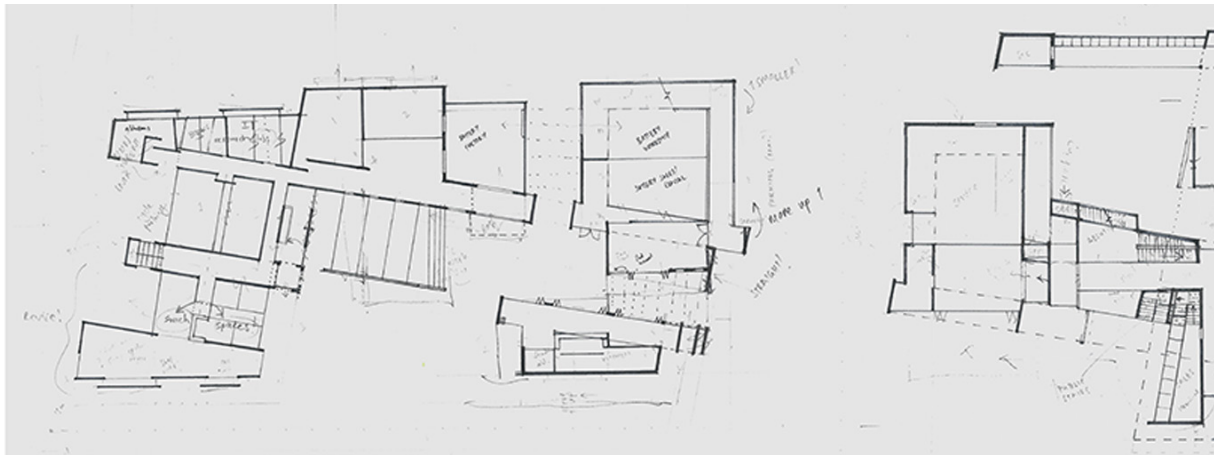


Figure 04.14.7 Definition between working and circulation space as a divider between different nodes and programmes in the project



but the **lack of identity** between the two was something that needed attention, as no coherent order could be recognized in the two sides. **Scale in context** was not considered at all, as the building was read as one **whole** rather than **separated nodes**.

From this point, the **series of images** below illustrate the **process of design** development from the base design to the second design exploration.

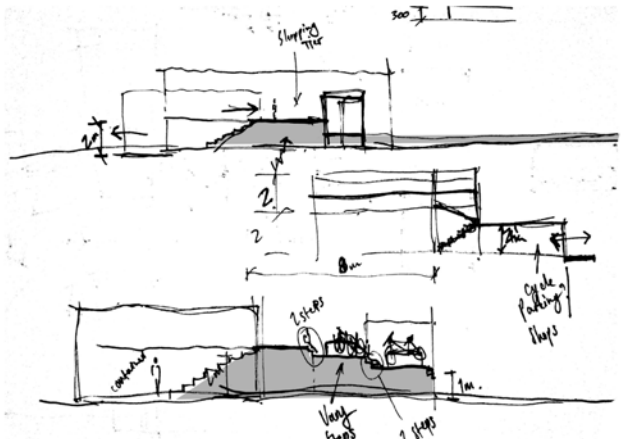


Figure 04.14.3 Section through Bus node: Lifting the street level to distinguish the bus terminal from the exterior walking space

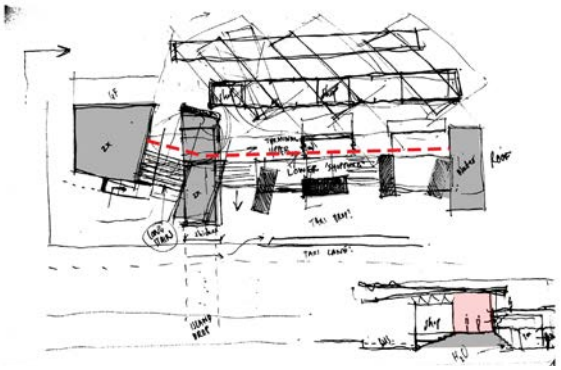


Figure 04.14.4 Development of nodes along the bus terminal with a public spine connecting nodes. Section shows the public spine as a lifted platform

Figure 04.14.8 Elevational development

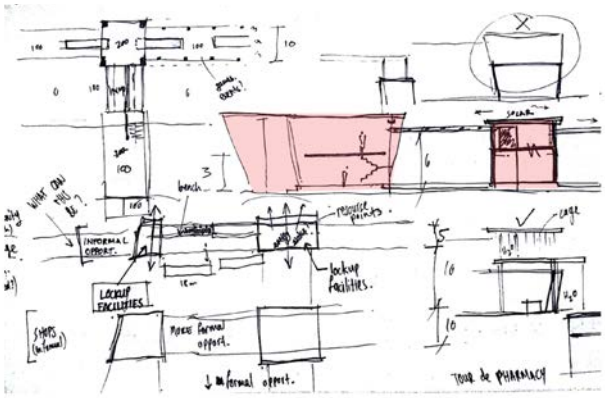


Figure 04.14.9 Exploration of section and heights of internal spaces

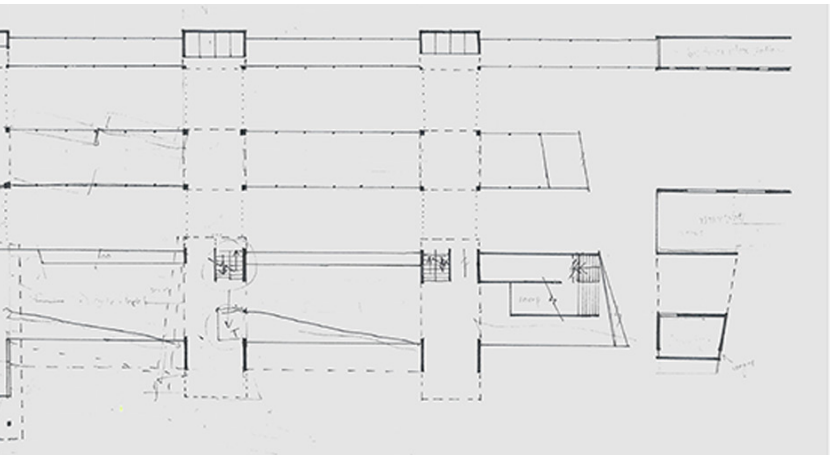


Figure 04.14.10 Overall development of the plan as a whole

-EXPLORATION TWO-

As a result of the development of design ideas from the Base Design, it was evident that a **stronger** node-and-spine-type development was needed. The proposed new model explores this notion where the program is broken up into its separate functions, and spatially these have been separated and linked together with a spine running past or through the nodes.

A differentiation between the north and south was made where the spine draws away to the east on the northern half of the development, creating a **new axis** that is linked across the road with a **bridge**. Ramps for cyclists that wrap around the two central buildings allow for vertical circulation to disabled people as well.

A **hierarchy of public space** started to develop from the central buildings, where small structures started to speak of the **context** of the surrounding buildings. These are then proposed structures where local traders can set up shop, and provide potential for their businesses to expand.

As the buildings started to respond to their context by breaking them up into **smaller footprints**, still **no coherent building language** was evident between the northern and southern part. The model also successfully depicted the required footprints of the programs, even though orientation of the structures were not considered. The central buildings did start to speak to one other, and were hierarchically defined as the most important structures defining the entrance to the precinct.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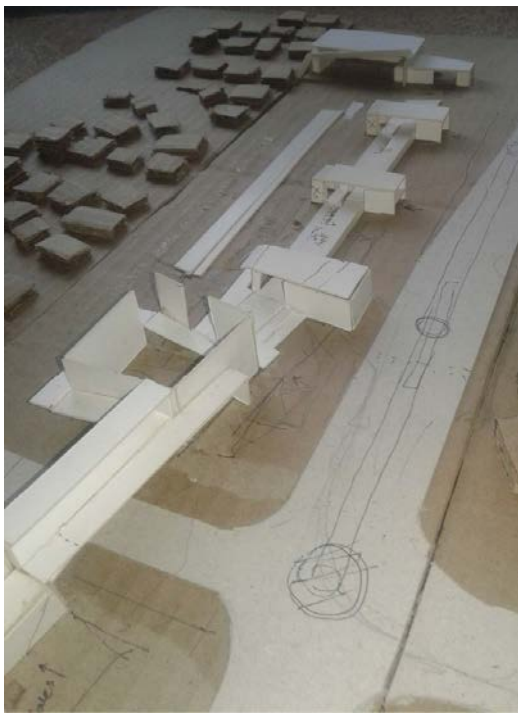


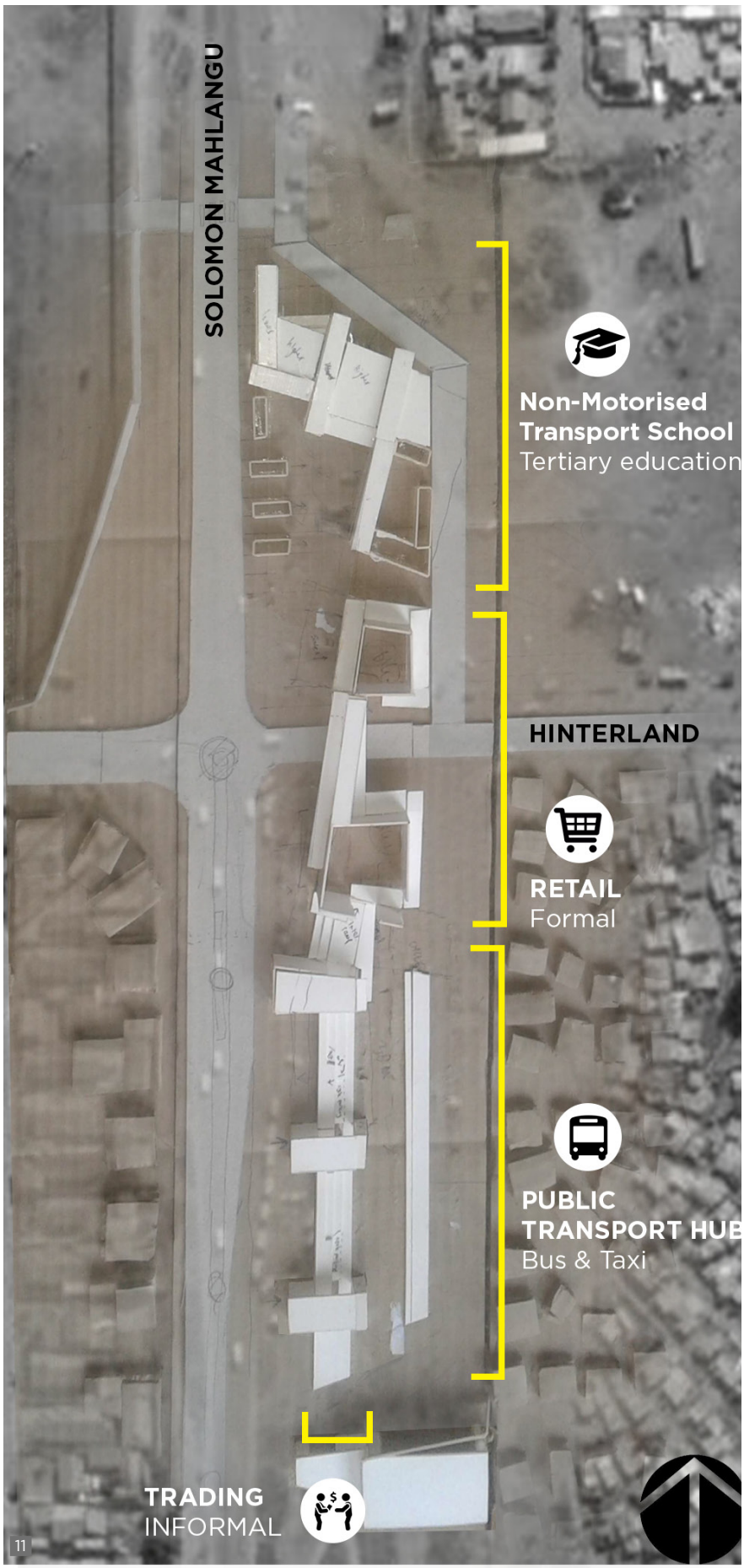


Figure 04.10: Photo of Northern part of model looking South (.1) and of Southern part looking South (.2) (Author 2017)
Figure 04.11: Model photograph with proposed programming of spaces (Author 2017)

The following series of images further illustrate the development from this point up until the June Design Exam stage of the project.

PLAN:NORTH

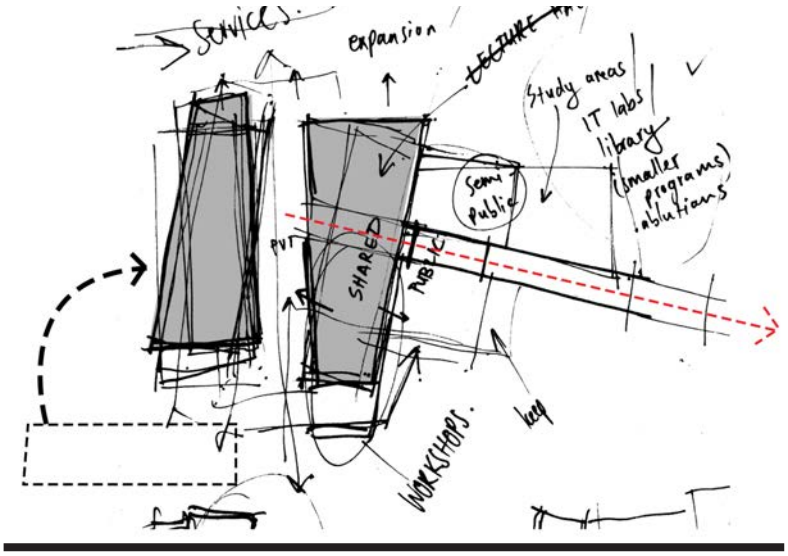


Figure 04.14.1 Northern Education buildings rotated 90° for better orientation

PLAN:SOUTH

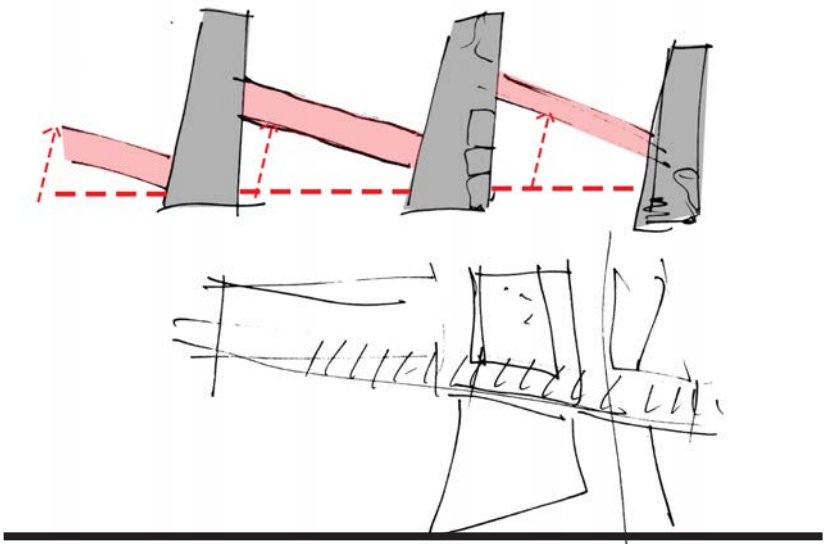


Figure 04.14.3 To address the rather linear endless spine, the image shows how the axis has been shifted to break this long public space in between nodes

ELEVATION

Figure 04.14.5 Different explorations of the nodes in section

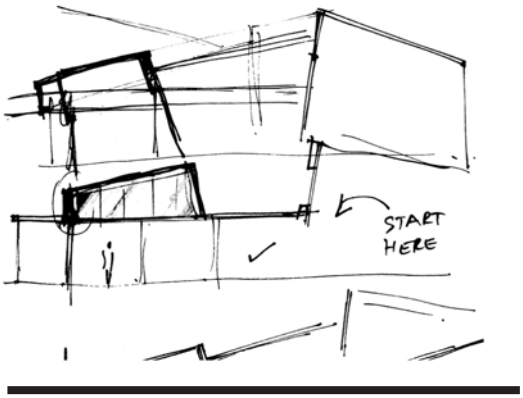


Figure 04.14.6 Further development of the Educational node in section and elevation

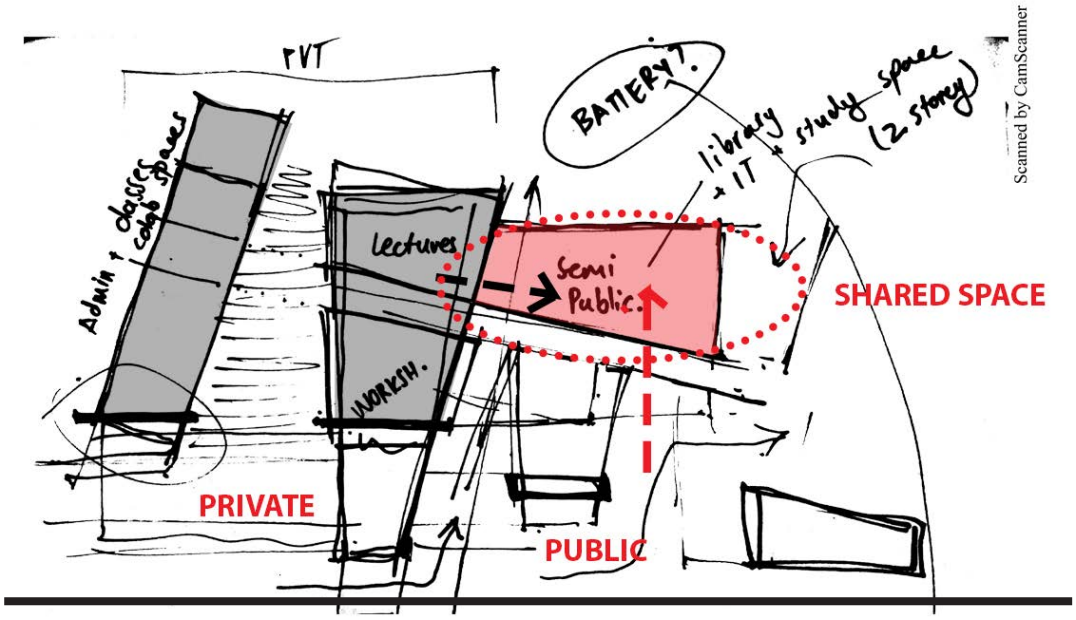


Figure 04.14.2 Shared space linking public and private spaces developed along the axial link

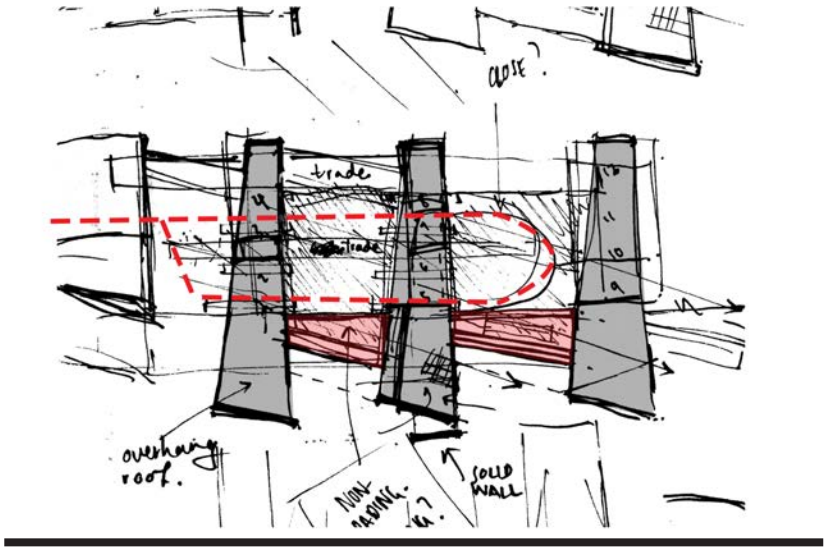


Figure 04.14.4 Nodal buildings extended over bus terminal area, where the notion of closing the bus routes is explored to separate the bus route completely from the street

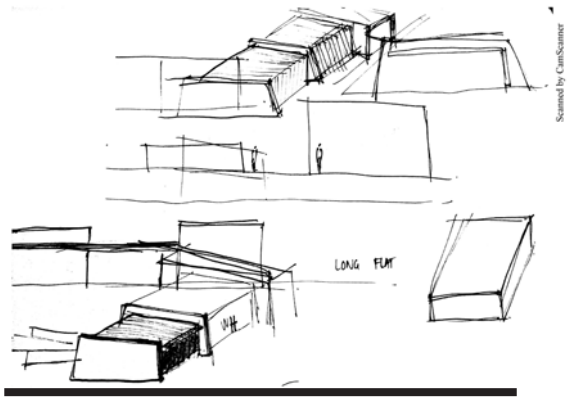


Figure 04.14.7 3D exploration of building with a feel for materiality starting to develop

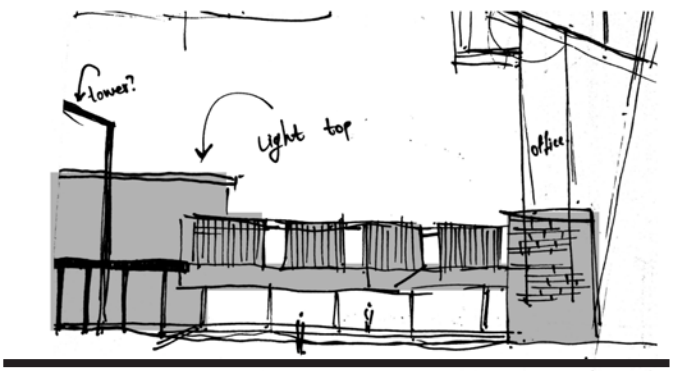


Figure 04.14.8 Materiality of street-facing facades considered on elevation

-EXPLORATION THREE-

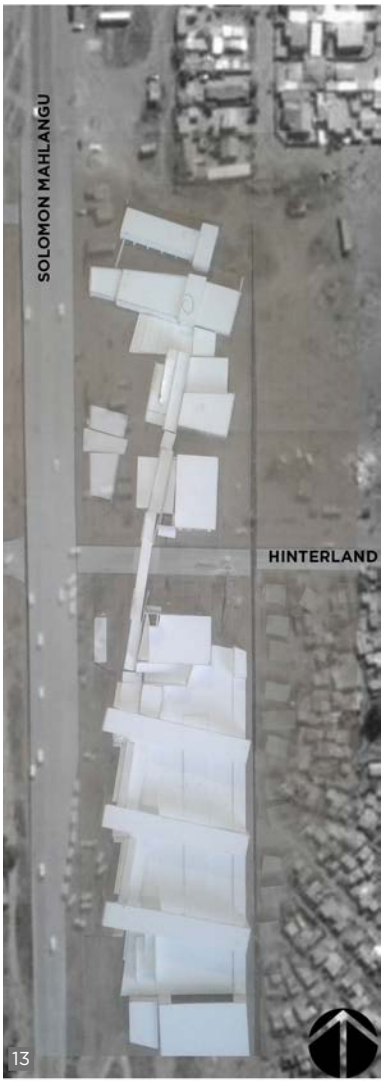
Developed from the previous iterations, the third exploration resolved the spatial manifestation of the programs within the project. A better understanding of public and private interaction allowed for interesting public spaces to develop between nodes.

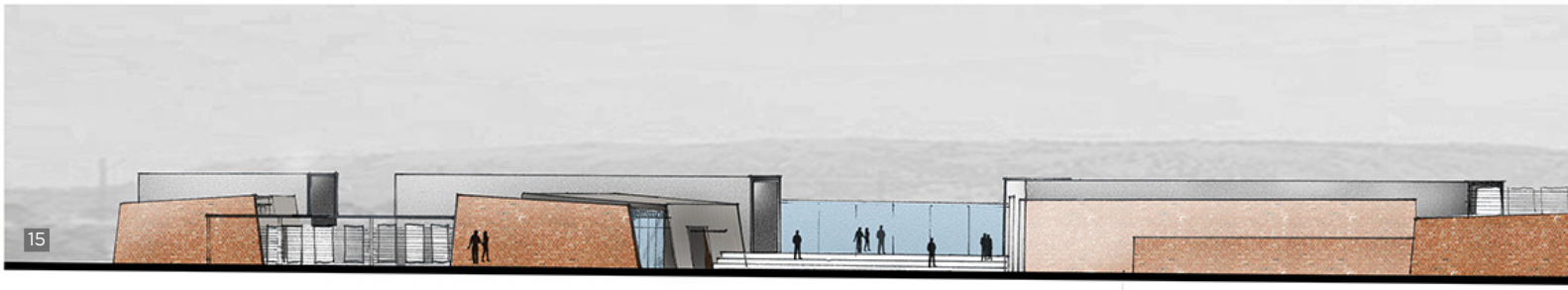
The public spine now not only existed of a **straight endless** axis on the southern end, but instead created a jagged shape that **pulls pedestrians in** from the street edge. This jagged edge intersects the Southern nodes, that stretch up to the informal settlement to the East, which started to create a **connection** between the intervention and the informal settlement, even though a lack of typographical response is evident.

On an architectural level, a **responsiveness to texture** initiated on the southern side, where the offices on the first floor responded to the texture of the informal settlement in its backdrop, as corrugated steel was used to clad the exterior of the structure. Tall brick structures ground the stereotomic mass as opposed to steel lightweight structures that create the framework for the First floor development.

Where the eastern elevation of the southern transport-terminal started to respond to its context, the northern part still required **major resolution.** The **axis** on this half was also **unresolved**, apparently leading to 'nowhere', with an angle that lead away from the road, rather than running parallel to, where the most public energy is found. A **coherent language** is still **missing** in this iteration, resulting in further investigation of the spatial and architectural design.

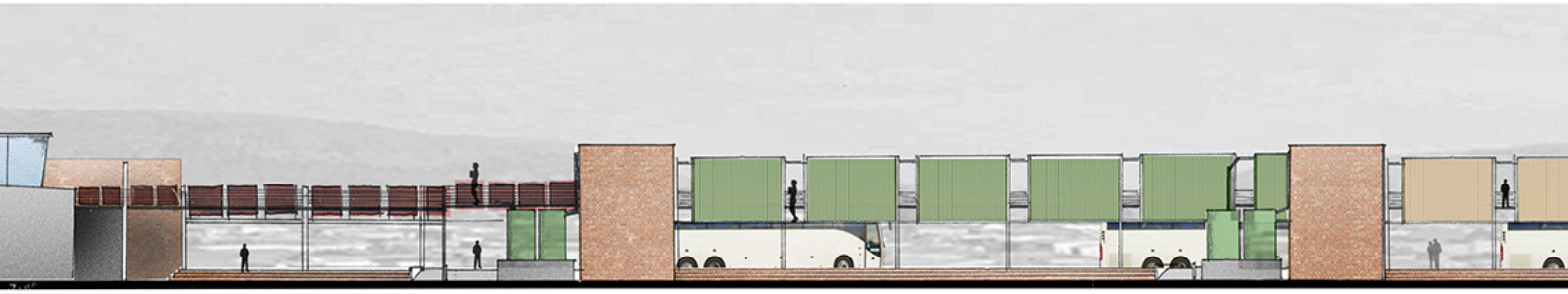
Figure 04.12: Model photograph looking from North to South (.1) Southern part of model looking South (Author 2017)
Figure 04.13: Photo of model from a birds-eye-view (Author 2017)
Figure 04.14: Plan on Ground and First floor level (June Exam presentation) (Author 2017)

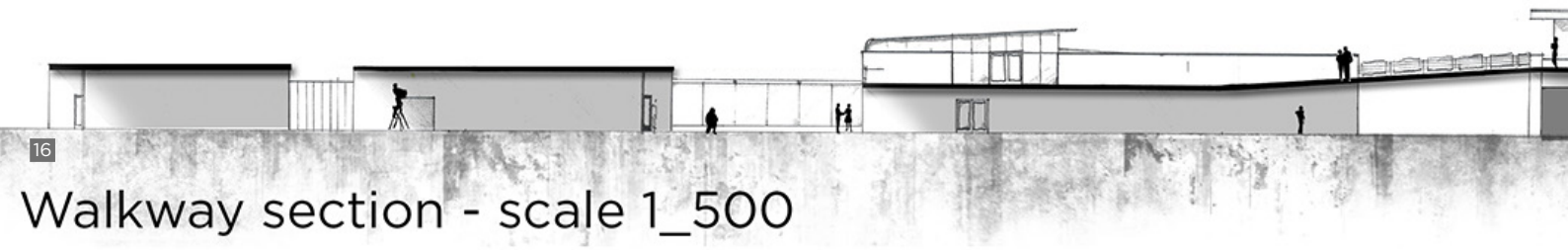




15

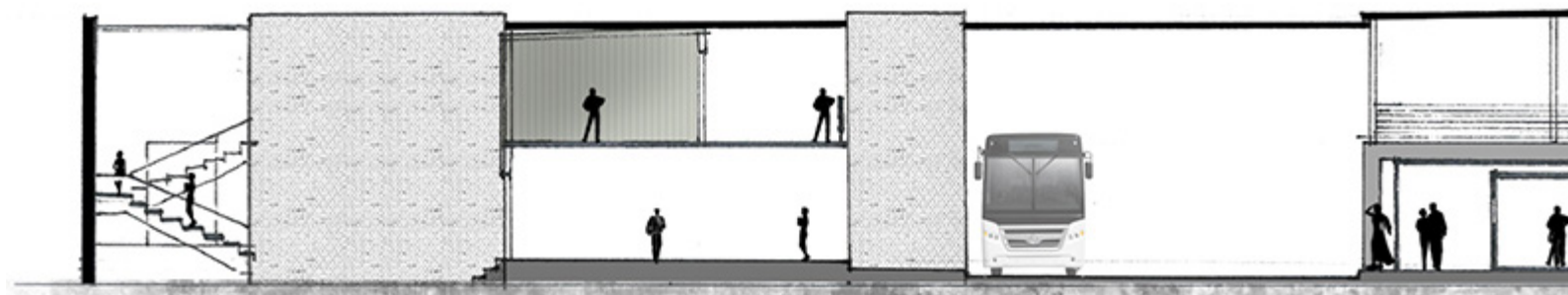
West Elevation - scale 1_500





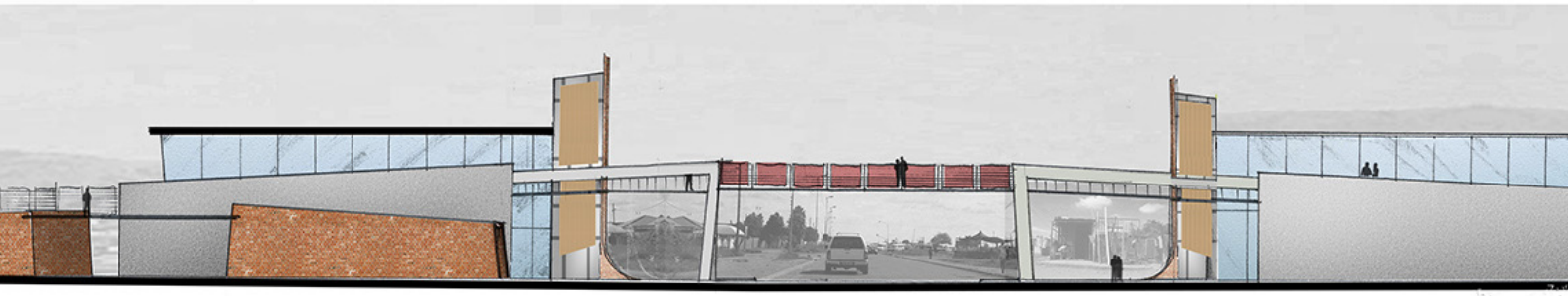
16

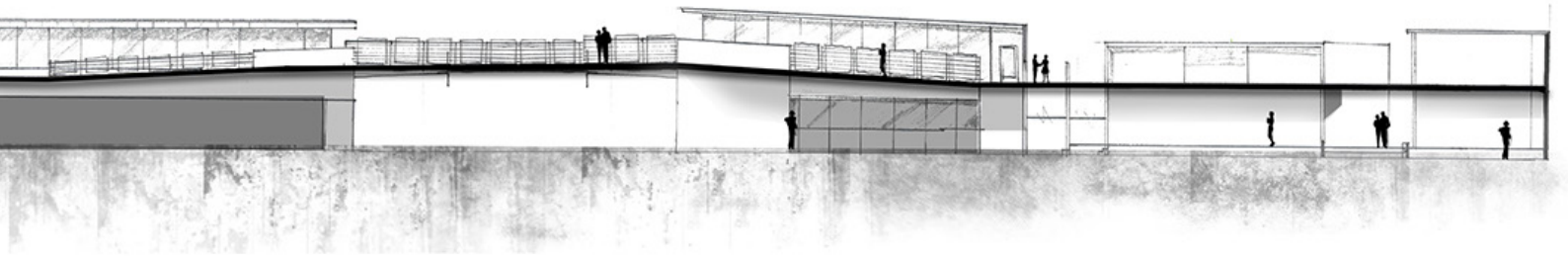
Walkway section - scale 1_500



17

Transport section - scale 1_200





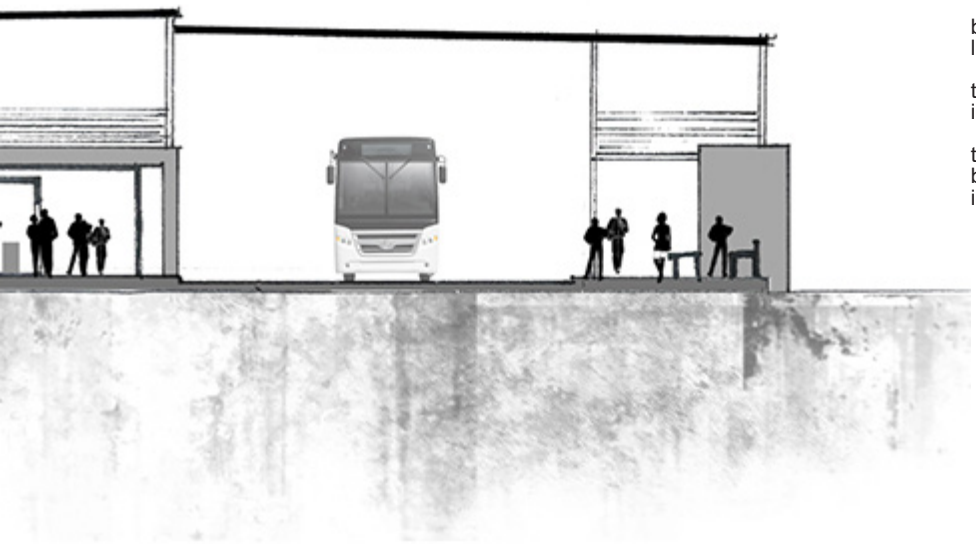


Figure 04.15: Western Elevation of entire building (breaking and continuing on next line - scale not as indicated) (Author 2017)
Figure 04.16: A North-South section through the spinal walkway (Scale NOT as indicated) (Author 2017)
Figure 04.17: East-West section through the transport nodes showing the relationship between bus and taxi stops (Scale NOT as indicated) (Author 2017)

From this point, a final process of iteration was done as illustrated by the diagrams, leading to the Final design option.

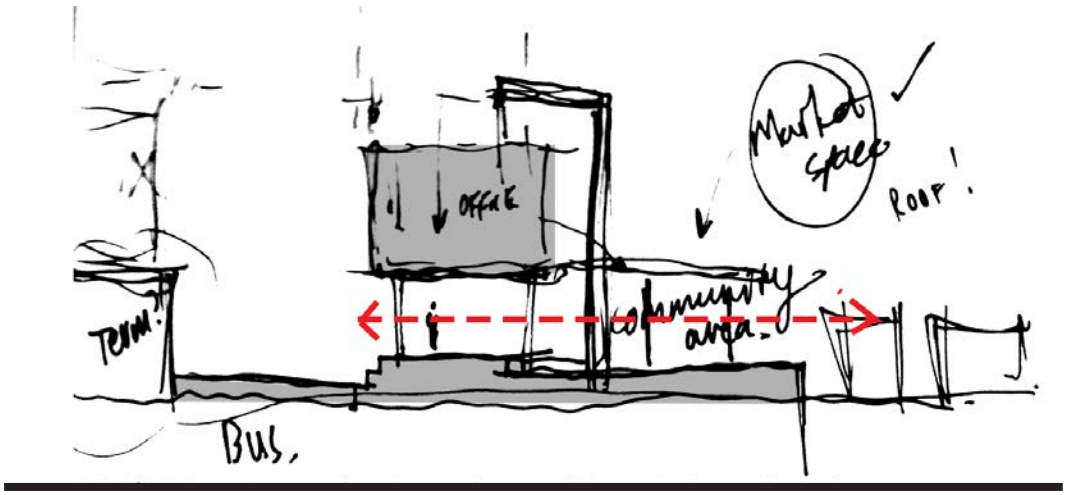


Figure 04.14.1 Opening up the elevated groundfloor platform allows for energy to stay on ground floor and elevating the offices above the public spine.

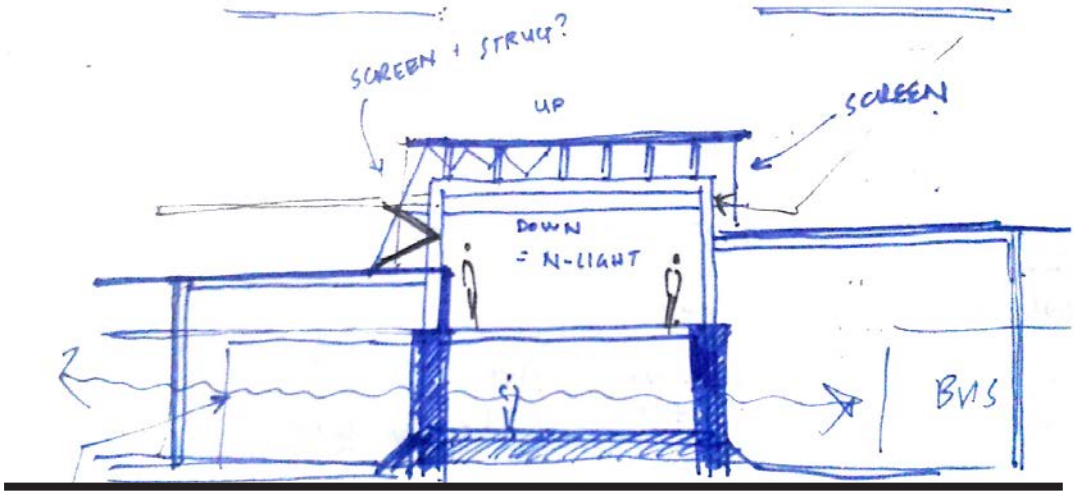


Figure 04.14.3 Exploration of natural light through the East/West facades, framed by a lighter steel structure as opposed to the central heavy concrete columns of the public spine

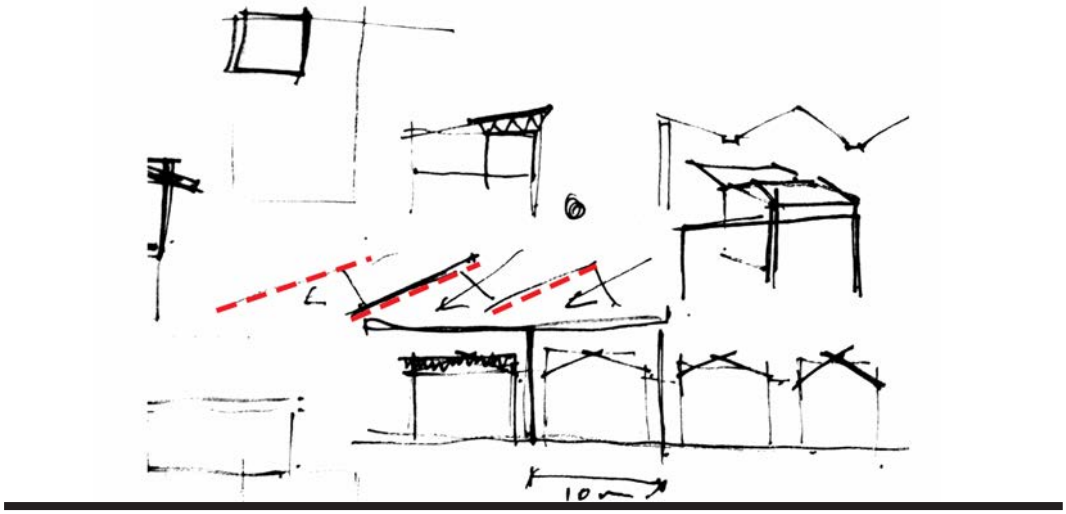


Figure 04.14.5 Exploration of roof angles facing the South, to allow more natural light to enter on the buildings predominantly stretching along their East/West axis'

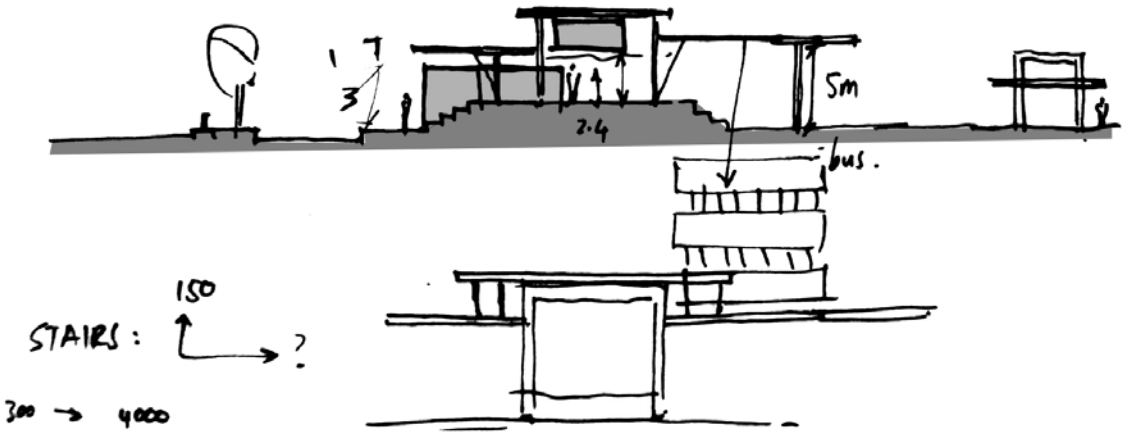


Figure 04.14.2 Ground level rising to the public spine, elevating pedestrians above the vehicle-movement levels on either side of the southern transport axis

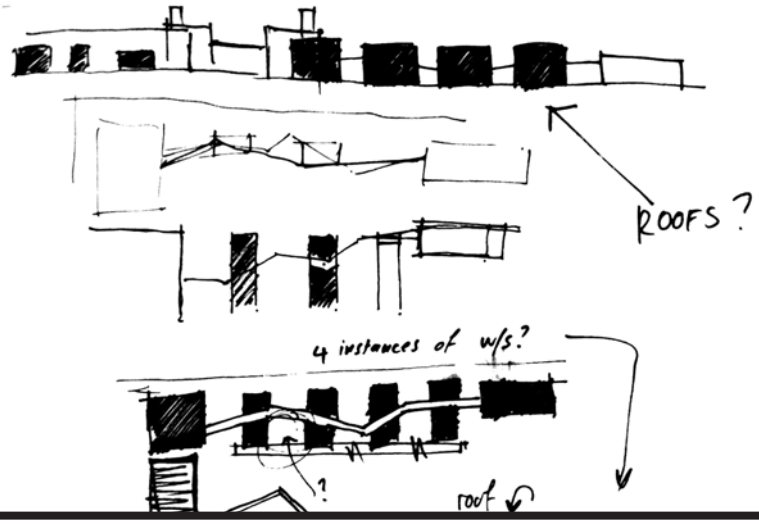


Figure 04.14.4 Street facade illustrating the difference between nodes on the north (left) and south (right)

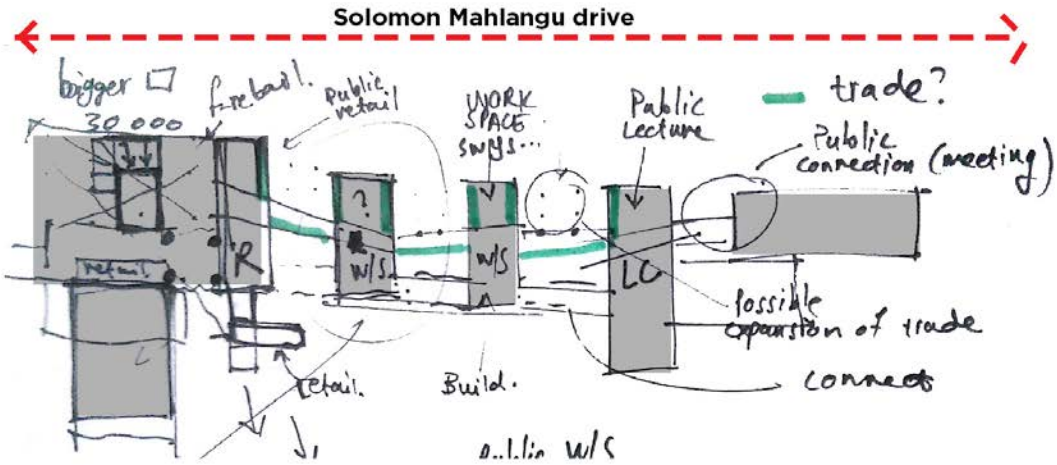
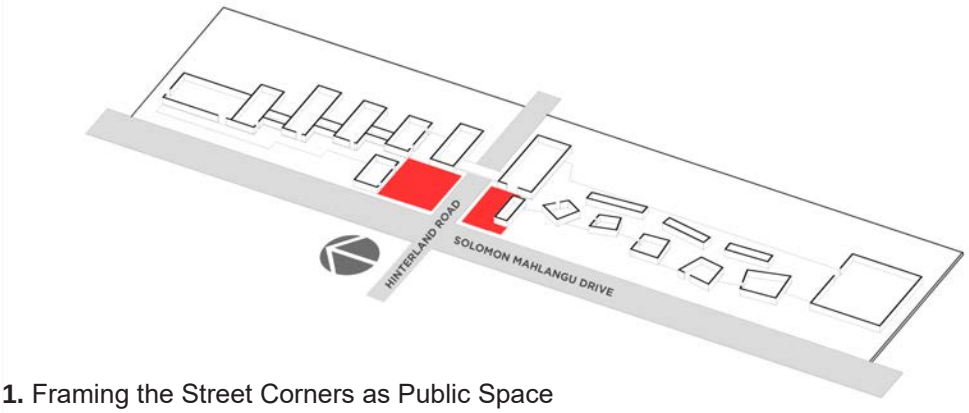


Figure 04.14.6 Revision of the northern plan, illustrating a hierarchical tapering of programmes adjacent to Solomon Mahlangu drive

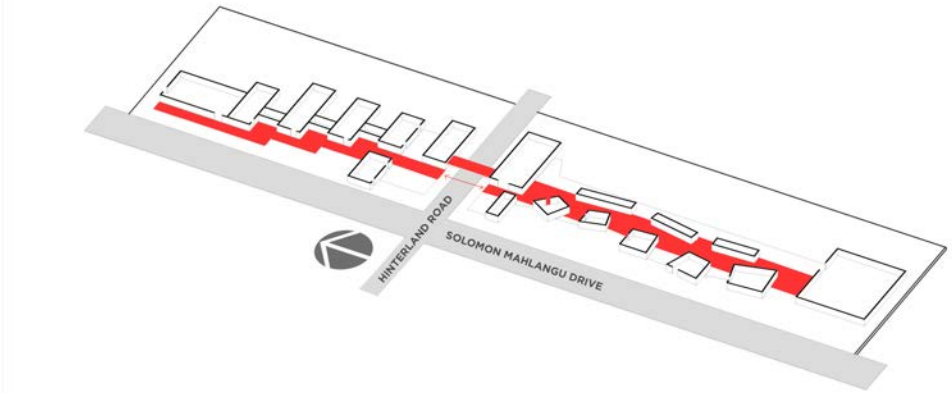
04.3

FINAL DESIGN INTENTIONS

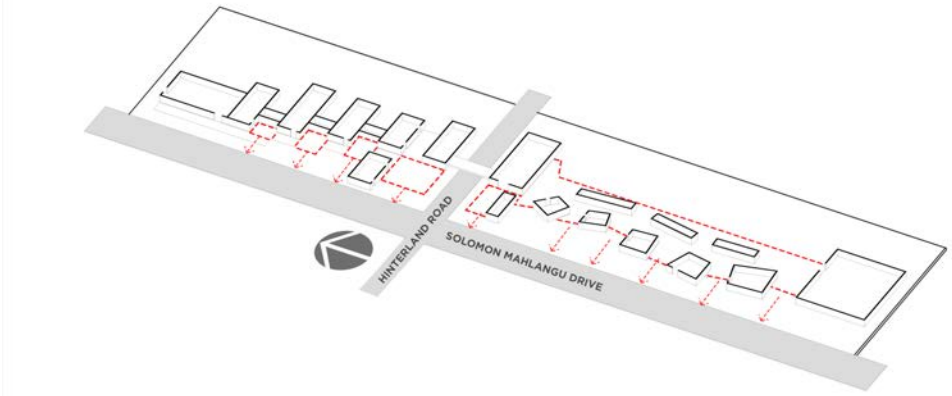
-DESIGN DRIVERS-



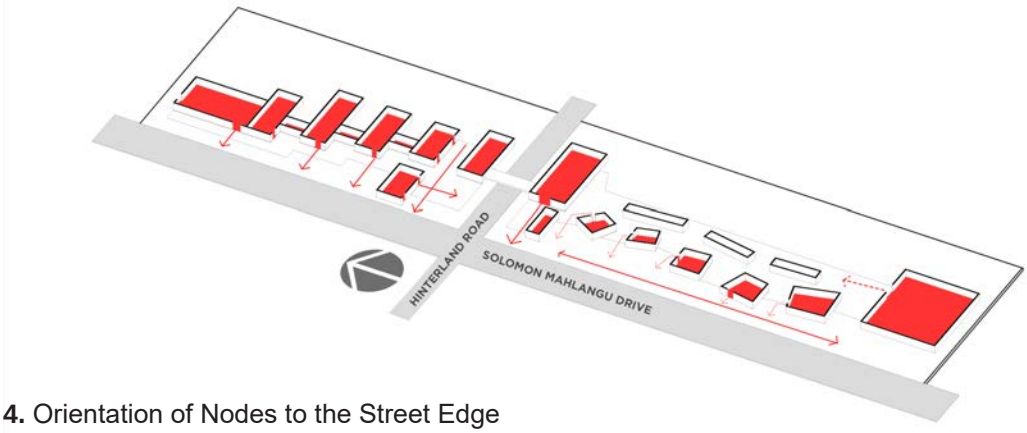
1. Framing the Street Corners as Public Space



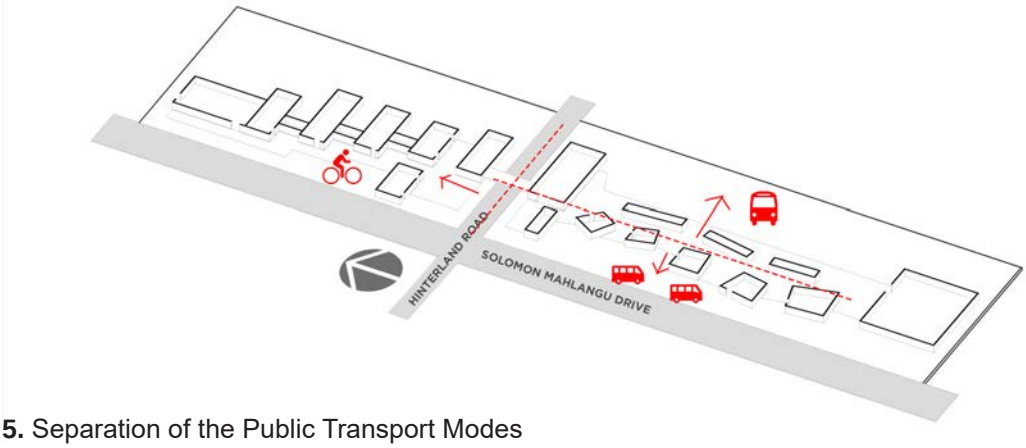
2. Pedestrian Movement past the Nodes



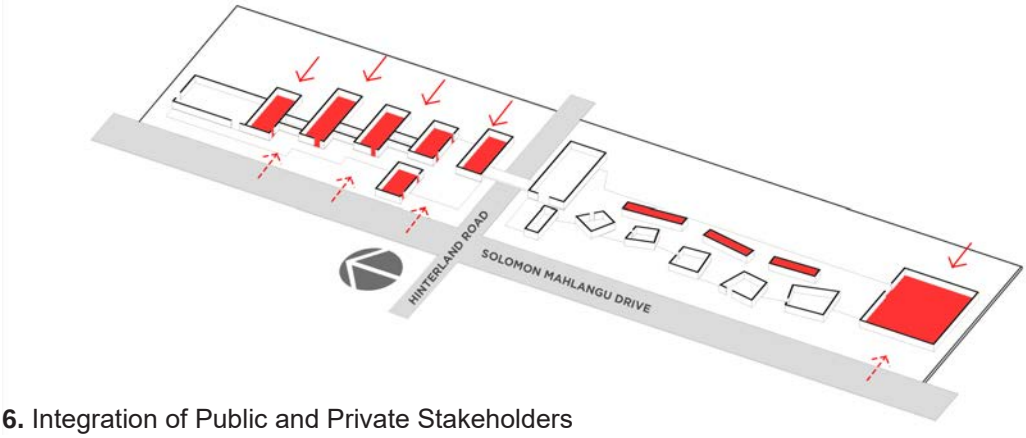
3. Orientation of public space to the Street Edge



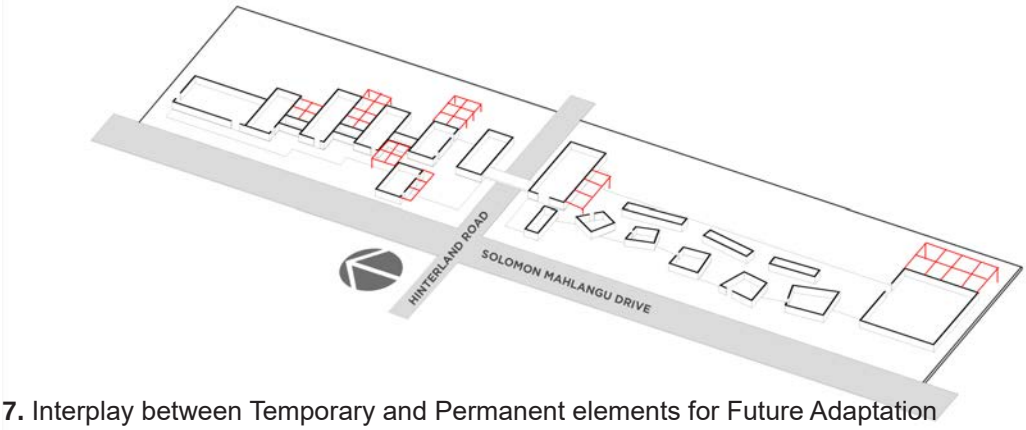
4. Orientation of Nodes to the Street Edge



5. Separation of the Public Transport Modes

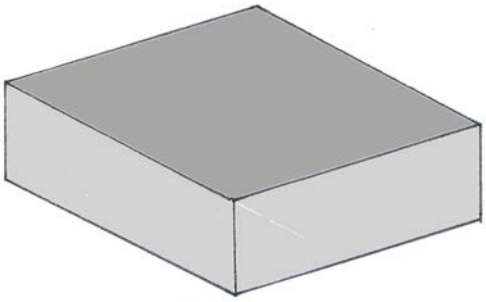


6. Integration of Public and Private Stakeholders

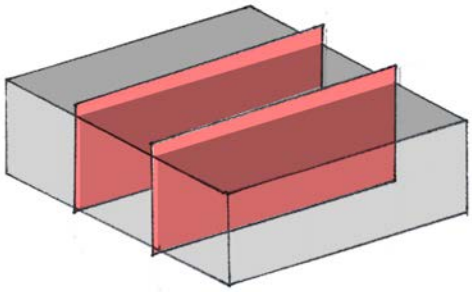


7. Interplay between Temporary and Permanent elements for Future Adaptation

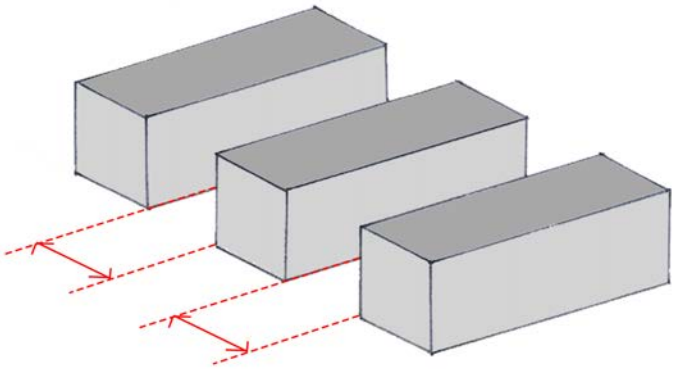
-PROGRAMMATIC DIVISION OF NODES-



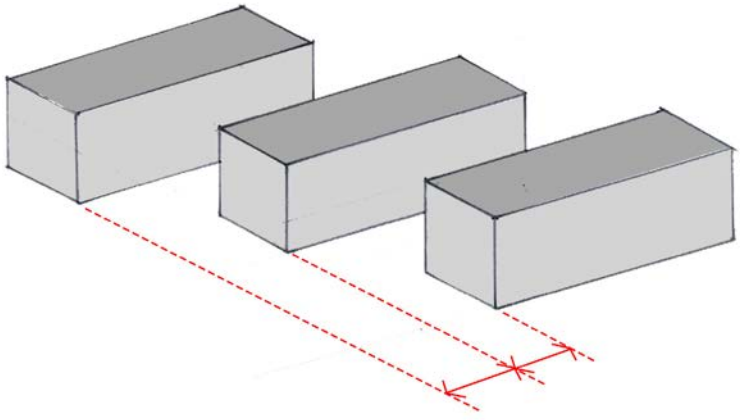
1. SINGLE BUILDING: Multiple programmes



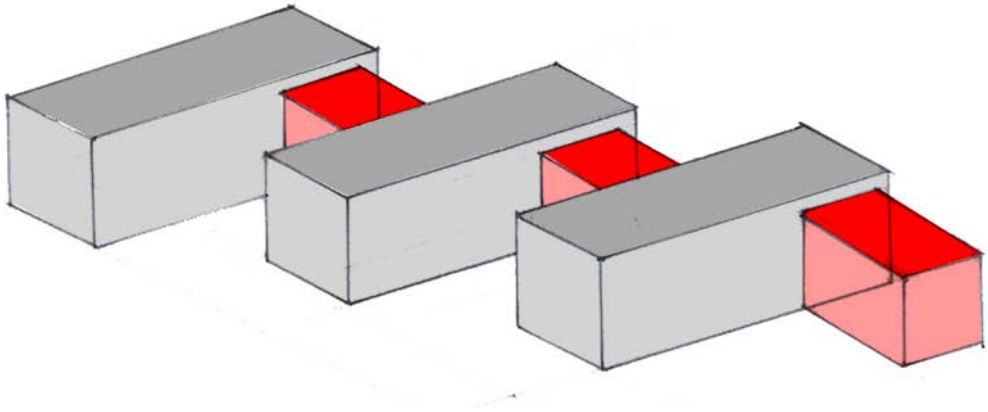
2. DIVIDE SINGLE BUILDING: Grouping similar programmes



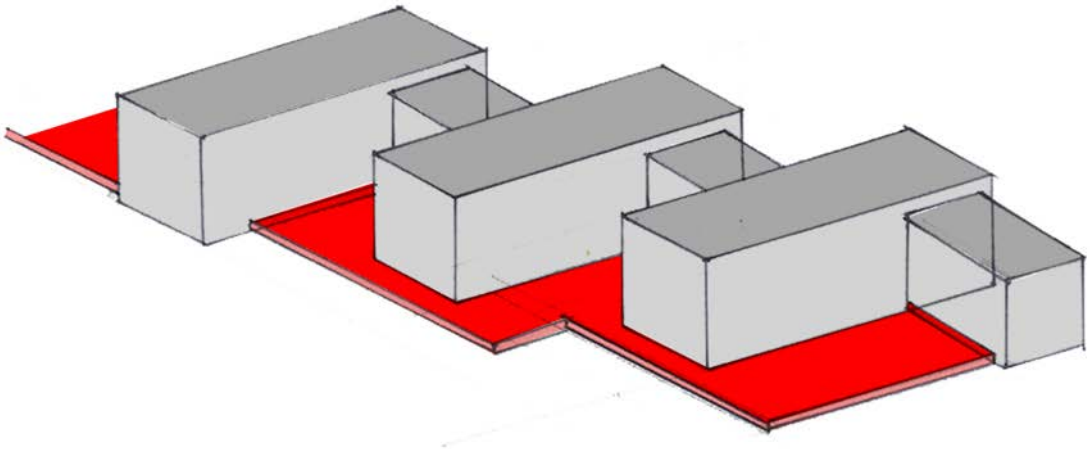
3. MULTIPLE BUILDINGS: Moving created nodes apart



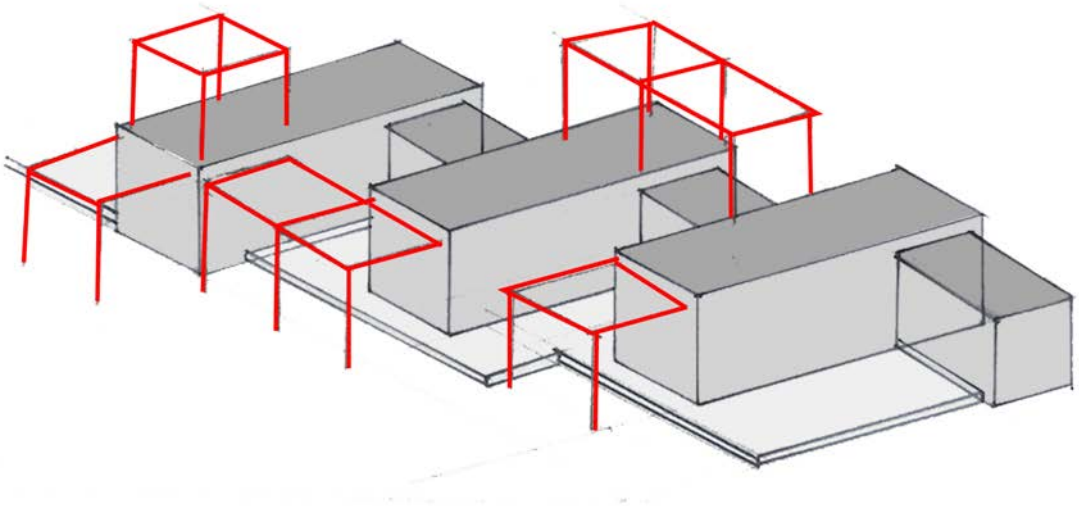
4. MULTIPLE BUILDINGS: Stepping nodes back from the street front



5. SPINAL AXIS: Creating a link between the Separated Nodes



6. COMMON PLATFORM: Establishing unique public spaces at each node



7. ADAPTIVE POSSIBILITY: Providing growth within the structural integrity of the Nodes and Spine

04.4

DESIGN RESOLUTION

-NON-MOTORISED TRANSPORT DEVELOPMENT CENTRE-

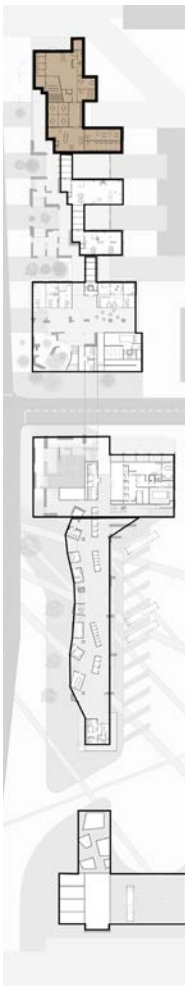
Starting at the most northern point of the site, the NMT-Development centre opposes the new entrance to the Mamelodi Campus of the University of Pretoria. This educational link houses a facility for **tertiary education**, where users can enroll in courses that teach entry-level engineering skills for the creation and adaptation of NMT (Non-Motorised Transport) such as bicycles or battery powered bicycles.

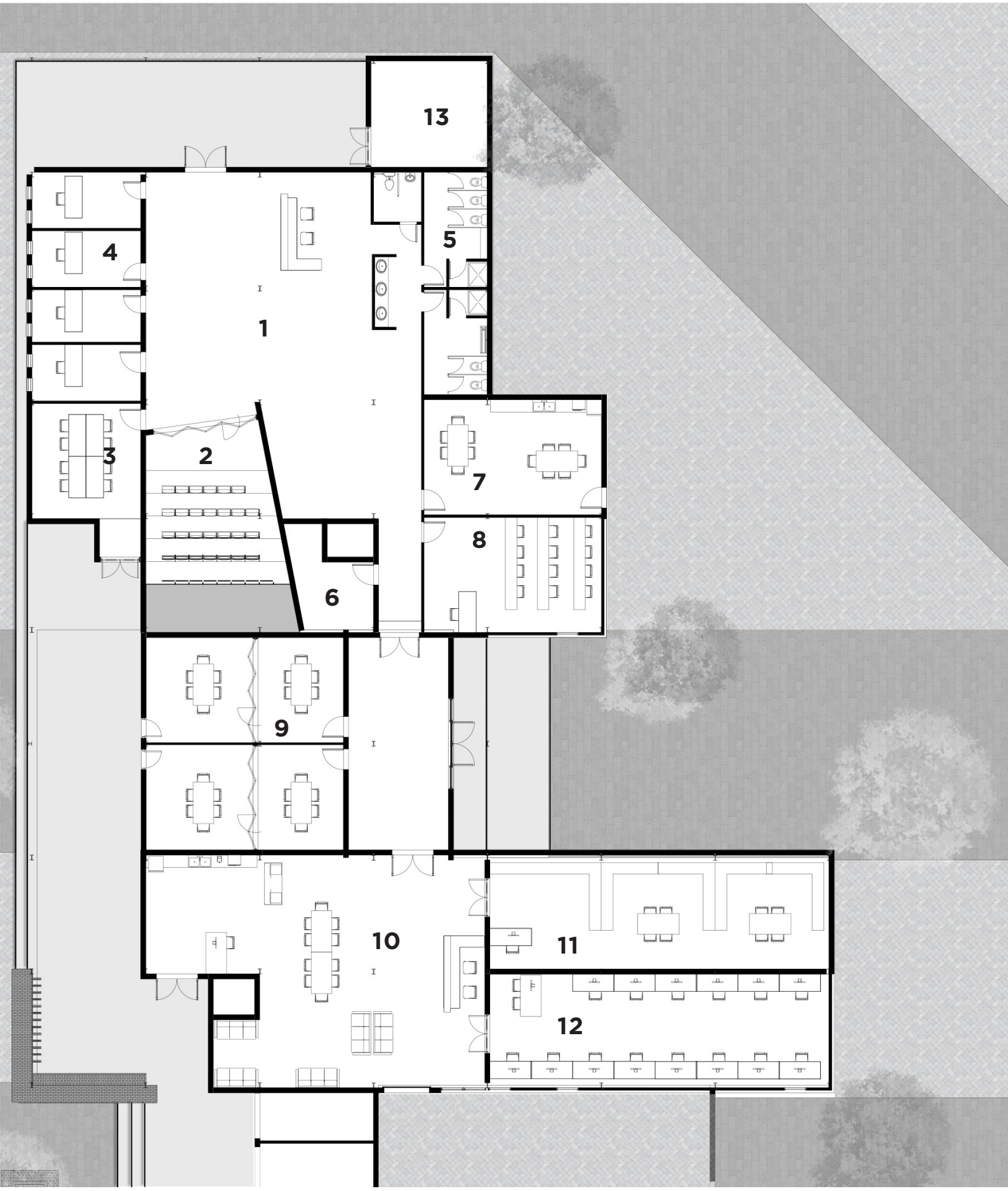
Rooms that allow **adequate natural daylight** were of importance, as well as thermal comfort within the study facilities. With the longitudinal axis stretching from East to West, the library and IT-rooms are provided with enough natural south-facing light, and minimal exposure to direct northern light. Adaptive steel portal frames are fixed to the permanent structure of the centre providing **space** for **informal traders** to set-up shop, while simultaneously providing a grid for future expansion of the centre.

Flexibility in the interior layout that can adapt to future necessary growth or change is also imperative to the function of the programme.

GROUND FLOOR
1 Foyer and exhibition space
2 Lecture Hall and Auditorium
3 Conference room
4 Staff offices
5 Ablutions
6 Store room
7 Staff Kitchen
8 Classroom
9 Co-lab meeting spaces
10 Study and break-out space
11 Library
12 IT Room
13 Bicycle lockup space

NMT-DEVELOPMENT PLAN
GROUND FLOOR





-BICYCLE-AND ACCESSORY WORKSHOP-

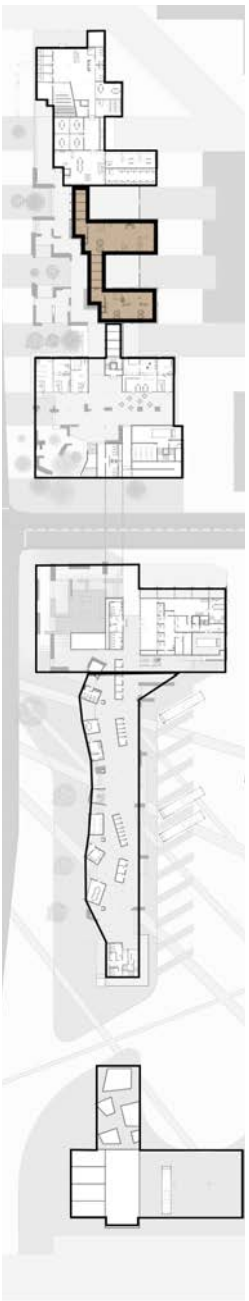
Providing a facility for the NMT-Centre to practically work, the workshop is orientated on the same axis, and with a similar south-facing clerestory window that lets in soft southern light from the top of a steel frame building. **Hydraform blocks** are used as structural walls, high on the northern side heavy machinery is attached to, providing stability, and low on the south to allow adequate area for natural daylight to enter the workbench area. On top of these blocks, **sandwich-panel** walling fills the remaining modular steel structure, with windows placed within the structure that holds these panels. The number and placement of the windows are determined by the use of the space within the workshops.

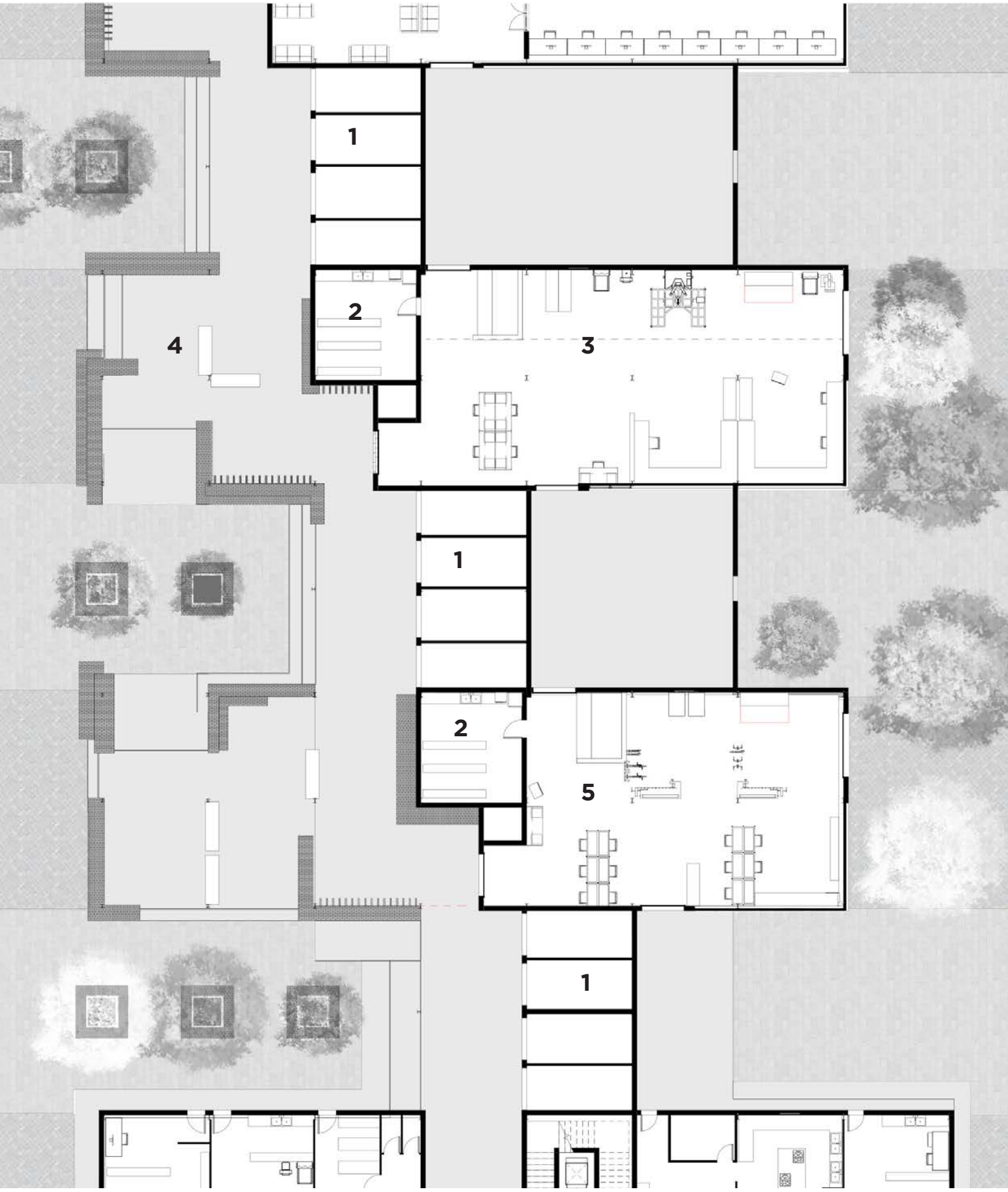
Similar to the Northern workshop, the Accessory workshop is a **smaller copy**, with less heavy machinery, and more space for an apprentice/master working environment.

Between both workshops, four public trading stores allow community members to run their own businesses, and benefit from the close vicinity of the workshops. Concrete **hollow-core roofs slabs** allow for future expansion on top, and the modular steel structure surrounding the stalls also facilitate both future development plans as well as structure for informal traders to attach their infrastructure to.

GROUND FLOOR
1 Rentable Public Trading stalls
2 Kitchen and Cleaning space
3 Bicycle Customization workshop
4 Public outdoor space
5 Bicycle Accessory workshop

WORKSHOPS PLAN
GROUND FLOOR

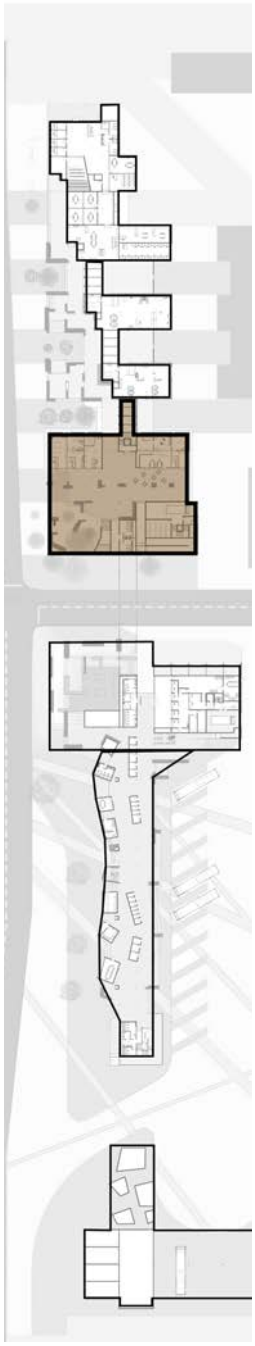




-FORMAL RETAIL AND POST OFFICE-

Spilling onto the norther public square, the south-facing retail facilities are provided for more **formal trading** of products made within the workshops, or provide facilities for external investors to invest into the precinct.

Framing the eastern side of the public square, the Post office provides a two-story anchor to the northern half of the precinct. On Ground floor, secure vehicular access allows for **safe delivery and collection** of post as well as cash used for the social grant dispensary program that is to be part of the National Post office system in the near future. An internal staircase with a vault on the First floor ensures no unauthorized access to the cash. The public entrance to the Post office is on the First floor, with an open public staircase leading up from the square below.



GROUND FLOOR
1 Formal flexible Retail space
2 Vertical Circulation (Stair + Lift)
3 Vehicle Pick-up garage
4 Post storage space
5 Vault
6 Security Office
7 Public Ablution facilities
8 Public outdoor Square

FIRST FLOOR
9 Post office cubicles
10 Post office back-of-office

RETAIL AND POST OFFICE
GROUND FLOOR

-TICKET OFFICES AND PUBLIC SQUARE-

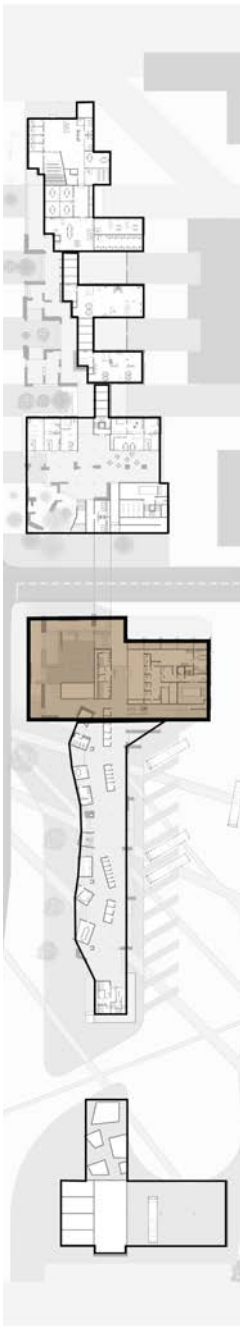
Both the Post Office and Ticket offices/ Banks are fully covered with solid concrete/ hydraform walls to allow private and safe areas where any cash is handled/stored. Garage doors allow cash-in-transit trucks to enter the buildings and be searched/ secured before moving securely to the vaults situated in the centre.

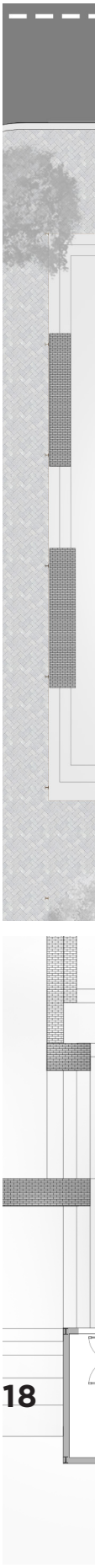
On the Southern end, the ticket offices on Ground floor and Banks on first floor share a break-out space, while each having their own independent vaults and employee search areas. A **grand public staircase** forms the public square on the Southern side of Hinterland road, with an array of **seating and trading benches** built within the staircase as it moves up towards the First floor. The staircase terminates in a secondary square where the Banks and ATM entrance connects to the Southern end of the bridge.

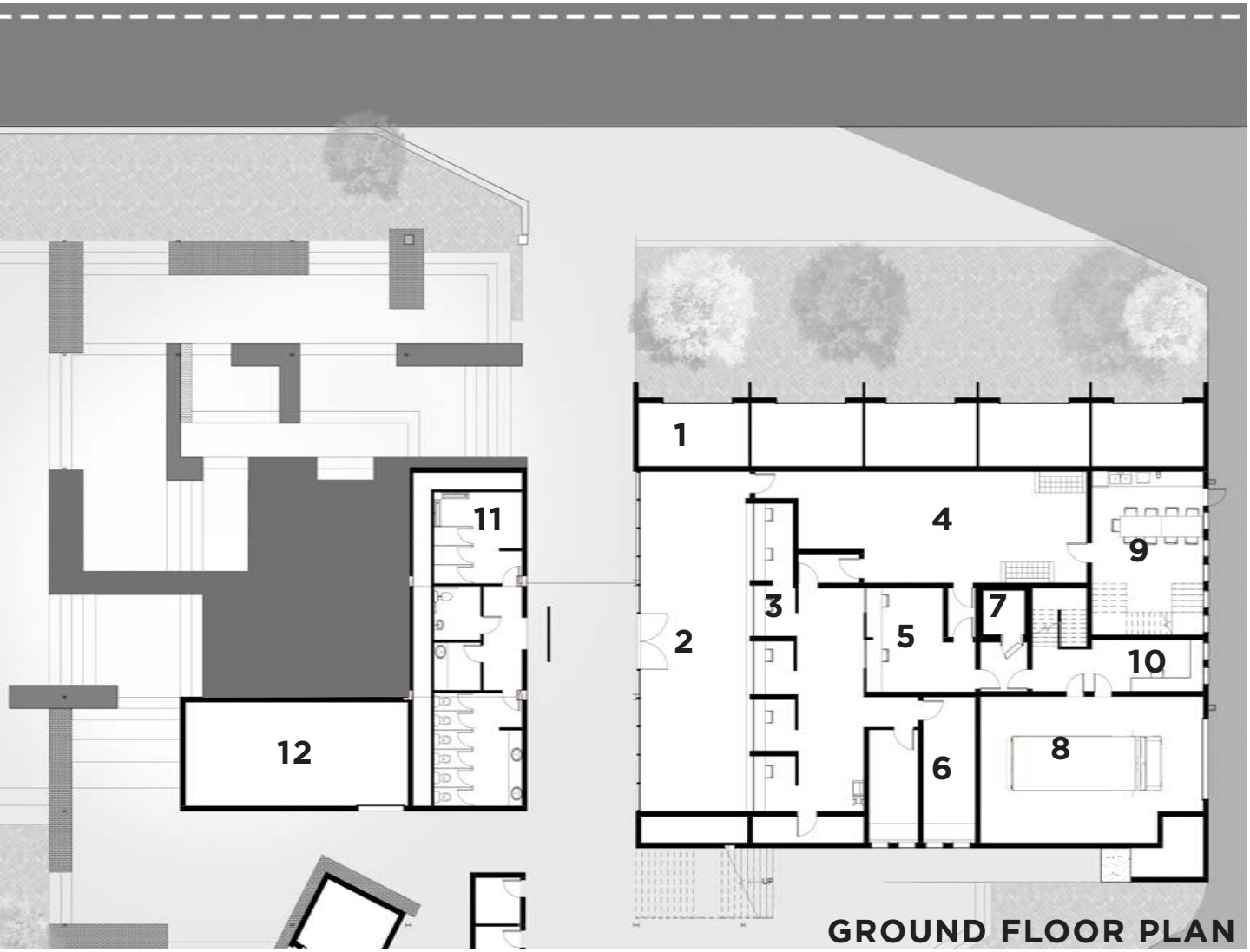
GROUND FLOOR
1 Rentable public trading stalls
2 Bus ticket office foyer
3 Bus ticket cashiers
4 Staff entrance and break-out
5 Vault cashiers
6 Manager offices
7 Vault
8 Cash pick-up garage
9 Staff kitchen
10 Security office
11 Public ablution facilities
12 Storage and plant room

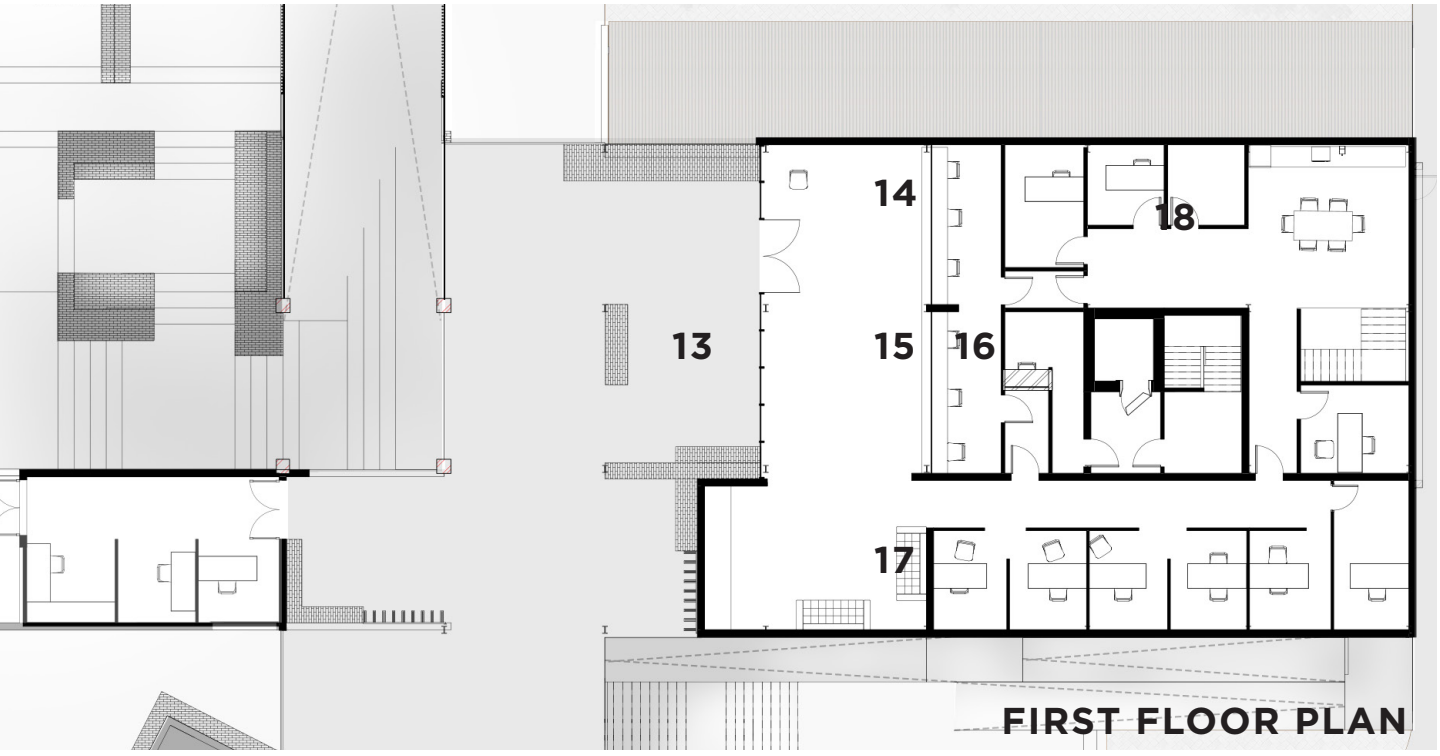
FIRST FLOOR
13 Bank foyer area
14 Bank manager offices
15 Vault cashier
16 Vault
17 Bank public offices
18 Staff break-out space
19 Facilities management office

RETAIL AND POST OFFICE
GROUND + FIRST FLOOR









-TRANSPORT DOCKS AND RENTABLE OFFICES-

The longest section of the precinct hosts the spine that splits the bus terminal on the east from the taxi terminal to the west. This long axis houses more trade storage facilities in the centre, while small taxi **ancillary buildings** host small meeting rooms, offices and storage for taxi drivers. This central spine then becomes the trading hub of the project, as this is where the most energy will be injected.

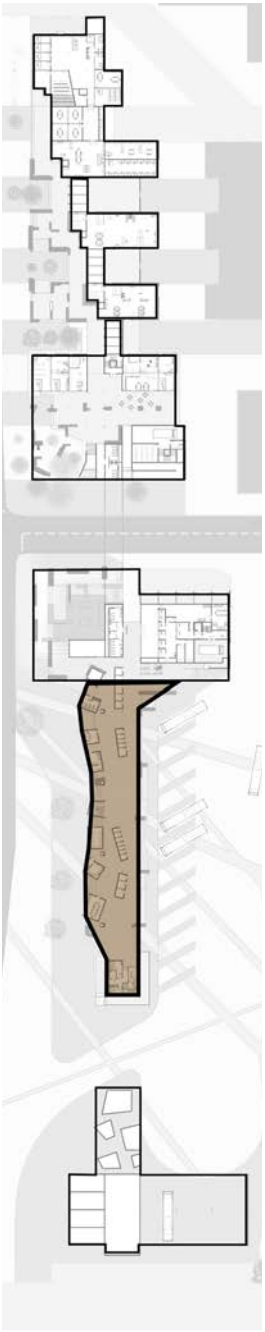
Small hydraform structures at the base of the steel column structure will provide additional informal trading platforms, as well as act as seating benches and bicycle lock-up structures within the bus-terminal side of the spine.

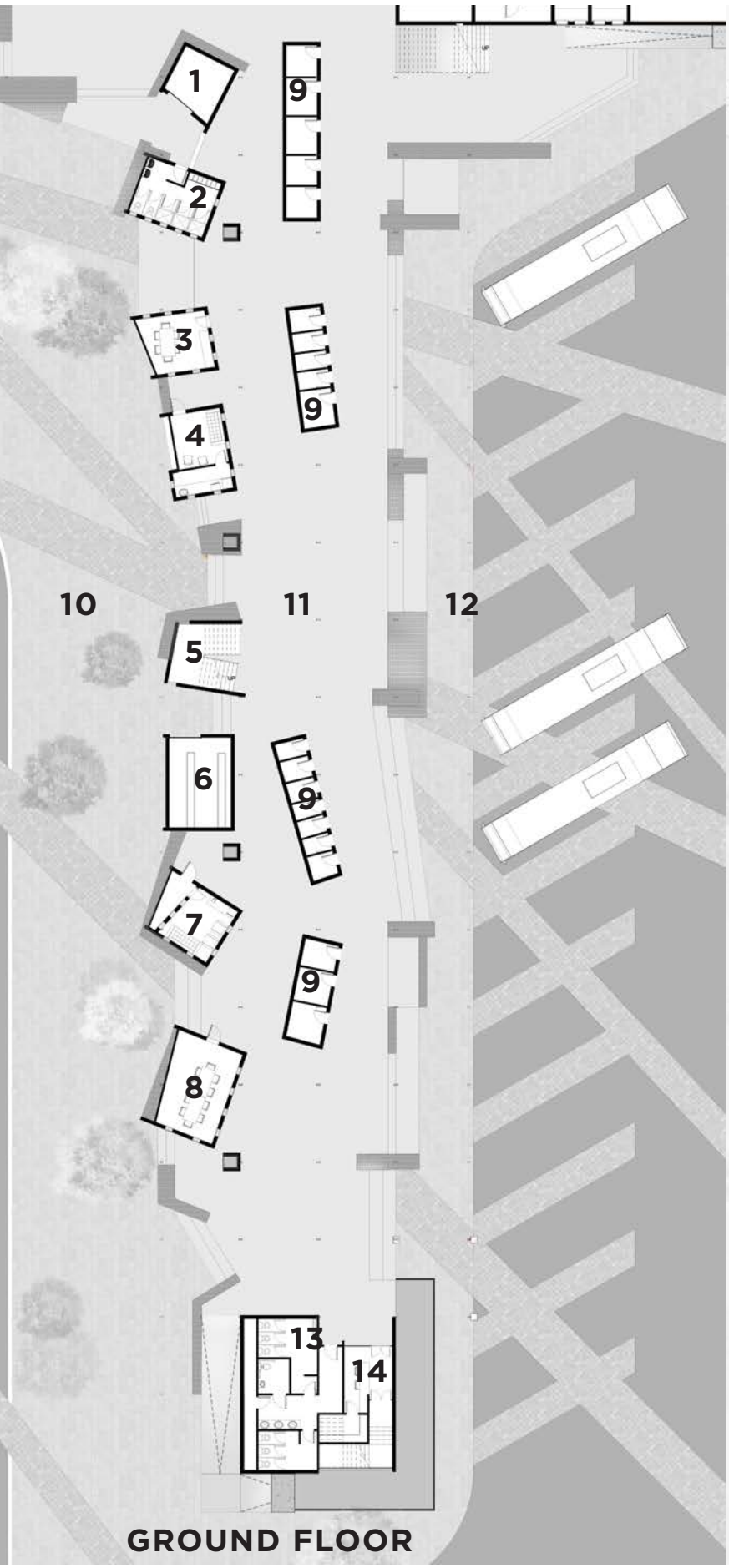
Offices situated on the first floor are walled with the same sandwich-panels and roofs as the warehouses on the north, providing natural southern light for the office spaces. With views to the east/west, these offices needed **vertical louvers**, provided with the pergola-type timber poles that also shade the verandas on ground level.

GROUND FLOOR
1 Taxi store room
2 Taxi ablutions and showers
3 Taxi meeting room
4 Taxi kitchen and relax area
5 Vertical circulation shaft
6 Taxi store room
7 Taxi kitchen and relax area
8 Taxi multipurpose room
9 Public rentable trade units
10 Taxi public interface
11 Public circulation axis
12 Bus public interface
13 Public ablution facilities
14 Security office, stair and ramp

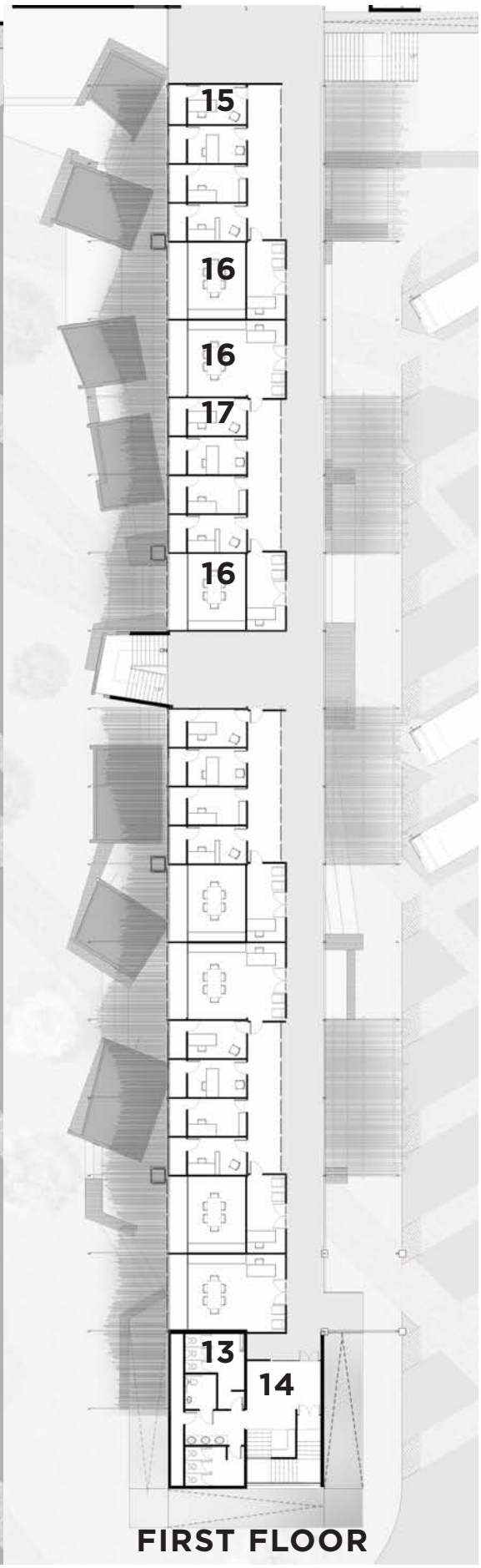
FIRST FLOOR
15 Flexible office unit
16 Flexible meeting unit

TRANSPORT NODE
GROUND + FIRST FLOOR





GROUND FLOOR



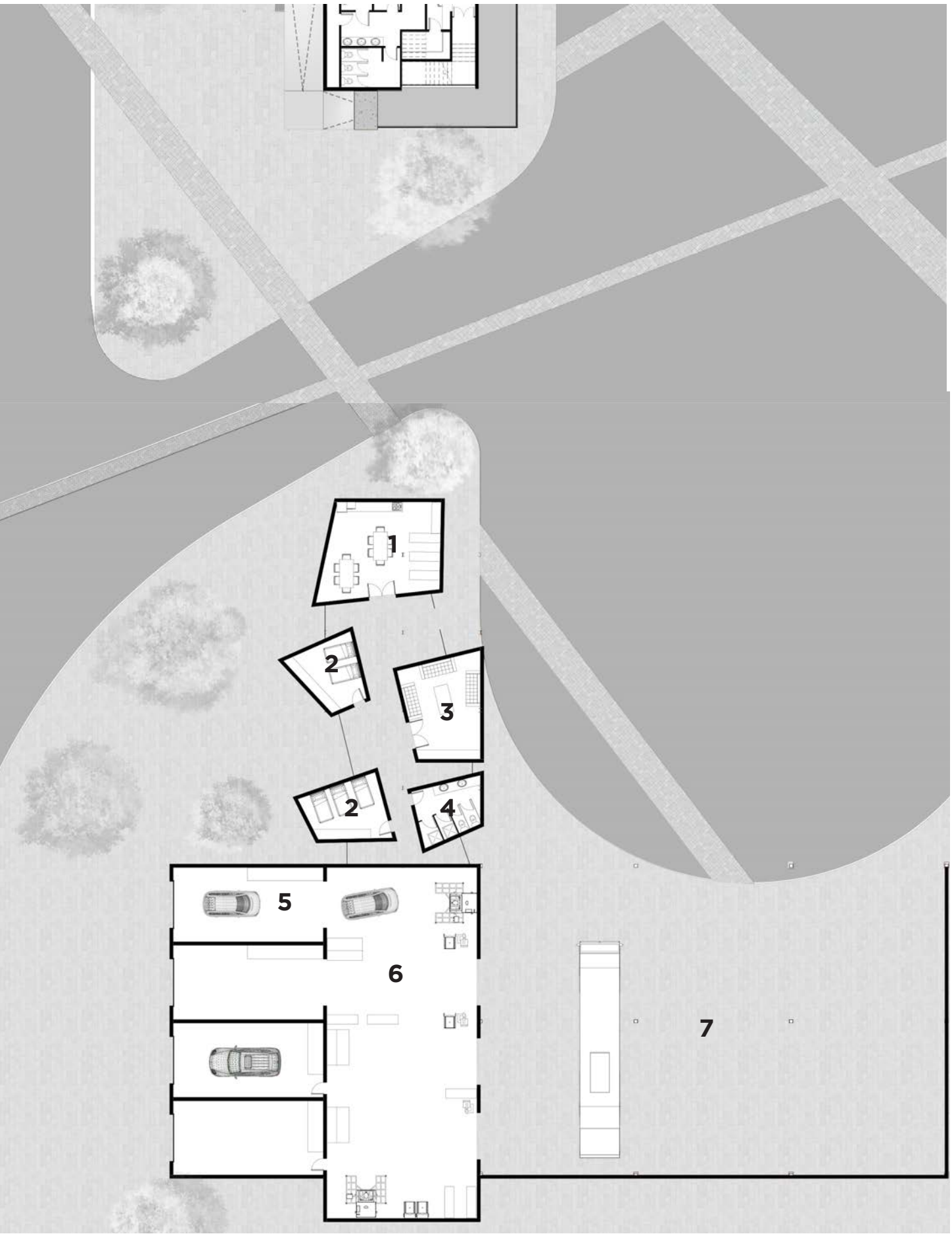
FIRST FLOOR

-BUS RESTING FACILITY/CAR WORKSHOPS-

Forming the southern anchor of the intervention, a shaded bus parking facility for 6 buses link to a workshop area where basic maintenance can be done on the vehicles. This facility connects to a public car workshop facility that utilizes the same workshop to serve as a platform for future vehicle-repair nodes which in the future can extend the precinct. Facilities for bus drivers to overnight and freshen up is also catered for in the same architectural style as the taxi facilities, with small block-buildings **organically designed** under the **repeating grid-structure** which provides a second roof, shielding the buildings from direct solar radiation which causes the buildings to naturally have a cool climate internally.

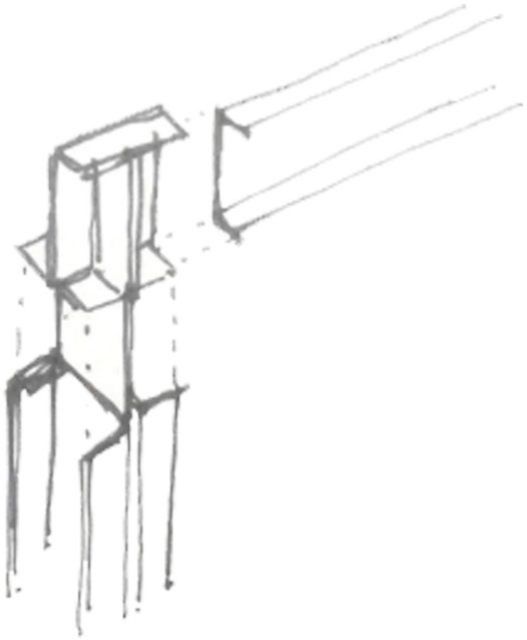
GROUND FLOOR
1 Bus driver kitchen and break-out
2 Bus driver overnight rooms
3 Bus driver relax room
4 Bus driver ablution facilities
5 Car workshops
6 Workshop room
7 Bus overnight parking

VEHICLE WORKSHOP
GROUND FLOOR



05

TECHNOLOGY

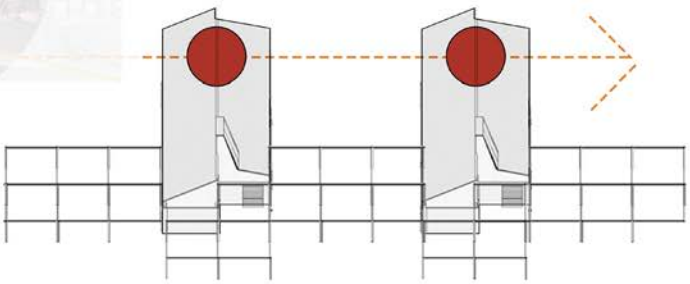


TECHNOLOGY CONCEPT

The techtonic temporality defines growth, while solid steriometry signals the permanence of programmatic nodal boundaries.

Steriotomic permanent elements define the **base of the nodes** while techtonic adaptive structures allow for growth of nodes, and also form the corridor where public trading and activities will happen between nodes.

TECHNOLOGY CONCEPT



DESIGN CONCEPT

1

05.1

TECHNICAL CONCEPT

One of the main design concepts is the development of a **Nodal corridor**, as seen in Chapter 4. It proposes that a Nodal development of Programs on a spine cause an **activity corridor** to grow **sporadically** between the main Nodes, which provides **infrastructure** for local informal or formal trader to latch onto.

Working from this design concept, the technical concept expands on this notion with the following: The **tectonic temporarilty** defines growth, while **solid stereometry** signals the permanence of programmatic nodal boundaries. The stereotomic elements (suggesting permanence) define the **base** footprint of the nodal programs while the tectonic structures (suggesting adaptation) allow for **growth** in between nodes while simultaneously forming the corridor where public trading and other activities will happen between the nodes.

The duality between the two define a clear **footprint** in which the **formal programs** are manifested which do not allow for sporadic growth by the public, but still provide a platform for formal growth if a specific program needs to expand/grow. The in-between public space however is constructed of a much more **flexible** nature. This allows for **public interaction** through providing infrastructural elements on which the user can attach their own building elements.

As both the stereotomic and tectonic elements play their respective roles in the growth of the precinct, these elements each have their own **predefined limitations**. These are:

-STEREOTOMIC CONCEPT -

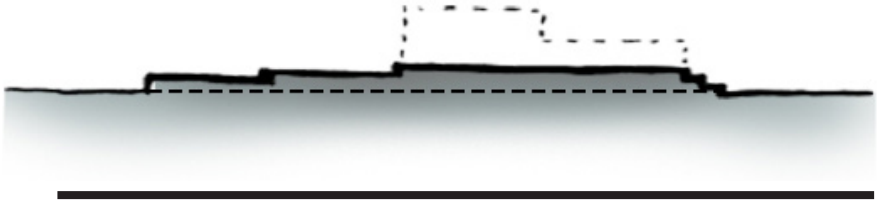
Using Mass elements to form the footprints and base of initial Nodal developments:

1. Existing **ground as work plane**
2. High mass **base as a building platform**
3. Building **footprint in high mass** block work
4. **Tectonic infill fixed** within the solid footprint
5. **High mass concrete floors** on first floor levels as an **alternative to tectonic roof** structure
6. Vertical **expansion** elements filling ground floor levels with high mass block work

Figure 05.1: (Cover) Technology concept (Author 2017)
Figure 05.2: Diagrams illustrating the different Stereotomic concepts listed above (1 - 6) (Author 2017)

1:

2:



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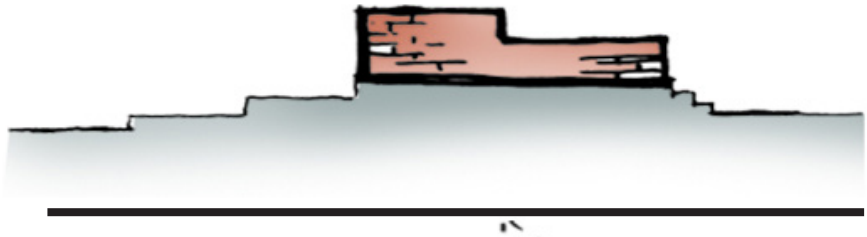

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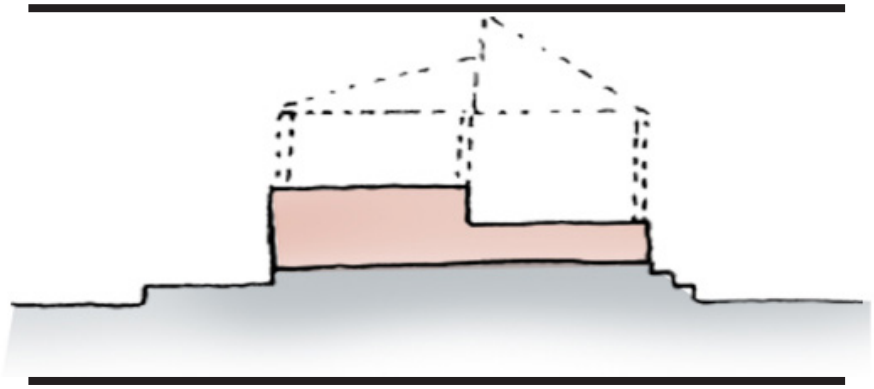

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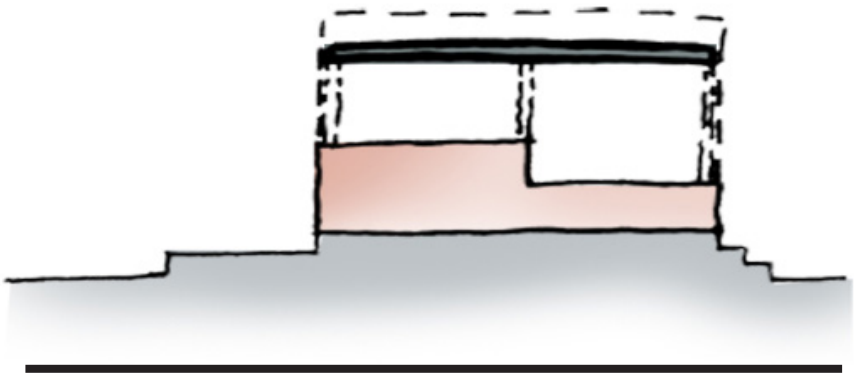

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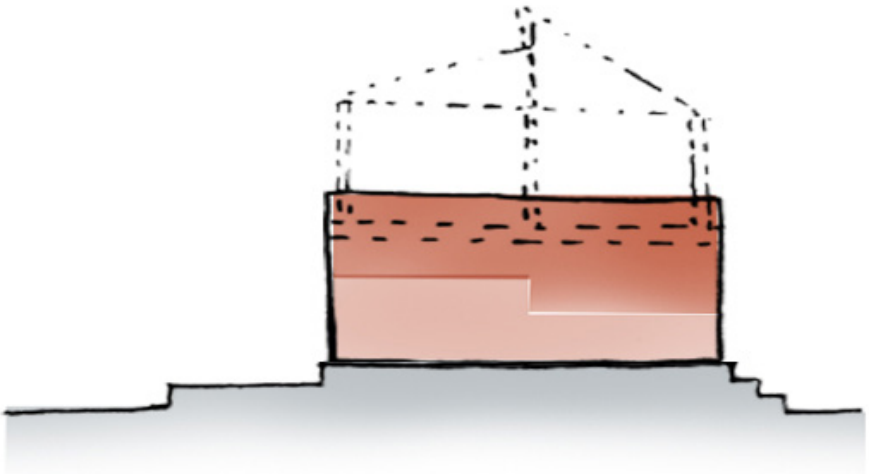


2

-TECTONIC CONCEPT-

Using single structural elements in **unique combinations** to create a variety of Structural Iterations:

1. Single channel element
2. Structural Column (2 x channels bolted together)
3. Attachment to column (A range of attachments to be fixed to bolted plates between the column elements)
4. Single beam to column (Using the same type of channel as a different component)
5. Structural beam (Double channels bolted to structural columns)
6. Structural Load-bearing Beam (Same as 5, but bolted ON TOP of columns)
7. Double story expansion (Double column bolted on top of existing column and beam structure)

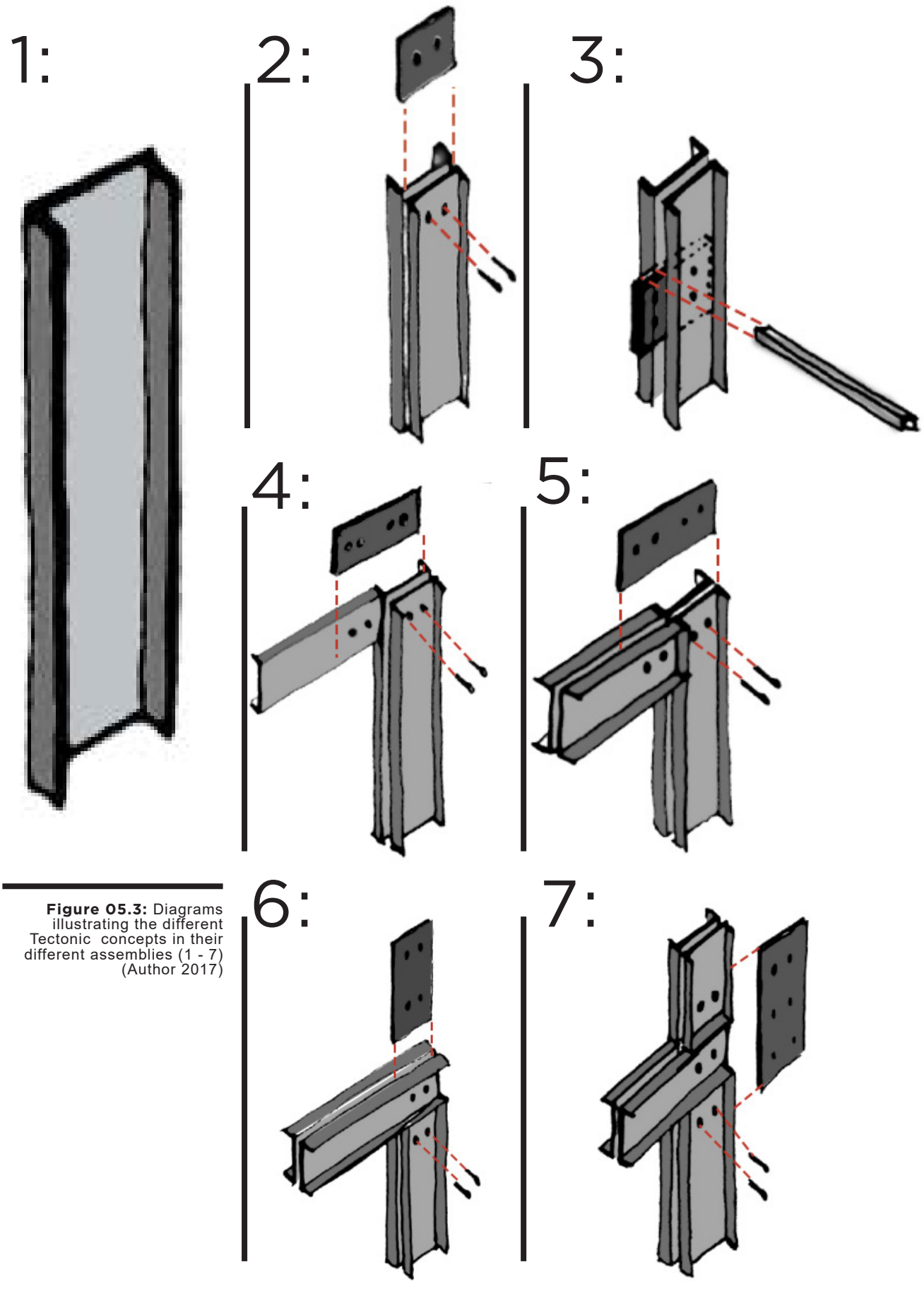


Figure 05.3: Diagrams illustrating the different Tectonic concepts in their different assemblies (1 - 7) (Author 2017)

3

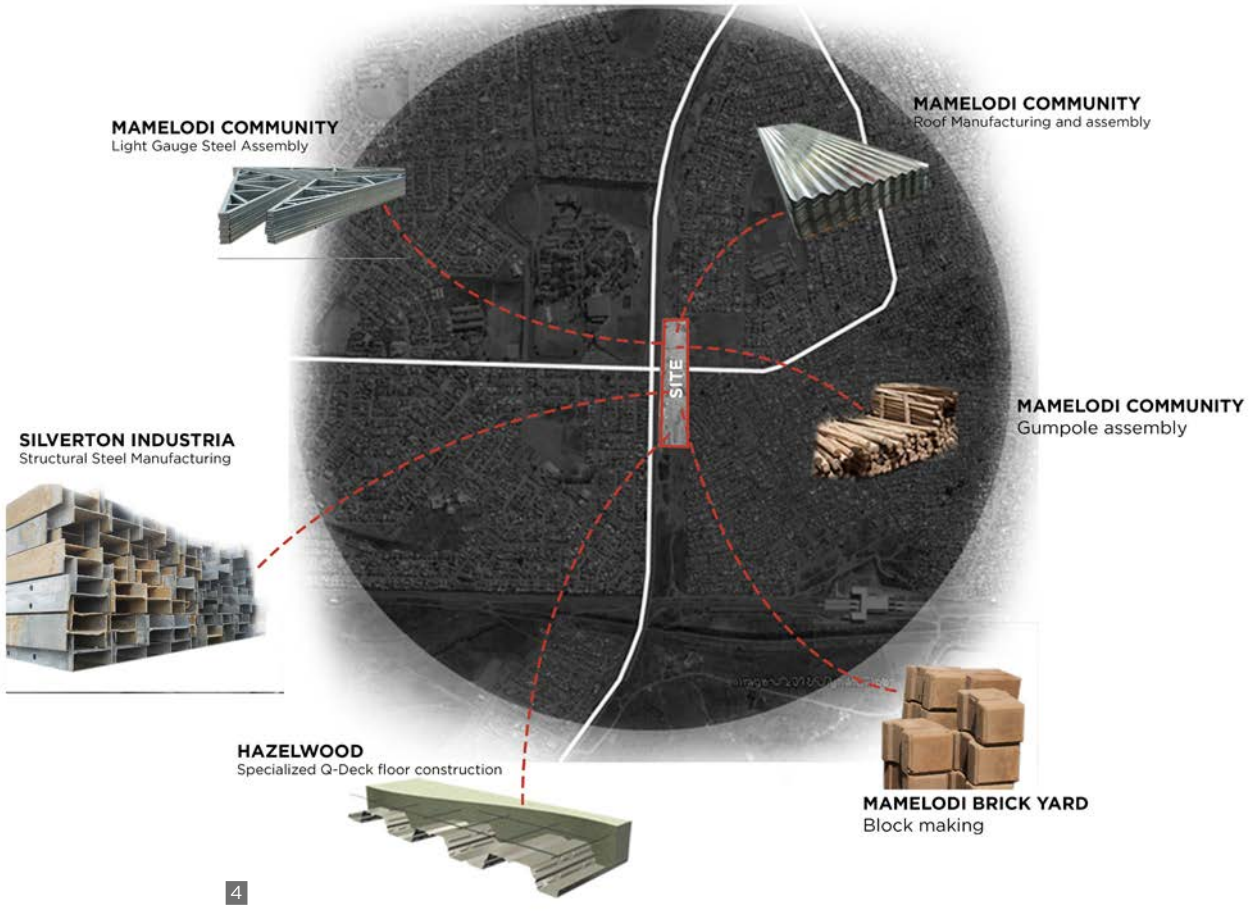
05.2

TECHNOLOGICAL INTENTIONS

In addition to the conceptual drivers of this project, other important characteristics also add to its technological development. These elements are seen as technological intentions, describing the **method and intent of construction** rather than the technical design framework that the conceptual generators provide.

Responding to the **textures and context** of the community, the components from which the project is built are all **locally sourced** or manufactured. The idea is that these elements are all constructed or assembled **through the community**, **in the community**. This provides a platform for the locals to **engage** in the construction of the project from an early stage, providing different parts of the community with different **skills** to manufacture their own material **to use in projects of their own**. As a result, this method allows for opportunities to be created where parts of the community could work together in their own projects after the completion of the building, thus not only providing **employment** opportunity in the construction phase, but teaching a skill set that could be used **beyond the metaphysical boundaries of this project**.

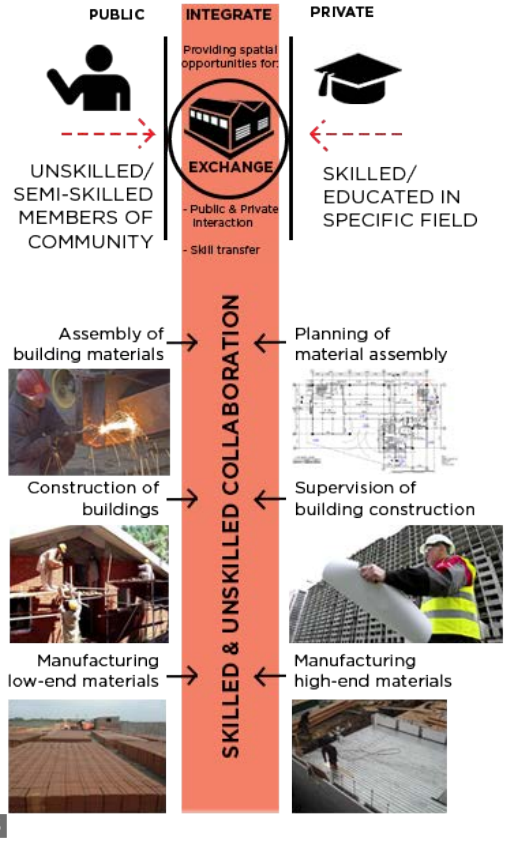
Figure 05.4: Different building components constructed off-site in separate labor groups (Author 2017)
Figure 05.5: Integrated Exchange diagram showing collaboration between skilled and unskilled parties (Author 2017)
Figure 05.6: Varying of elemental intentions between nodes and links (Author 2017)



Transfer of skills also provides a **platform of interaction** for several skilled artisans and professionals in the area (e.g. steel manufacturing and forming in Silverton, block making in the Mamelodi brick yards, light gauge steel sheet metal industry, and concrete casting specialists to name a few). **Transfer of knowledge** allow for unskilled Mamelodi community members to develop skills of their own, and also start a **relationship** between the skilled master and the unskilled community member, which may lead to future mutual benefit.

This same principal that the project's program introduces (**Figure 05.5**) where a space for integration between the skilled private school and the unskilled public community member is provided, is applied thus also applied in the construction phase of the precinct.

Another intention that drives the technological development is the **intentional variation of elements** between nodes and links. The table below (**Figure 05.6**) demonstrates how the same **stereotomic and tectonic elements** are used in **different ways** in **nodal** development than they are used in the spinal **link** spaces. **Different interpretation of the same elements** thus also provide variation between programmed spaces which adds to the contrasts created between nodes and links.



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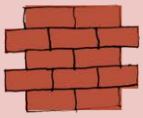
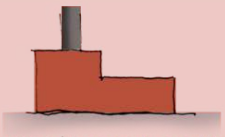
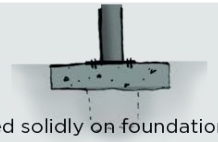
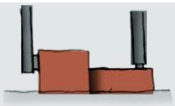
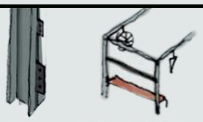
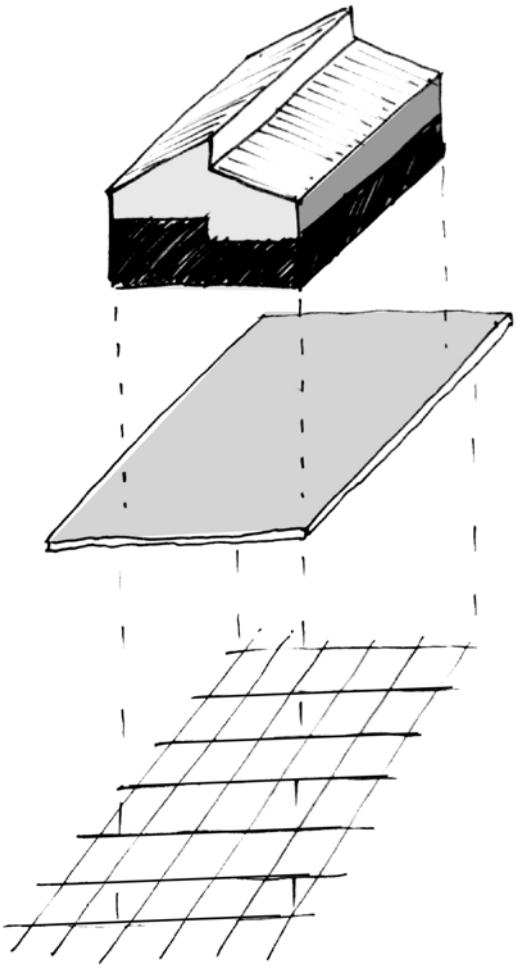
ELEMENTS	NODE	LINK	
PLATFORM	 Level base on which nodes are built	 Public spaces as steps up to nodes	STEREOTOMIC ELEMENTS
BASE	 Blocks used for mass walling	 Blocks used to create seating/ trading platform elements	
COLUMN FOOTING	 Grounded solidly on foundation for structural stability	 Columns not touching, 'floating' above ground level	TECHTONIC ELEMENTS
ATTACHMENTS	 Industrial attachment used on BEAMS	 Plates between COLUMNS creating platform for attachment of elemetns	
SHADING DEVICE	 Structural Mentis Grid used for shading	 Gumpoles used for perforated shading	

6

05.3

STRUCTURAL SYSTEM

Supporting the duality of concepts between stereotomic and tectonic element, links and nodes, the structural systems form **parts of the whole** and are a combination of elements within the project. These are classified under the following categories: The Grid, Primary Structure and Secondary Structure.



7

Figure 05.7: Elements of the structural system broken up (Author 2017)

-SECONDARY STRUCTURE -

'Everything that holds something up, but isn't crucial to the building's structural integrity' (as defined by Archinect, 2015). Stuck to or on the structural framework, the secondary elements include the **walls**, whether mass block work or light steel-clad wall panels, and the **shading elements** that provide protection to solar radiation in the vertical and horizontal planes.

-PRIMARY STRUCTURE -

Built along the edges of the grid, the primary structure means*: 'Everything without which the building won't stand up'.* **Forming the platform** on which each building is built, the **substructure and base** level forms the first level of the primary structure. Building on this, the **structural steel framework** defines the interior and exterior space and holds up the final primary element: The roof, which encloses the space below whether public or private, and provides protection to the natural elements.

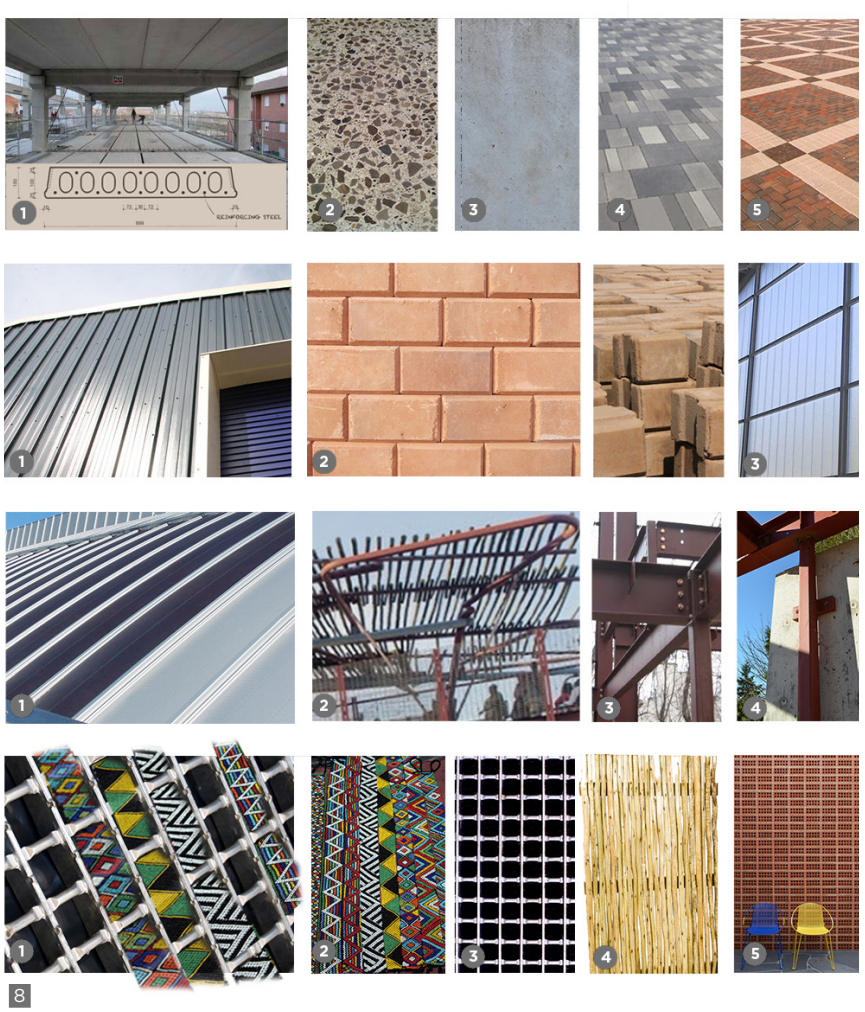
-THE GRID -

As an intangible base layer, the grid is a **4,8m x 4,8m** guideline that forms the outline for buildings and public spaces. It creates a **fixed rectangular mesh** on plan which is used to define the threshold between spaces, and allows a framework for **logical expansion and adaptation**.

05.4

MATERIALS

Inspired by the genus loci, the material pallet has been developed as a **mixture of lightweight and solid elements** that represent the **vernacular texture** of Mamelodi. These materials are all locally sourced to support the low-tech intention of applicable skill-transfer to the community. **Figure 05.8** illustrates the list of materials proposed.



FLOOR AND PAVING

1. CONCRETE FIRST FLOOR SLABS - 900 x 150 x 5000mm 50MPa Type X Echo Reinforced slab blocks resting on steel structure beams

2. SCHOOL + RETAIL INTERIOR - 13m aggregate in concrete grinded and polished floor

3. WORKSHOP INTERIOR - Power floated screed on concrete surface bed

4. EXTERIOR PUBLIC PAVING - 400 x 600 x 60 Large concrete urban pavers laid in stack bond

5. EXTERIOR PUBLIC PAVING - 220 x 110 x 65 Red and Yellow COROBRICK pavers laid in random bond alowing for water penetration through joints (see Water filtration System)

WALL AND INFILL

1. INFILL WALL TOP - KLIPTITE IBR 700 profile steel sheet type ISOWALL cladding with ROCKWOOL insulation and flush interior
(Local manufacturer: ISOWALL - Silverton)

2. WALL BASE - 220 x 250 x 115 SABS-Approved Soil-cement HYDRAFORM blocks dry-stacked and plastered at edges
(Manufactured in-situ with clay found in proximity)

3. WINDOWS - 16mm Selectogal clear Polygal Polycarbonate sheets type placed in Light Gauge steel frame - SHGF of 0.35
(Manufactured locally by Danpal)

ROOF AND STRUCTURE

1. ROOF SHEETING - KLIPTITE IBR 700 profile roof sheet with DRYTEC 550 SOLAR FLEX solar panels inserted between ridges

2. SCREEN ROOF EXTERIOR - 50mm - 110mm radius Gum Pole screen fixed to Gum Pole perlins on Steel structure (3)

3. STEEL BUILDING STRUCTURE - 230mm and 150mm Steel C-Chanel Structure used as beams and columns bolted together by 15mm steel fixing plate on joints

4. STRUCTURAL WALL - Reinforced concrete wall cast in-situ at Bank and Post Office areas

VERTICAL SHADING

1. VERTICAL EXTERIOR SHADING (EAST/WEST) - Beads (2) woven into Steel Mentis Grid (3) at random spacings

2. DECORATIVE SCREENING ELEMENT - African beads woven into 60mm strips with unique patterns
(Done by locals - women employed to make strips)

3. STEEL VERTICAL EXTERIOR SHADING - Steel mentis grid fixed to steel structure at East and West facades

4. TIMBER POLE EXTERIOR SHADING - Timber Gum Poles fixed into Steel structure with cut-out window openings on East and West facades

3. BRICK SCREEN - 220 x 110 x 75mm COROBRICK ROAN brick with 10 holes placed on side to form perforated screen on West facades

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Figure 05.8: Proposed material pallet (Author 2017)

05.5

RAINWATER HARVESTING

Given the location on a threshold to an informal settlement with **limited connections** to any formal municipal water supply, strategies to harvest rainwater should provide enough to service the **entire intervention,** and give the **excess water back** to the informal settlement adjacent to the site.

Covering over **10 000m²** in roof and ground floor area, a large amount of rainwater is harvested and stored for use across the precinct. Being a public building, a lot of water can be used as is, for non-potable use such as flushing toilets washing cars or taxis. This thus eliminates the need for all water to be filtered for potable use.

The tables below show the calculations for **potable and non-potable** use, and proposes the amount of storage tanks to be installed to sustain the entire precinct throughout the year. A need for potable water means that there are two systems of water collection needed. One for **unfiltered** non-potable water, and one for **potable** use for showering and drinking.

In conclusion, there is **enough water** collected on the **roof to fulfill the potable water needs, and enough groundwater for non-potable needs.** This makes the task of separating the water uses easy, filtering only the roof harvested water for potable use.

FUNCTION	BUILDING m²	EQUIPMENT DEMAND*	WATER DEMAND - POTABLE (l)	WATER DEMAND - NON POTABLE (l)
A - School and Workshops 50 users incl staff	870 + 251 + 197 **TOTAL = 1318m²**	WC - 4 HWB - 3 URINALS - 1 KITCHEN SINK - 1 WORKSHOP SINK - 2 SHOWER - 2	2L/use - 3 x 30 use = **180L/day** 2L/use - 1 x 5 use = **10L/day** 2L/use - 3 x 20 use = **120L/day** 20L/use - 2 x 2 use = **80L/day** **TOTAL - 390L/day**	4,5l/flush - 4 x 30 flush = **540L/day** 1L/flush - 1 x 10 flush = **10L/day** **TOTAL - 550L/day**
B - Retail, Post office and Public square 200 users per day incl staff	1200 + 184 + 159 + 360 **TOTAL = 1903m²**	WC - 7 HWB - 4 URINALS - 1	2L/use - 4 x 20 use = **200L/day** **TOTAL - 200L/day**	4,5/flush - 7 x 20 flush = **630L/day** 1L/flush - 1 x 15 flush = **15L/day** **TOTAL = 645L/day**
C - Bus ticket office and Taxi + Public waiting 200 users per day incl staff	800 + 400+ 80 **TOTAL = 1280m²**	WC - 15 HWB - 8 URINALS - 3 KITCHEN SINKS - 3 SHOWERS - 2 WASHING (CARS)	2L/use - 8 x 15 use = **240L/day** 2L/use - 3 x 10 use = **60L/day** 20L/use - 2 x 10 use = **400L/day** **TOTAL - 700L/day**	4,5/flush - 15 x 20 flush = **1350L/day** 1L/flush - 3 x 10 flush = **30L/day** 30L/wash - 10 cars/day = **300L/day** **TOTAL - 1680L/day**
D - Offices and Bank 40 users per day (office and bank staff) Public bank users included in C	640 + 312 **TOTAL = 952m²**	WC - 5 HWB - 3 KITCHEN SINK - 3	2L/use - 3 x 10 use = **60L/day** 2L/use - 3 x 5 use = **30L/day** **TOTAL - 90L/day**	4,5L/flush - 5 x 10 flush = **225L/day** **TOTAL - 225L/day**

RAINWATER HARVEST	ROOF/year (L)	SURFACE/year (L)	ROOF/day (L)	SURFACE/day (L)
A	601 302	343 400	1689	965
B	311 298	515 100	874	1447
C	182 520	1 010 000	513	2837
D	434 499	0	1221	0

AVERAGE MONTHLY PRECIPITATION FOR PRETORIA (mm)		AVERAGE HARVEST PER MONTH (90% of surfaces)
January	136mm	2796m² x 0.136m = 380,256 L
February	5mm	2796m² x 0.005m = 13,980 L
March	82mm	2796m² x 0.082m = 229,272 L
April	51mm	2796m² x 0.051m = 142,596 L
May	13mm	2796m² x 0.013m = 36,348 L
June	7mm	2796m² x 0.007m = 19,572 L
July	3mm	2796m² x 0.003m = 8,388 L
August	6mm	2796m² x 0.006m = 16,776 L
September	22mm	2796m² x 0.022m = 61,512 L
October	71mm	2796m² x 0.071m = 198,516 L
November	98mm	2796m² x 0.098m = 274,008 L
December	110mm	2796m² x 0.110m = 307,560 L

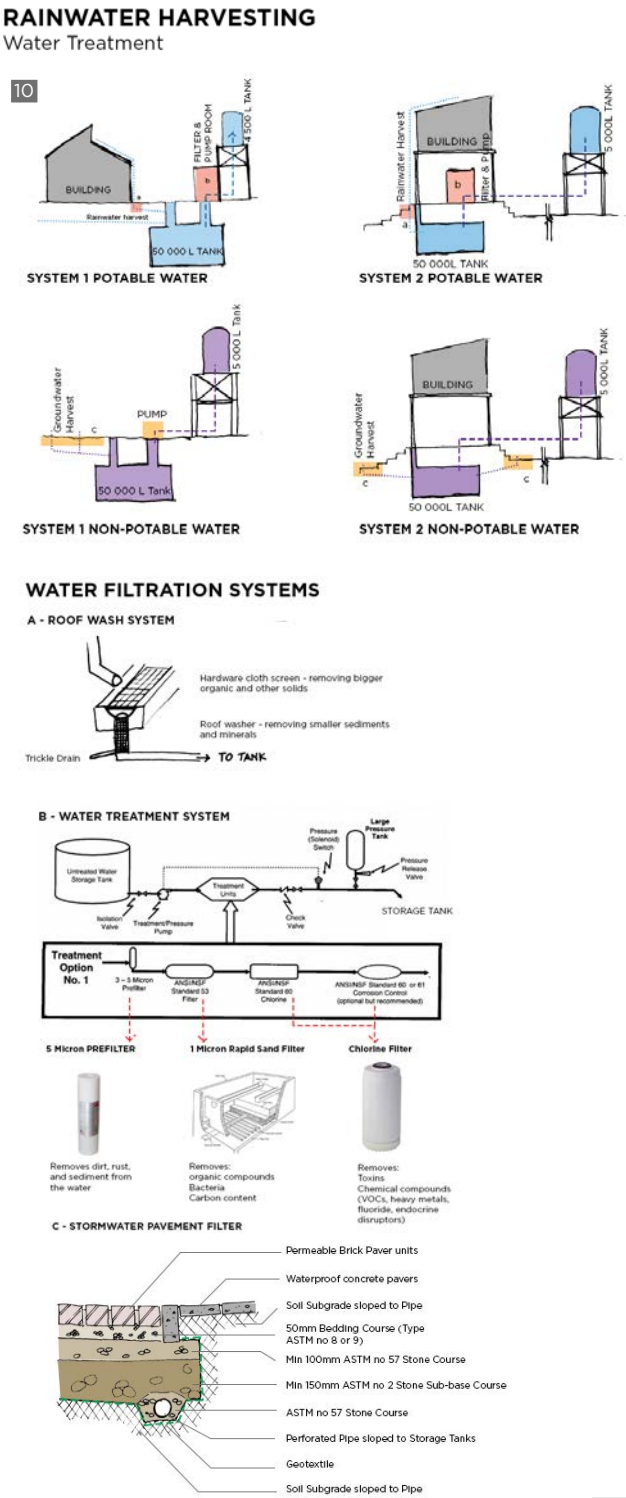
Source: http://www.climatetemp.info/south-africa/pretoria.htm

SUMMARY OF WATER REQUIRED per day	POTABLE	NON-POTABLE
A	390L	550L
B	200L	645L
C	700L	1680L
D	90L	225L
TOTAL WATER REQUIRED per month (x30)		
A	11700 L	16500 L
B	6000 L	19350 L
C	21000 L	50400 L
D	2700 L	6750 L
TOTAL	**46400 L**	**93000 L**

Figure 05.9: Rainwater harvesting strategies on plan
Figure 05.10: Different water filtration systems and processes (Author 2017)

Figure 05.10 illustrates the two-systems water flow throughout the precinct, as well as storage for each separate system. The diagram below further illustrates the different diagrammatic filtration and storage processes for each system.

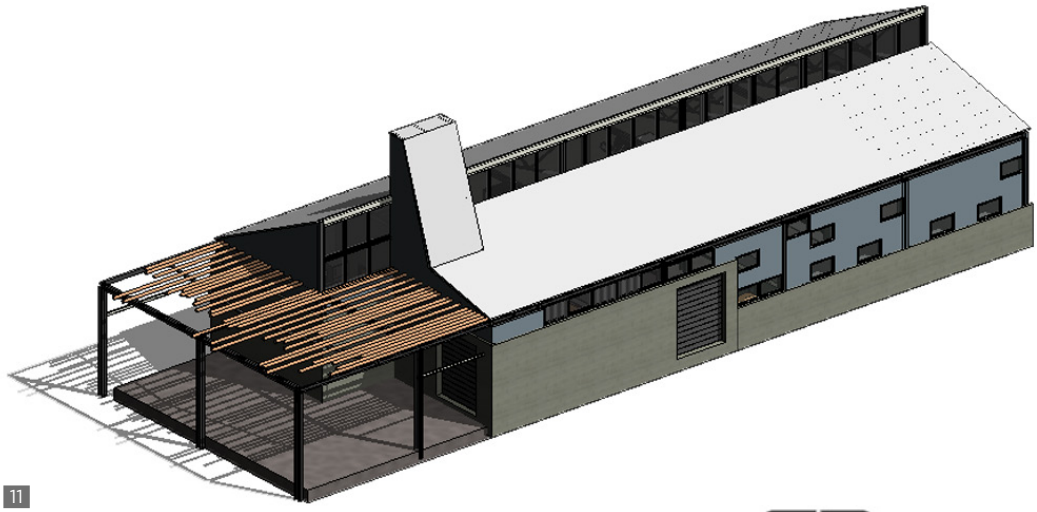
Excess water harvested within the precinct will be pumped to the adjacent **community of Phomolong**, where they can use the water for their own personal use, as well as public toilets and washing facilities that have been programmatically proposed to the east of the precinct.



05.6

PASSIVE SYSTEMS

-NATURAL VENTILATION AND CLIMATE-



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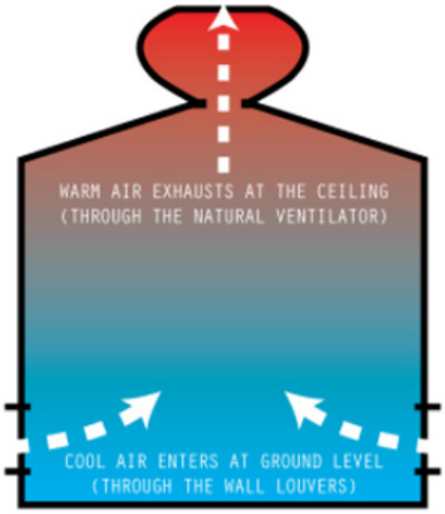
With the **educational link** on the northern end divided into several spread-out workshop nodes, a strategy for **climate control** is needed within these spaces as these spaces will be occupied throughout the most of the day with 10 to 20 people each as well as heavier heat-generating machinery. This causes temperatures to rise within these spaces if not properly ventilated. As mechanically induced ventilation has major electricity-cost implications, a system of **natural passive ventilation** is looked at as an alternative.



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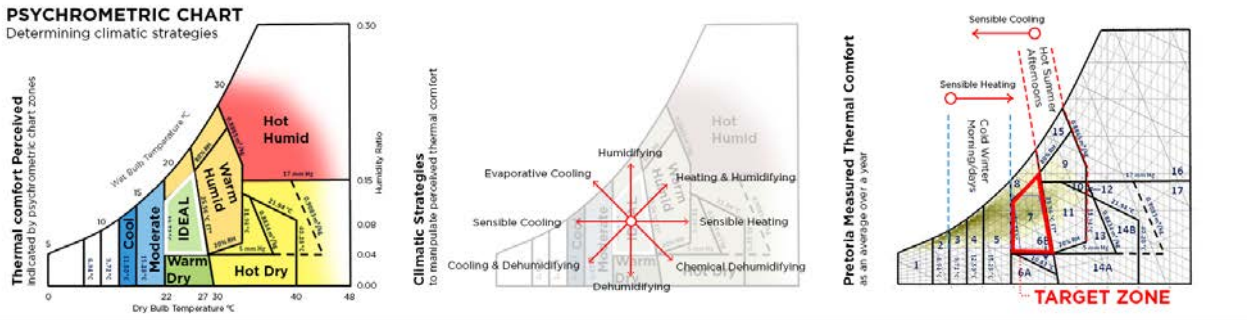
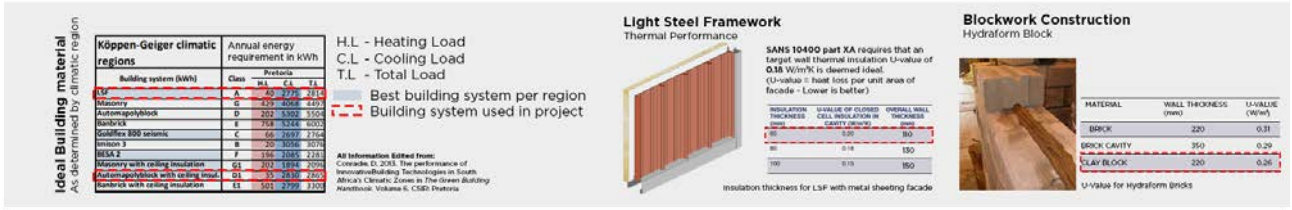
Passive ventilation works when natural outside air movement and **pressure differences** is used to both ventilate and cool the interior of a building. The concept of buoyancy-driven ventilation is used, where the air temperature differences cause a **natural movement of air** within the building. (**Figure 05.12**). Hot air within the building exits at a solar chimney in the highest point of the building, creating a pressure difference in the building that sucks in cool air at a low cavity within the building. The cold air then heats up through the natural activities and bodies within the building which then again exits through the solar chimney (Moffit, 2011).

Several factors play a role in the efficiency of this system, evaluated in the table on the next page.

The effective implementation of this system allows for a well-ventilated internal climate, cooling the building through continuous air movement, which can be reversed in colder winter days by closing the stack vent to keep the hot air still inside the building which warms-up the interior space. (**Figure 05.14**)





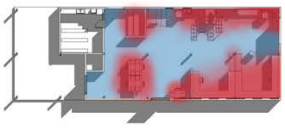
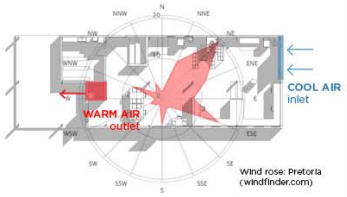
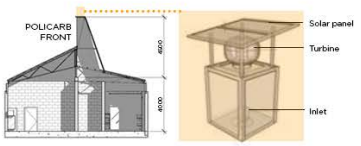
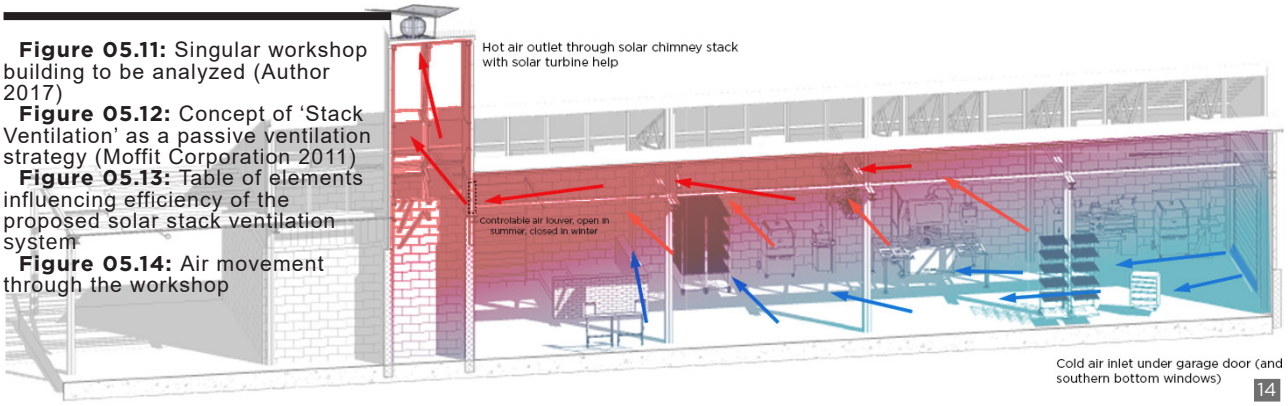
REQUIREMENT	CONDITION	STATUS	DIAGRAM
CEILING HEIGHT Warm air can not move away from users/equipment if the ceiling is too low. Stack effect ventilation requires high ceilings to work	Varies from 3500mm - 4700mm	GOOD	
OCCUPANCY Number of people active in the area has a direct relation to the amount of heat generated, as well as the number of heat-generating equipment in the workspace	10 - 20 Occupants 5 Heat-generating machines	GOOD	
ORIENTATION Prevailant wind direction has a direct impact on the number of air changes. Having air move through the length of the building before exiting through the stack generates greater air changes than through the width.	Long axis EAST-WEST, air entrance: East, exit: West PTA wind condition: predominantly East	EXCELLENT	
CHIMNEY The height of the stack should idealy be above 1,5 x the workspace height. This could however be smaller if air turbines are introduced Chimney face material should heat easily, glass is ideal 13	Average workspace height: 4m Chimney Height: 4,5m Turbine required for additional airflow	AVERAGE	 Additional solar turbine proposed on top of stack chimney, when sun is out, air moves fast and building cools down. When sun is not out, air moves slower, cooling building slower

Figure 05.11: Singular workshop building to be analyzed (Author 2017)
Figure 05.12: Concept of 'Stack Ventilation' as a passive ventilation strategy (Moffit Corporation 2011)
Figure 05.13: Table of elements influencing efficiency of the proposed solar stack ventilation system
Figure 05.14: Air movement through the workshop



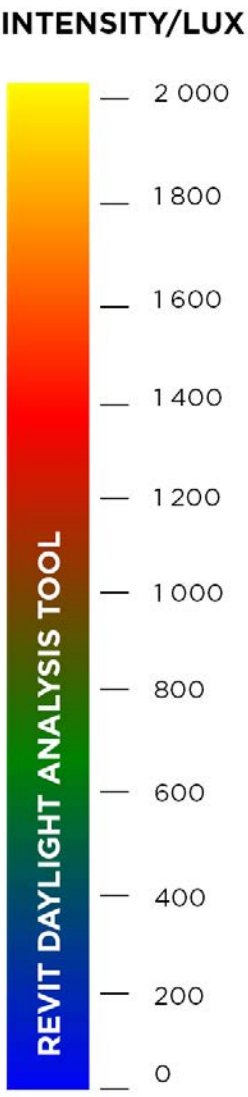
-NATURAL DAYLIGHT-

In addition to the system of passive ventilation, natural daylight is investigated as another method of passively **enhancing** the **spatial qualities** of the workshop interior space. "…light is a critical element in our social life through its reflection on identity, cultural beliefs, morals and sense of importance in our environment" (Bille et al, 2007:266).

Quality of natural light is essential in the experience of a space as an **extension to the material use**, and can be effectively manipulated to create a spatial quality that supports the programmatic use. This daylight is then a quantitative value that can be measured in lux, defined as: *"a unit of illumination equal to the direct illumination on a surface that is everywhere one meter from a uniform point source of one candle intensity or equal to one lumen per square meter"* (Merriam-Webster, 2017).

Typically, a workshop where assembling and drawing will take place, should have a minimum illumination of 750-1000 lux (**Figure 05.15**), but could exceed this minimum requirement if no direct daylight glare is induced through solar radiation. This phenomenon is avoided by **orientating the windows to the south**, which delivers a more consistent quality of light, as direct sunlight from the north is never an issue. As seen in **Figure 05.17**, the analysis of modeling software (REVIT daylight analysis tool) indicates that there is sufficient natural daylight throughout the year for the buildings intended programme.

Figure 05.15: Table illustrating ideal luminance of a space per program (Revit daylight analysis 2017)
Figure 05.16: Daylight analysis colour chart per lux
Figure 05.17: Daylight simulations testing the space in winter and summer (Author 2017)



16

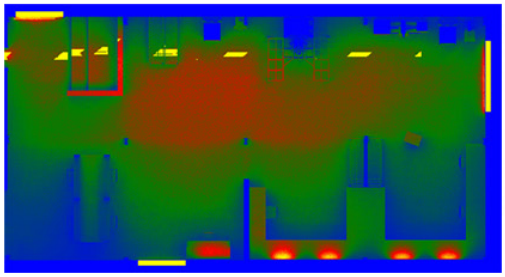
ACTIVITY	ILLUMINATION (lux)
Public Areas with dark surrounds	20 - 50
Simple orientation for short visits	50 - 100
Working areas with low visual tasks	100 - 150
Warehouses, Homes, Theatres, Archives	150
Easy Office Work, Classes	250
Normal Office, Library	500
Supermarkets, **Workshops**, Offices	**750**
Drawing Offices, Mechanical workshops	1 000
Detailed Drawing work	1 500 - 2 000
Low contrast tasks	2 000 - 5 000
Very special visual tasks	5 000 - 20 000

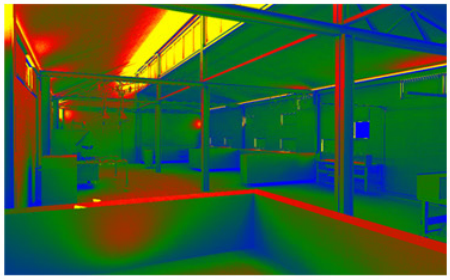
15

SUMMER SOLSTICE: WINTER SOLSTICE:

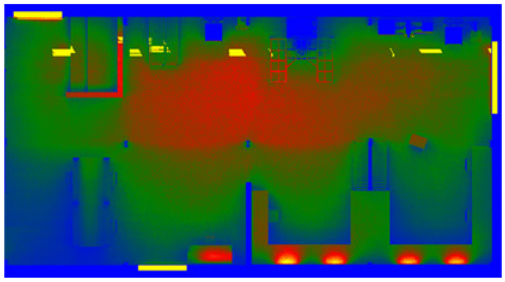
PLAN 3D INTERIOR

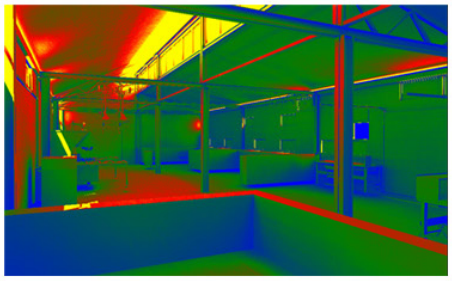
10H00



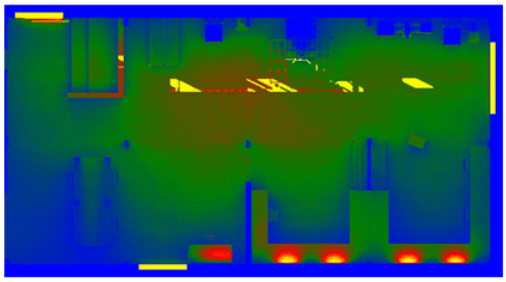


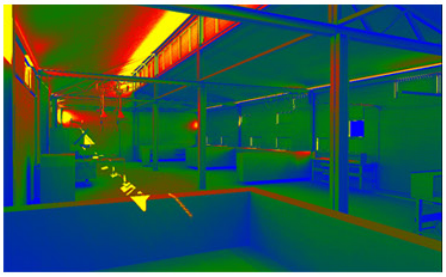
13H00



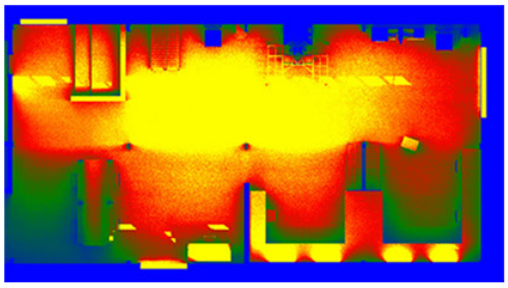


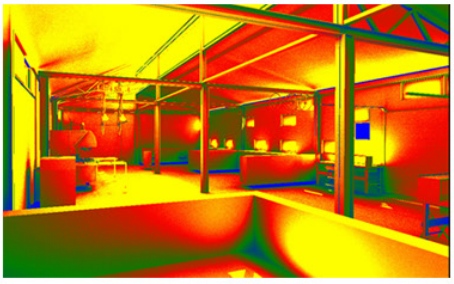
16H00



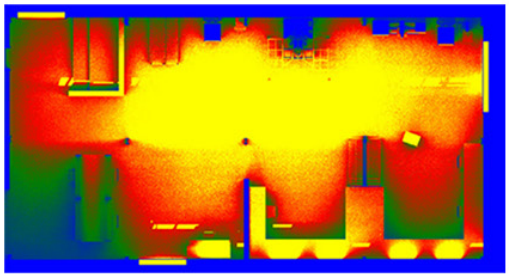


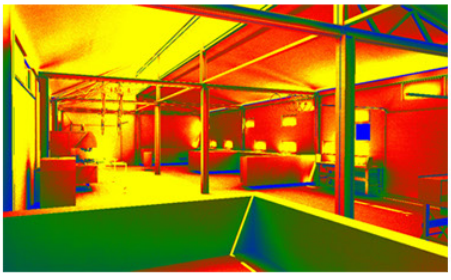
10H00



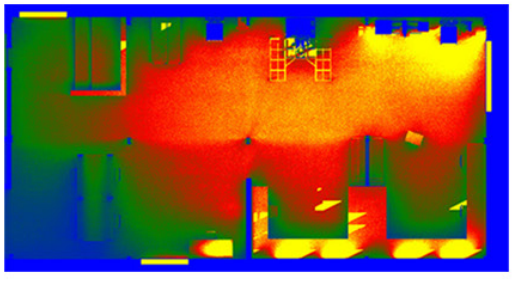


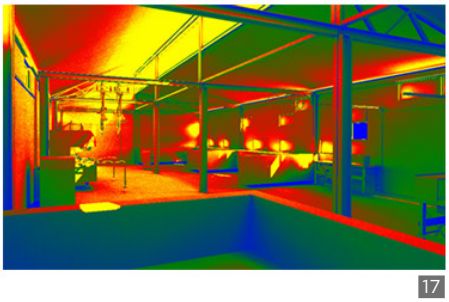
13H00





16H00





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05.7

TECHNICAL INVESTIGATION

The modularity of this project suggests that details be resolved to such an extent that it can be **repeated** along the grid throughout the entire precinct. The diagrams below illustrate the investigation and development of the different elements of structure, walls as infill, roofs and detail elements in such a way that it **translates into the technical concept** of adaptation.

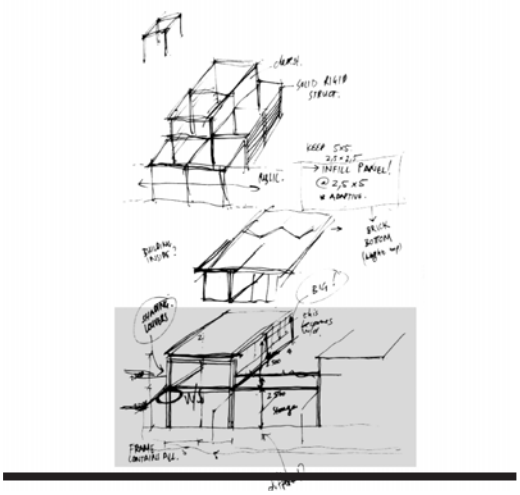

Figure 05.14.1 Initial structure development

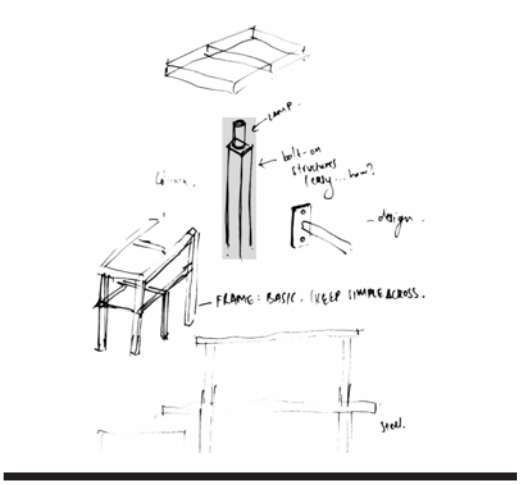

Figure 05.14.2 Structural elements

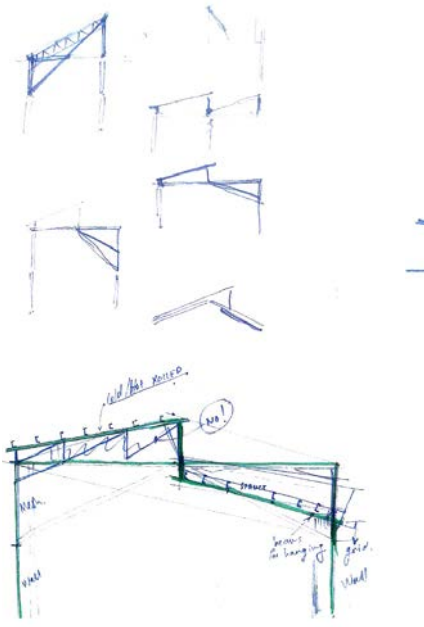

Figure 05.14.3 Truss shape development

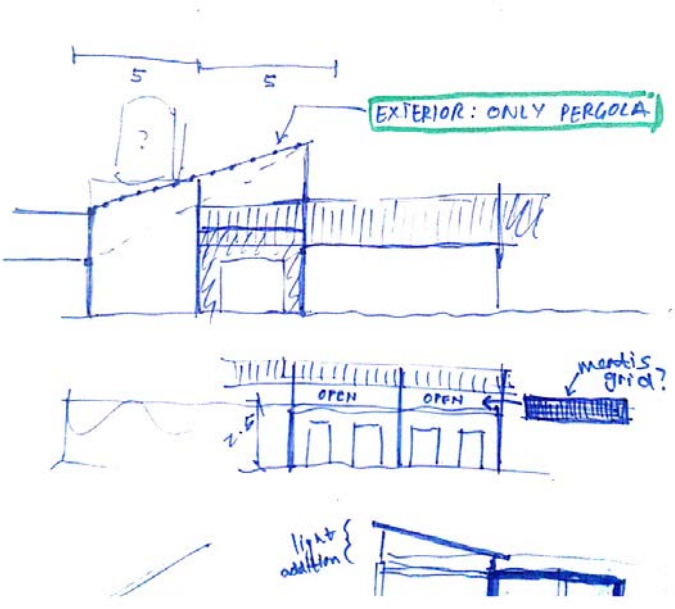

Figure 05.14.4 Initial vertical and horizontal shading investigation

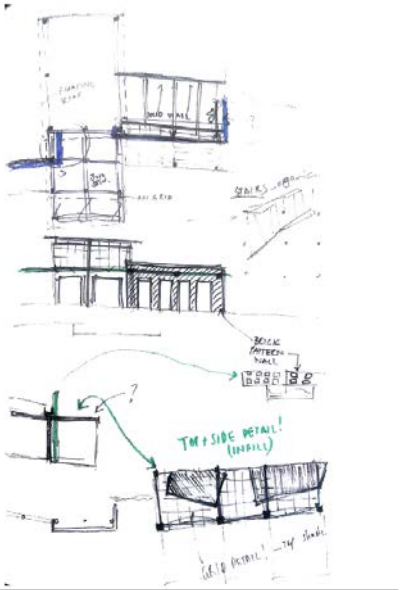

Figure 05.14.5 investigation of modular grid development

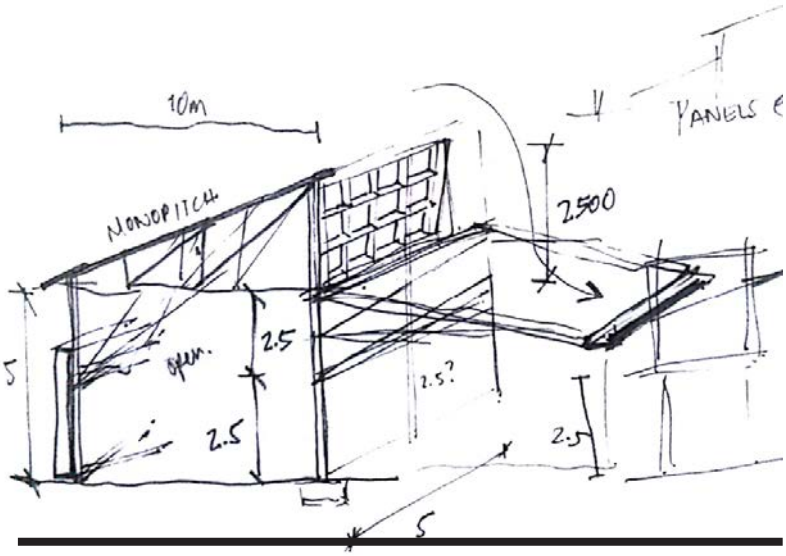

Figure 05.14.6 Initial truss and infill investigation

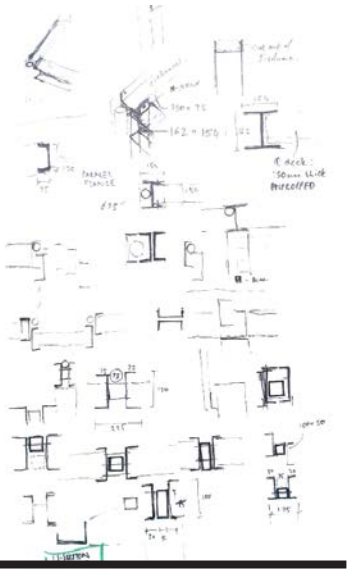

Figure 05.14.7 Column section exploration

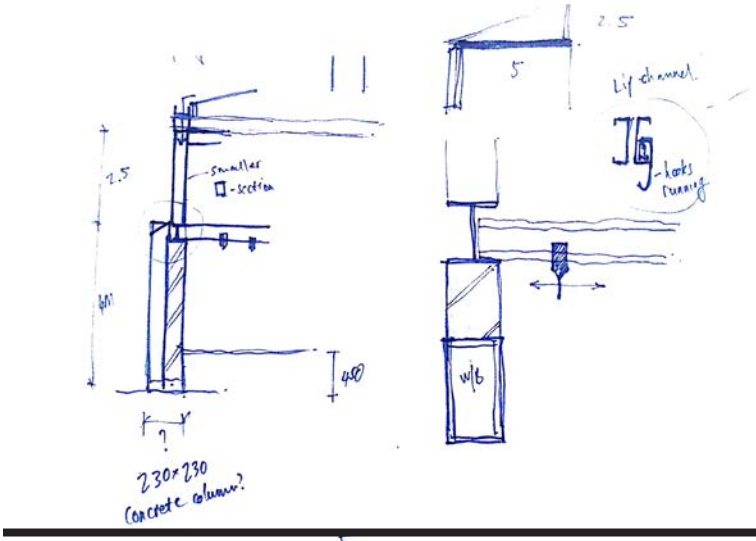

Figure 05.14.8 Initial junction investigation

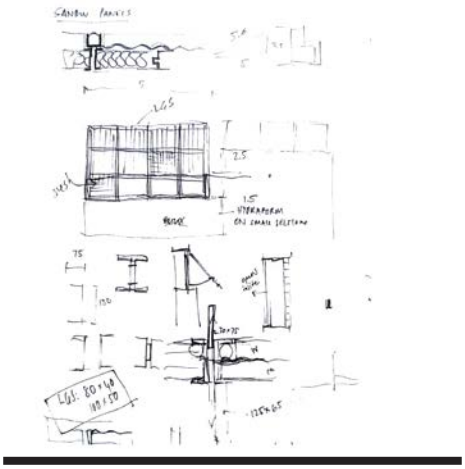

Figure 05.14.9 Wall panels - sandwich panel construction and assembly

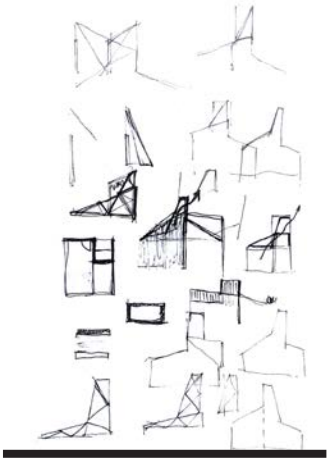

Figure 05.14.10 Workshop elevation and stack ventilation chimney shape

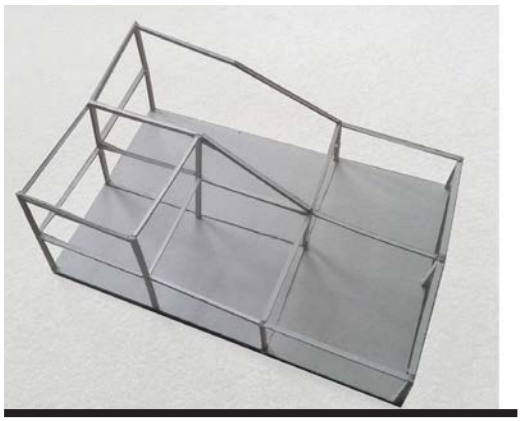

Figure 05.14.1 First structural maquette indicating the structural components on the proposed grid

Figure 05.14.2 Modular roof trusses fixed in various ways to the structural maquette

Figure 05.14.3 Model of structural iteration explaining the variety of uses and fixing of a single element for beam and column construction

Figure 05.14.4 Slab cast between beam and quick assembly of structural elements for future adaptation

Figure 05.14.5 Detail view of fixing between structural elements

Figure 05.14.6 Detail view of steel plates serving as spacers and fixers in the structural elements

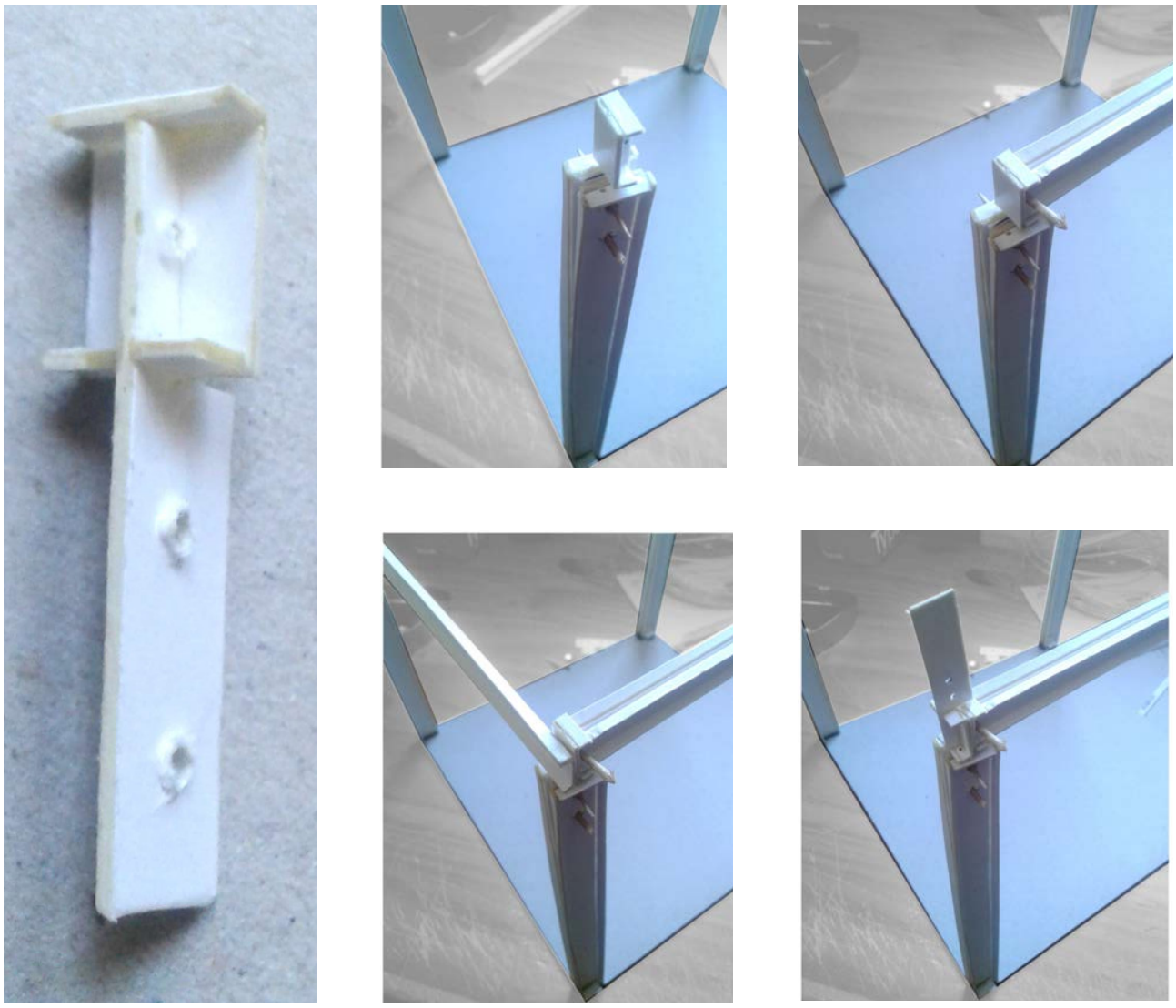

Figure 05.18: Technical development model assembled in stages with new modular joint that bolts to the structure

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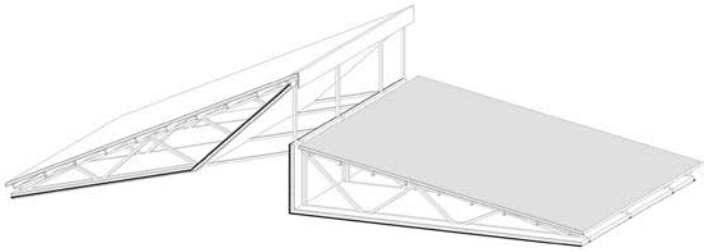
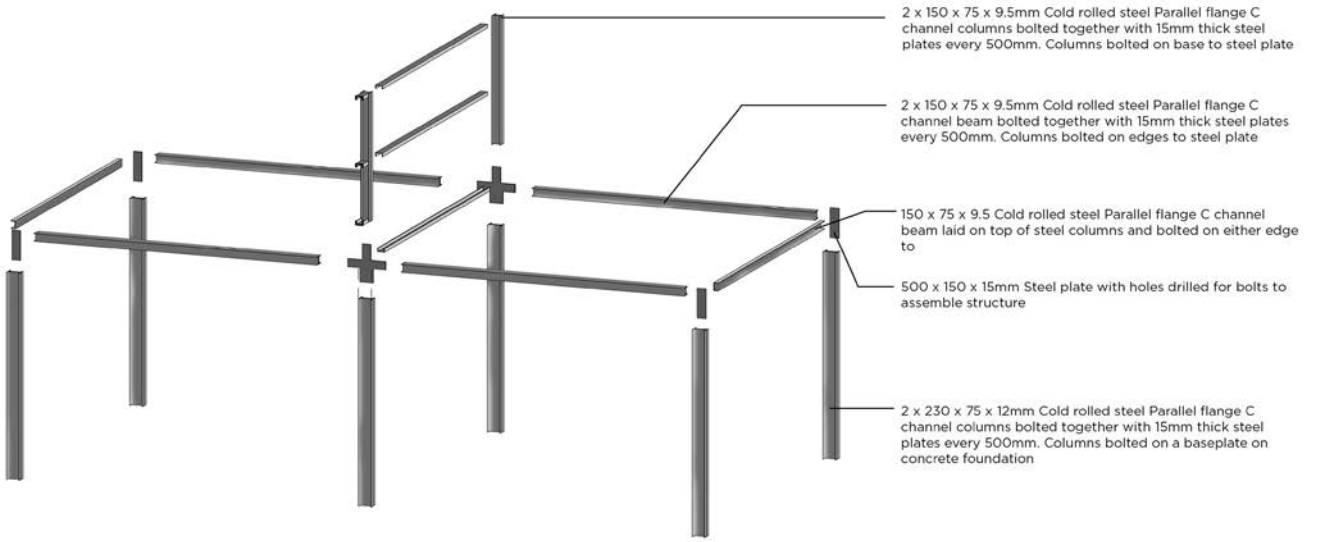
05.8

TECHNICAL ITERATION

-DETAIL ONE: STRUCTURE-





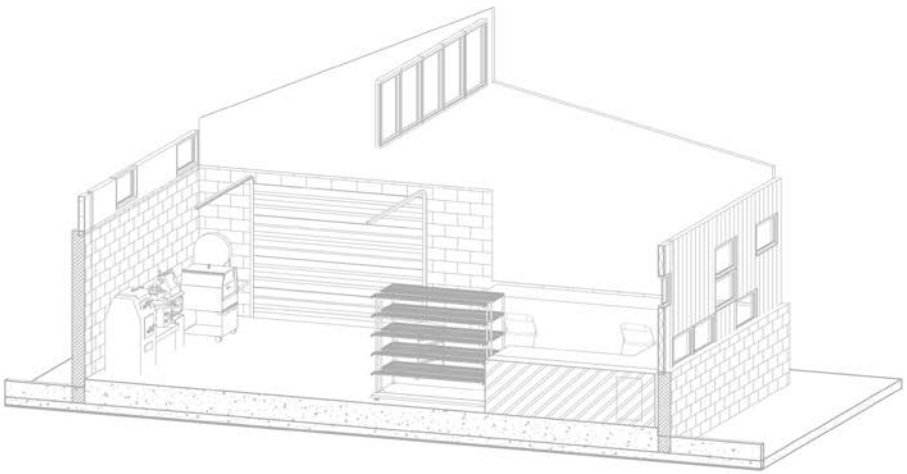


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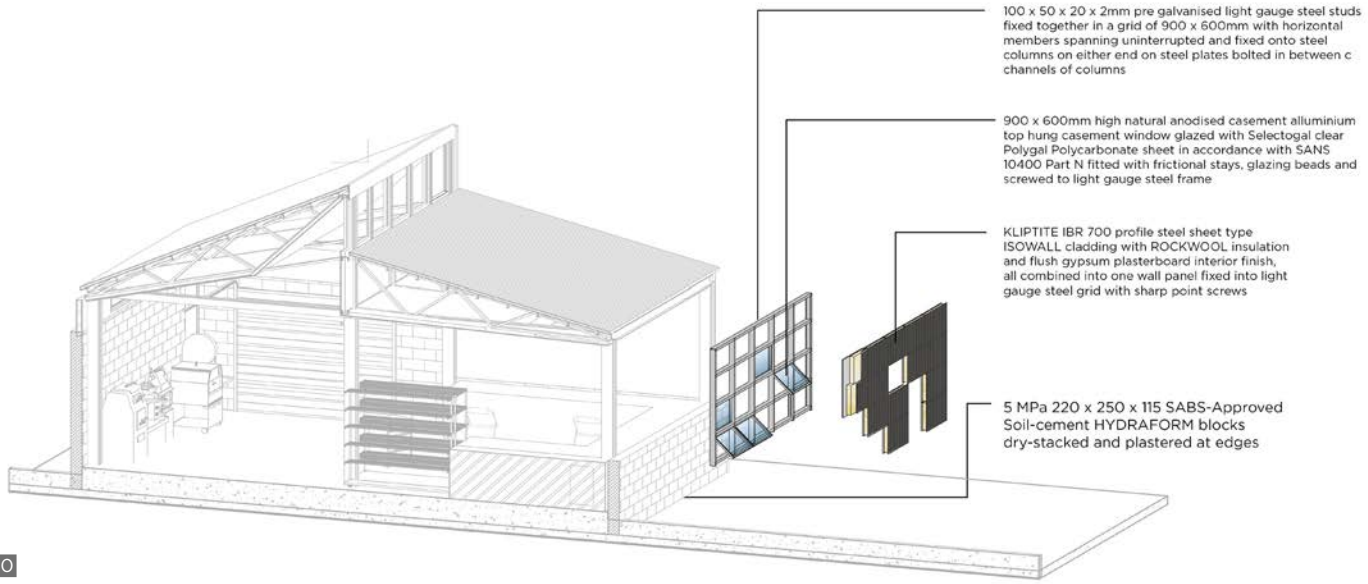
Figure 05.19: Structure extrusion detail development (Author 2017)
Figure 05.20: Wall extrusion detail development (Author 2017)
Figure 05.21: Roof extrusion detail development (Author 2017)

-DETAIL TWO: WALLS-



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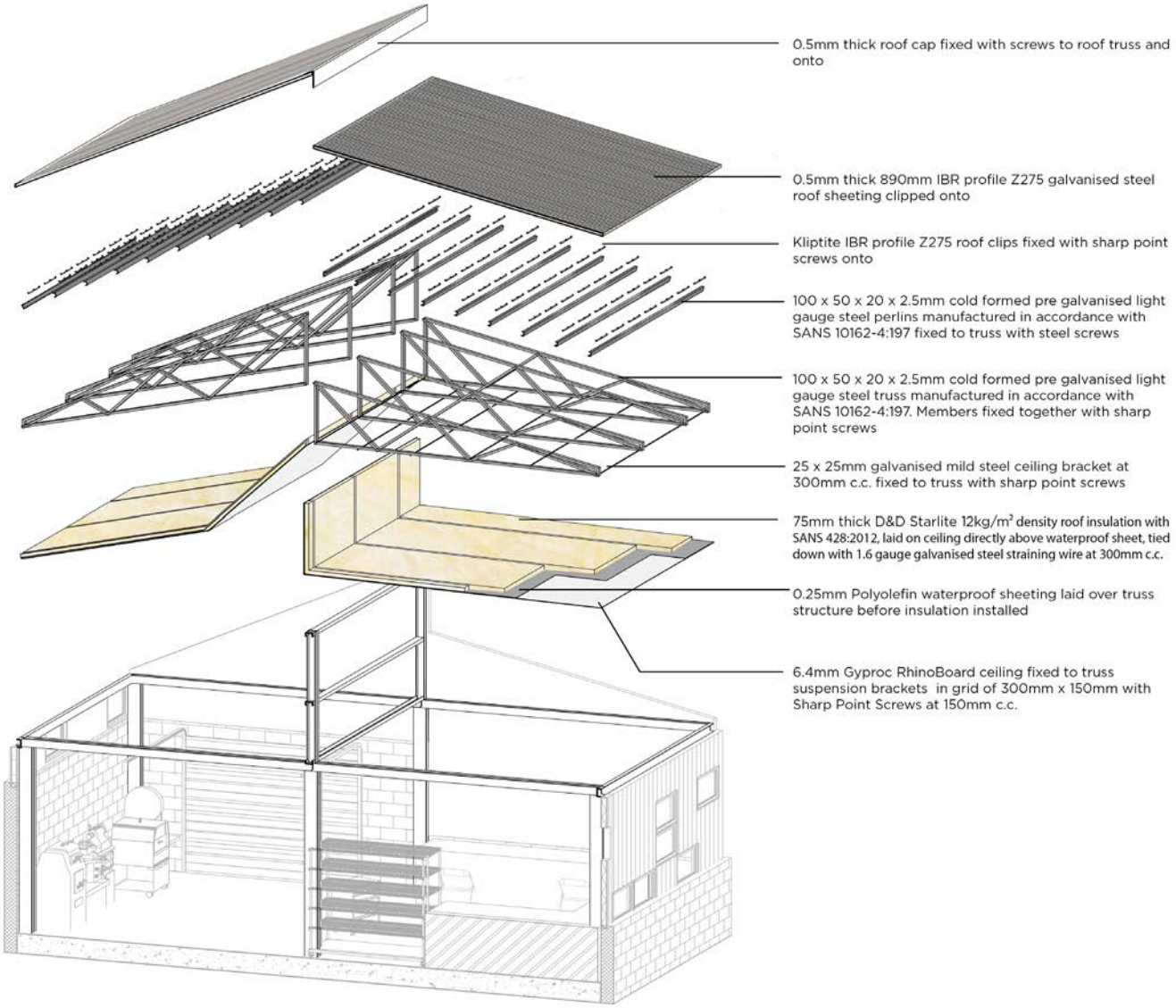
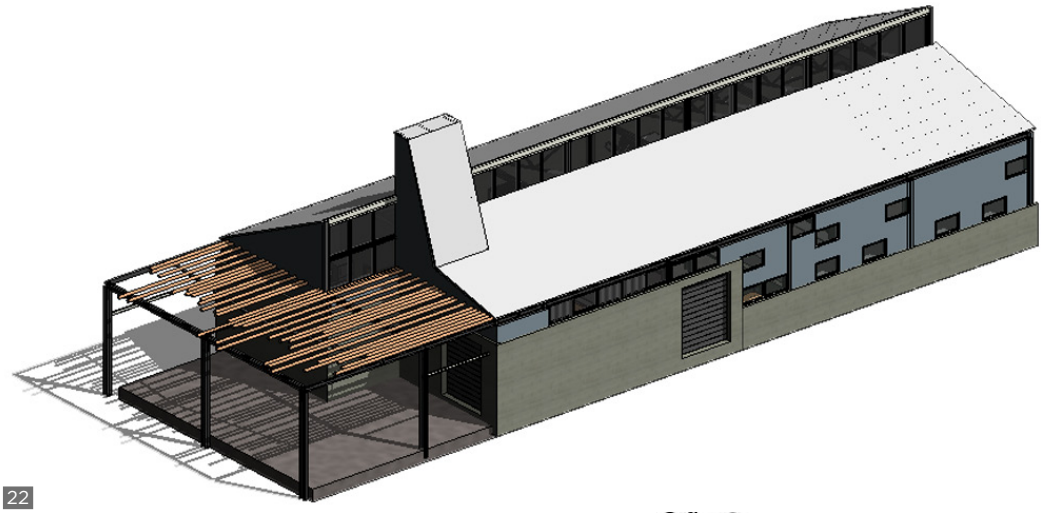


21

-SECTION DETAILS-



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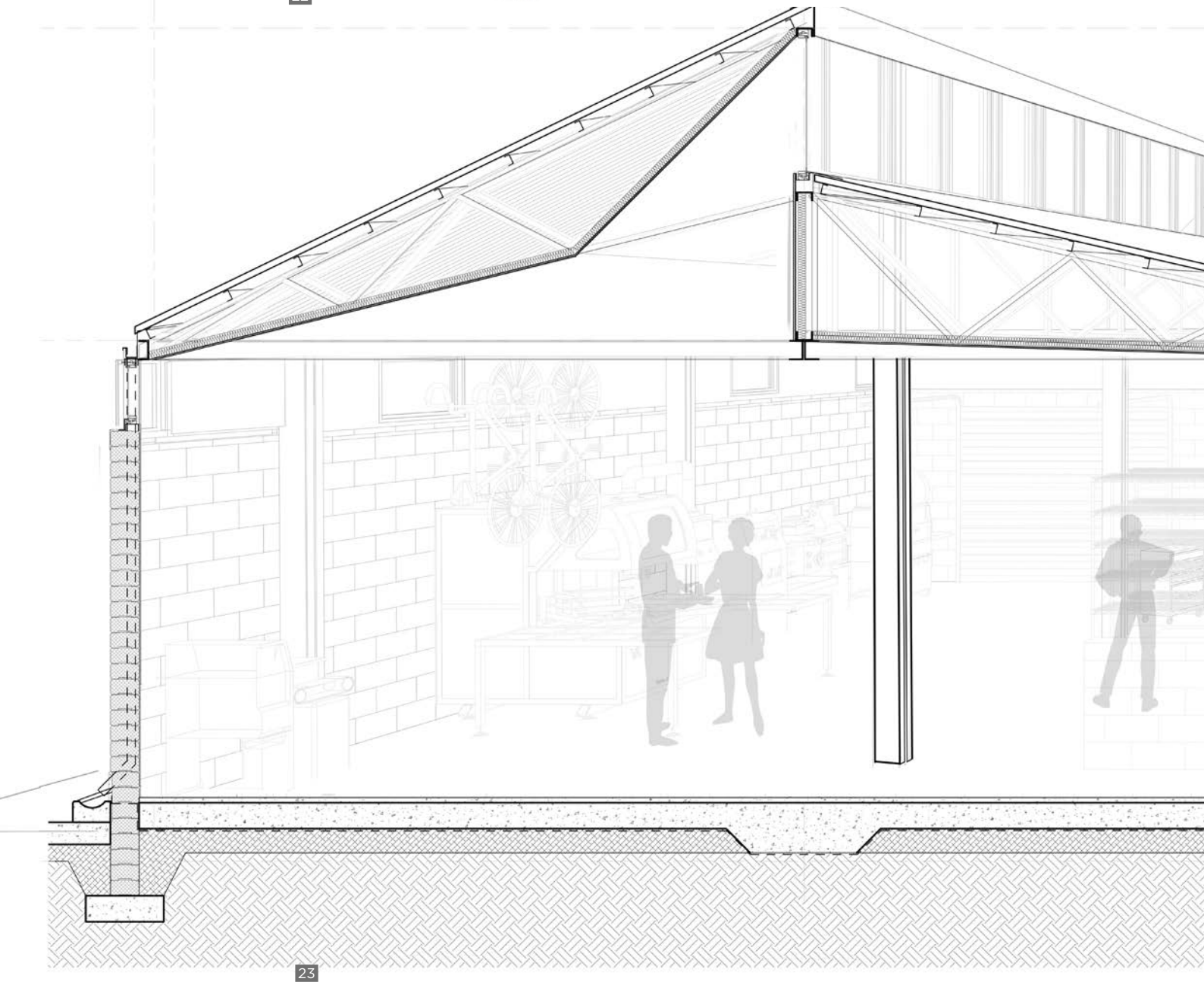

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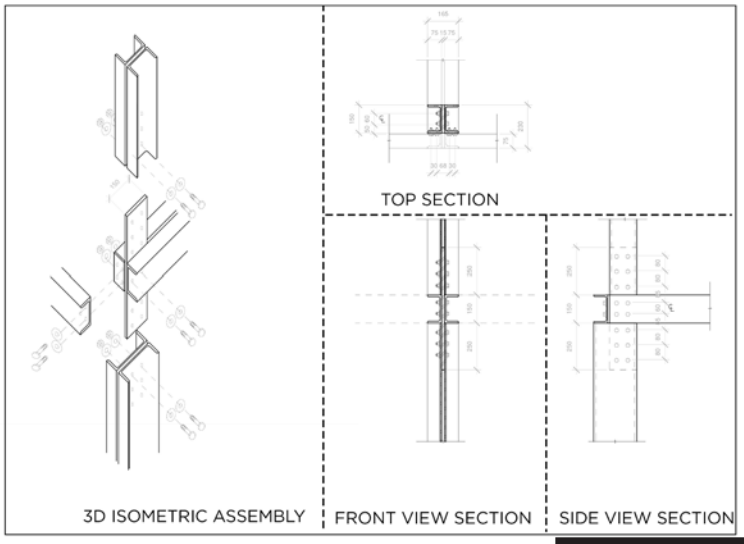
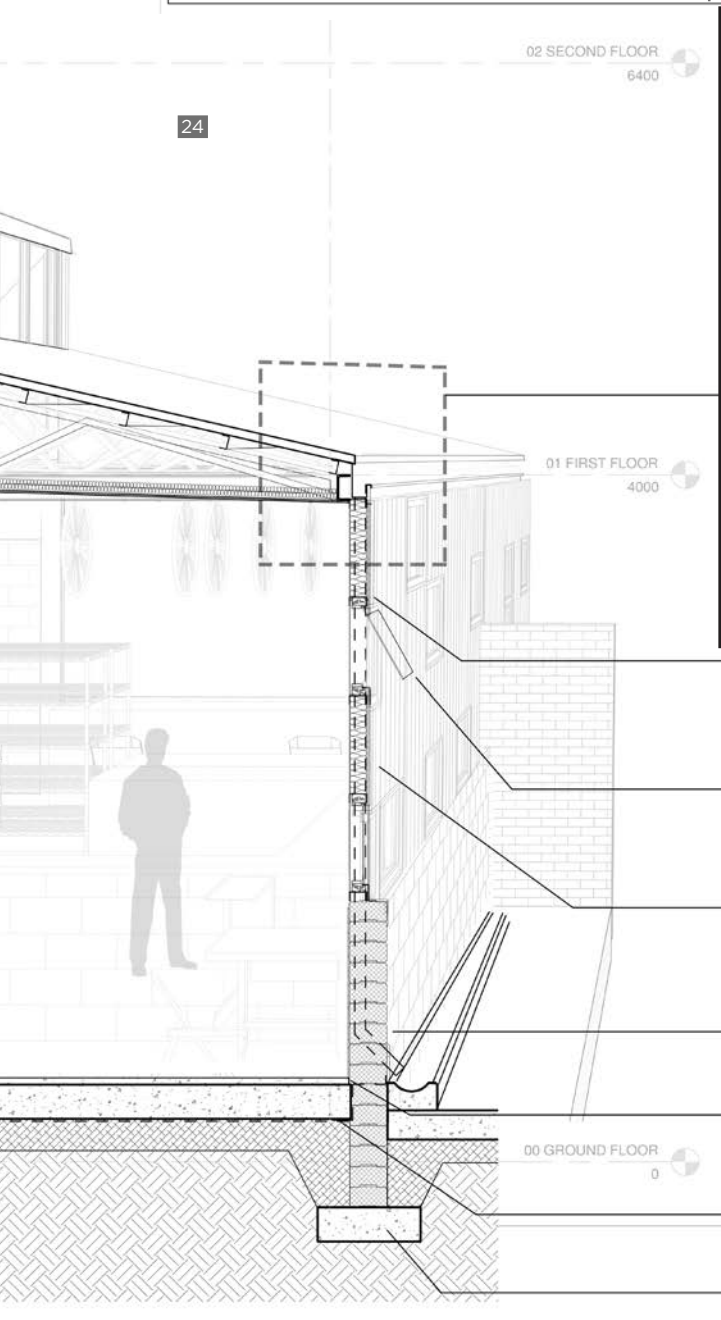
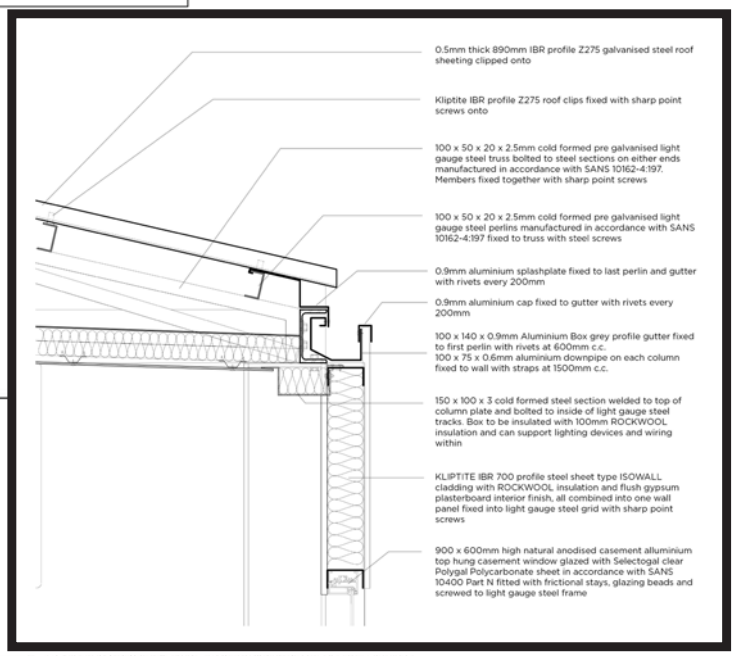


Figure 05.22: Workshop element under investigation (Author 2017)
Figure 05.23: Section through center of workshop (Author 2017)
Figure 05.24: Detail assembly drawing of column and attached elements (Author 2017)
Figure 05.25: Detail callout section of intersection between wall and roof (Author 2017)

24





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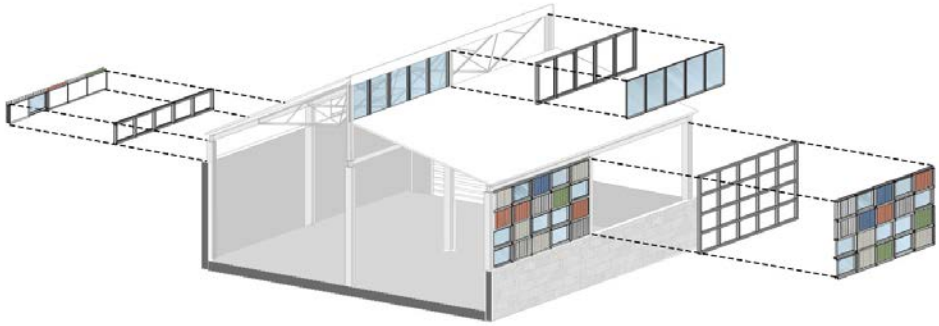
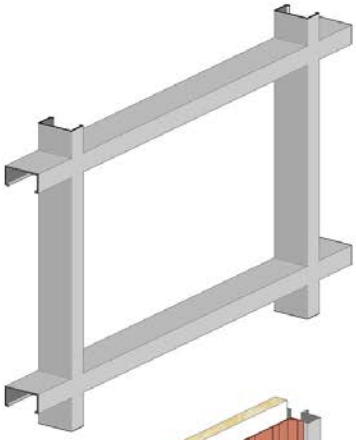
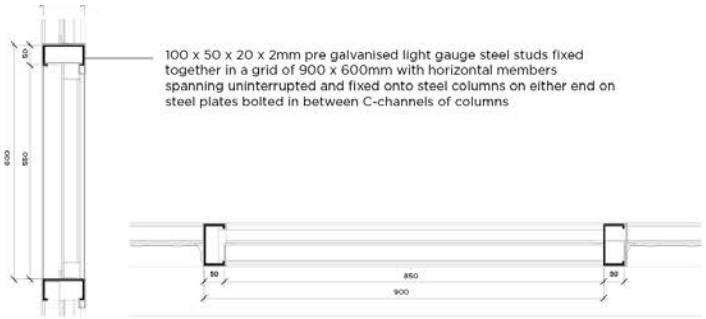
05.9

TECHNICAL RESOLUTION

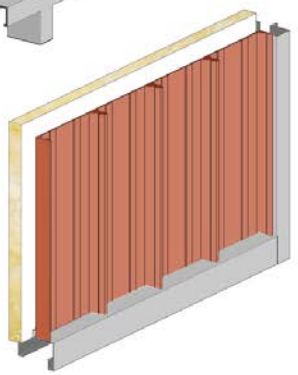
-WALL INFILL PANEL-

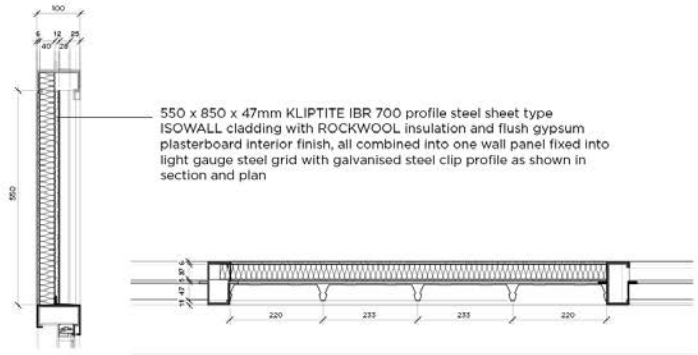




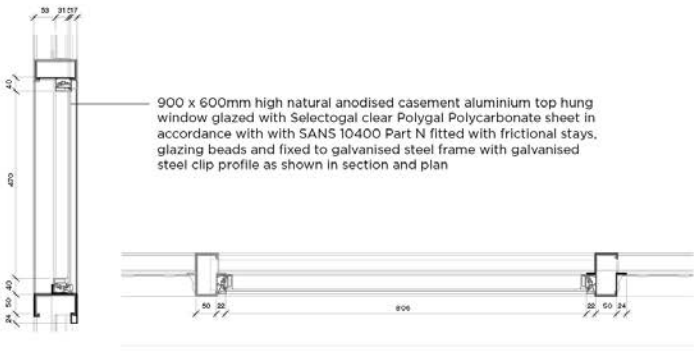


100 x 50 x 20 x 2mm pre galvanised light gauge steel studs fixed together in a grid of 900 x 600mm with horizontal members spanning uninterrupted and fixed onto steel columns on either end on steel plates bolted in between C-channels of columns



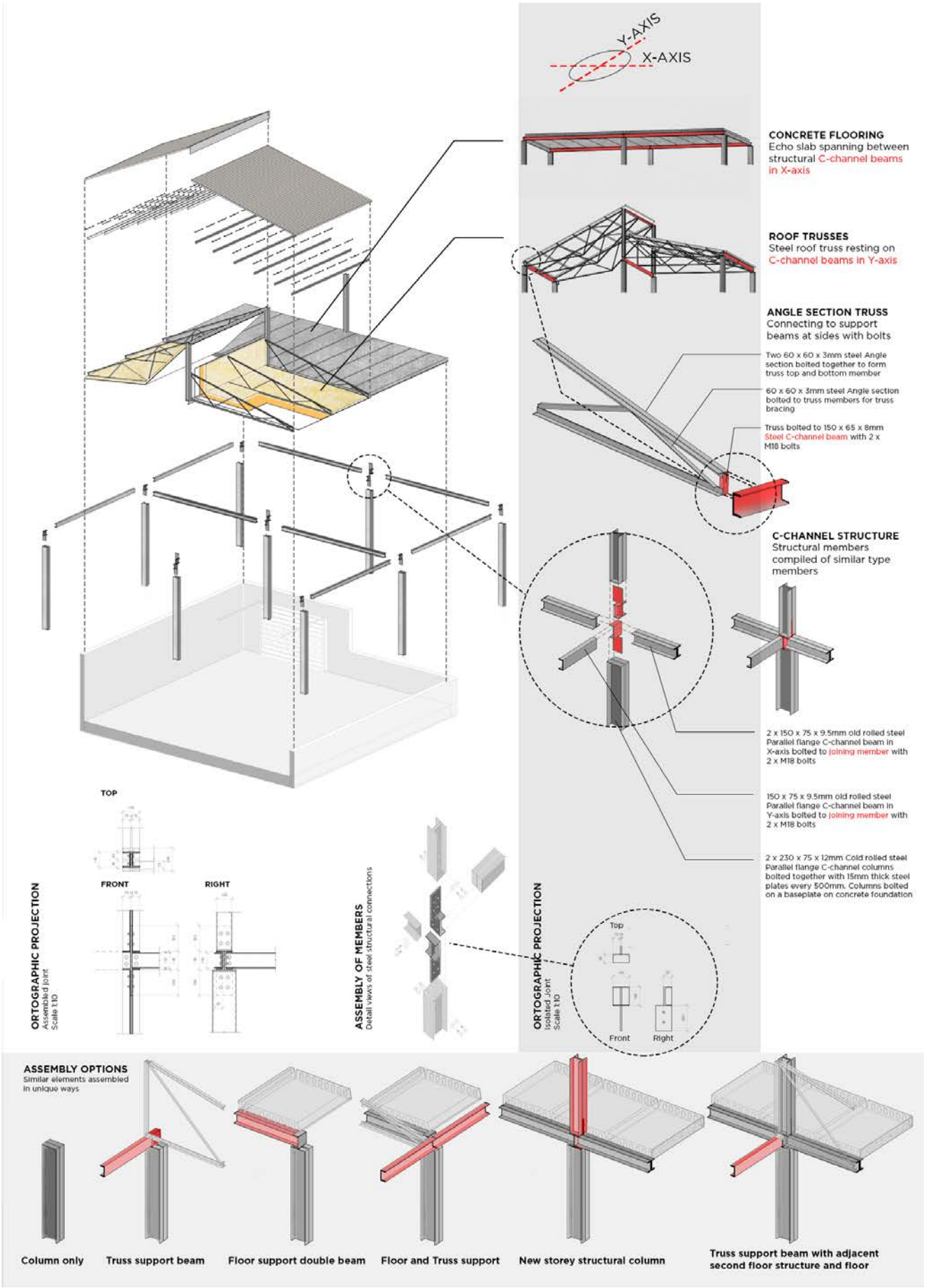


550 x 850 x 47mm KLIPTITE IBR 700 profile steel sheet type ISOWALL cladding with ROCKWOOL insulation and flush gypsum plasterboard interior finish, all combined into one wall panel fixed into light gauge steel grid with galvanised steel clip profile as shown in section and plan



900 x 600mm high natural anodised casement aluminium top hung window glazed with Selectogal clear Polygal Polycarbonate sheet in accordance with with SANS 10400 Part N fitted with frictional stays, glazing beads and fixed to galvanised steel frame with galvanised steel clip profile as shown in section and plan

-WALL INFILL PANEL-



06

FINAL PRESENTATION

-INTRODUCTION PAGES-
-PLAN HAND RENDERING-
-FINAL MODEL PHOTOS-
-SUPPORT CREW-

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

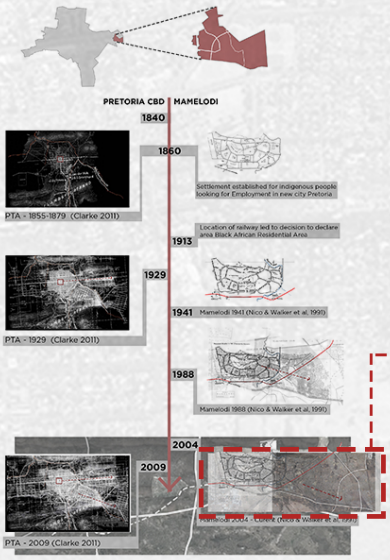
THE COMMUNAL COMMUTE

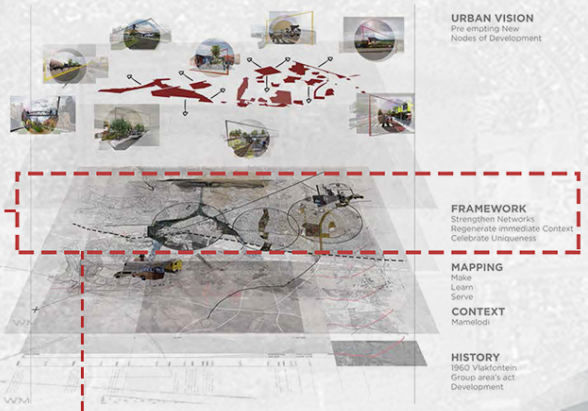
Addressing Public Infrastructure as a vehicle for Equitable Access to the city

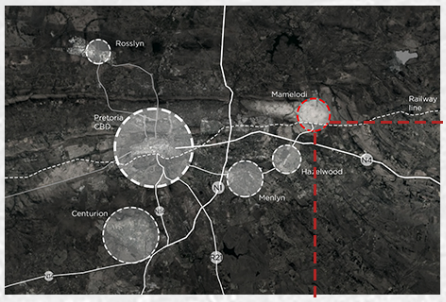
"Access is the prerequisite to using any space. Without the ability to enter or to move within it, to receive and transmit information and goods, space is of no value, however vast or rich in resources.

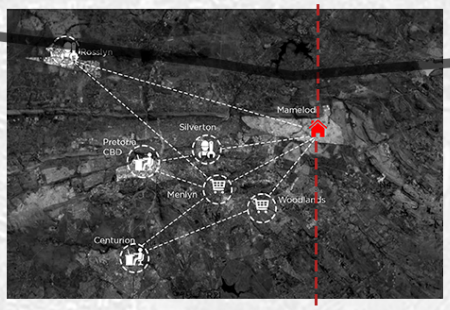
A level of a city is in the same proportion to the capacity of its circulation"

(Lynch & Hack, 1984)









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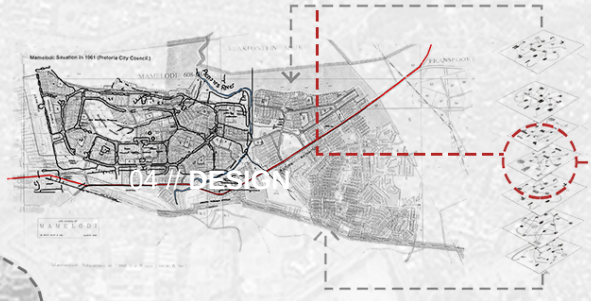
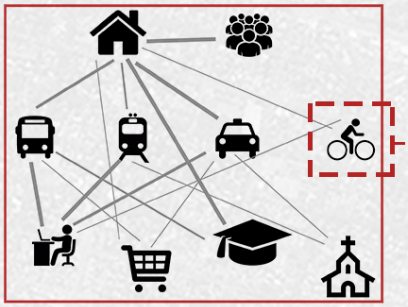
LAYERS OF SELF-DEVELOPING NETWORKS ESTABLISHED WITHIN THE COMMUNITY



SEPARATED PUBLIC TRANSPORT NETWORK LAYER



University of Pretoria: Groenkloof Campus

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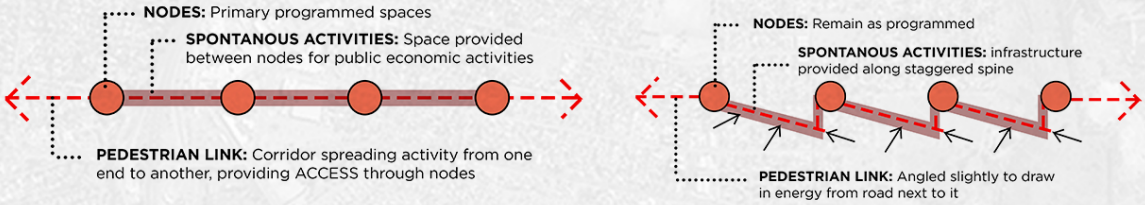
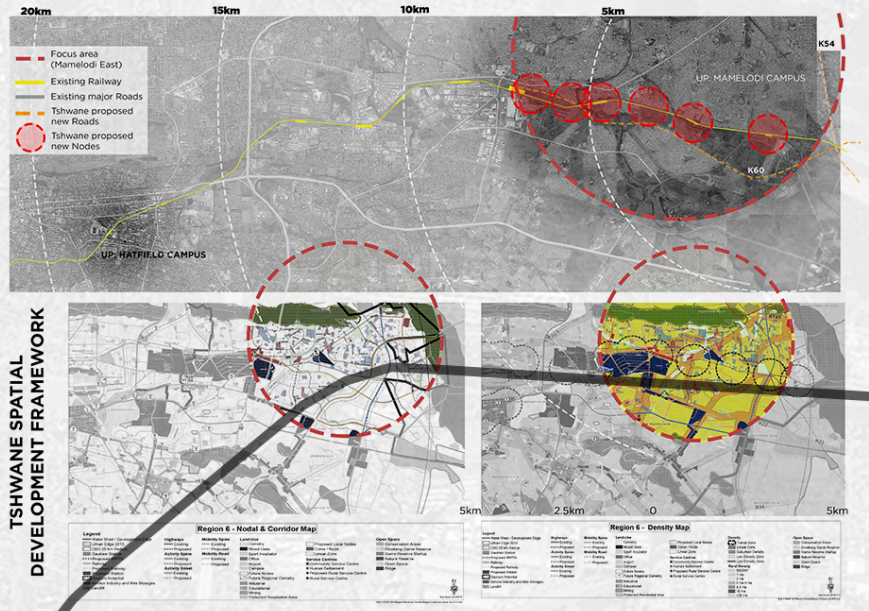
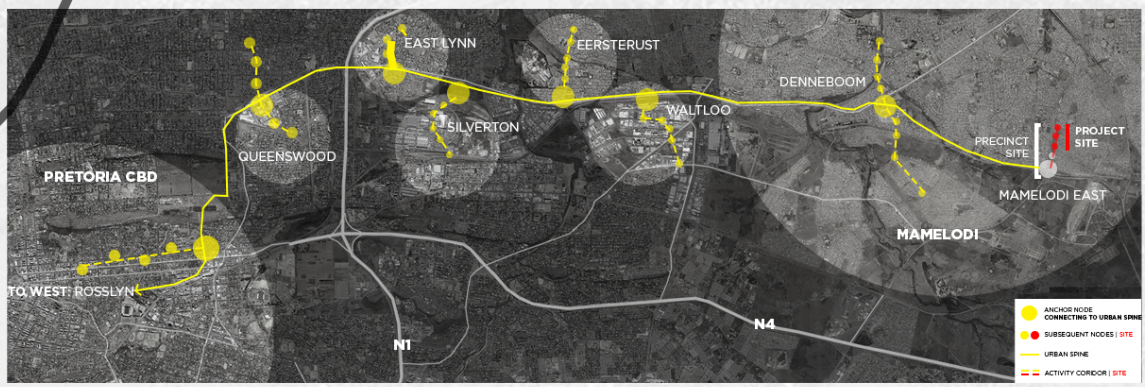
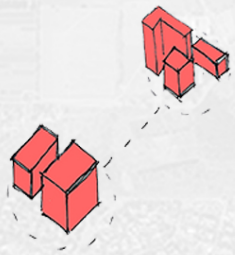
URBAN THEORY: BEADS ON A STRING

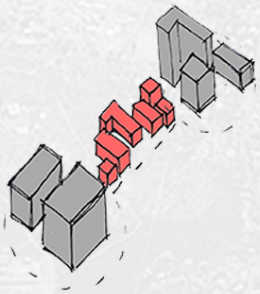




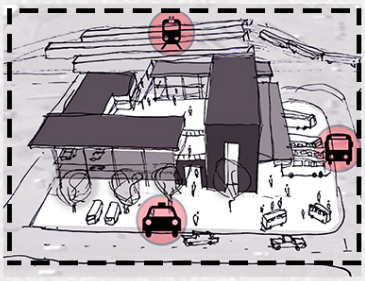


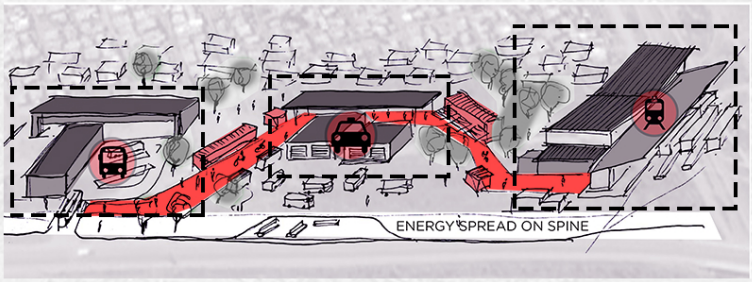


ACTIVITY NODES planned on the spine for formal development, attracting energy and activity along the spine



ENERGY CORRIDOR forming in between major nodes where public development and informal trading takes place. The spine maintains energy flow throughout the precinct





COMBINED HUB - All energy focused on a single condensed building

NODAL HUB - Energy spread across spine, creating smaller centres and stimulating growth in-between

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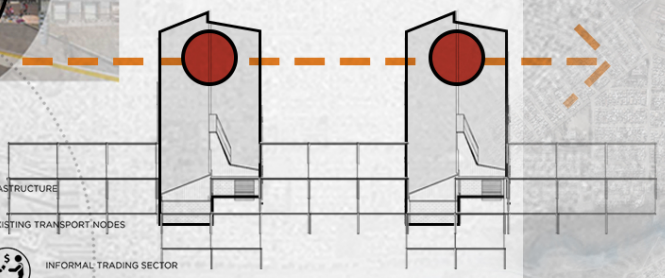
CONCEPTS AND INTENTIONS



ARCHITECTURAL DRIVERS

ARCHITECTURE

- SITE CONDITIONS
- SITE TOPOGRAPHY
- EXISTING SERVICES
- RECREATIONAL/OPEN SPACES
- EXISTING INFRASTRUCTURE
- EXISTING TRANSPORT NODES
- INFORMAL TRADING SECTOR
- SECURITY ISSUES

CONCEPTUAL DRIVERS

URBAN DRIVERS

URBAN

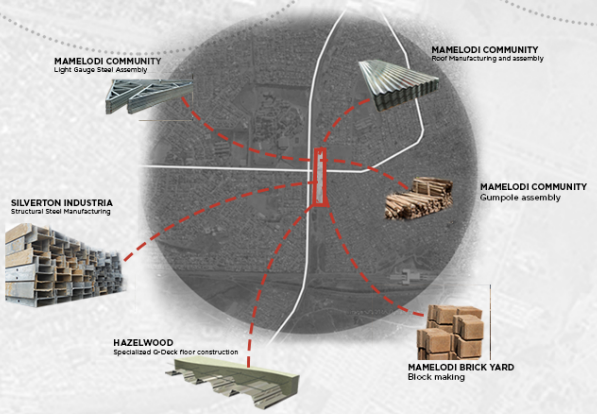
- AVAILABLE CONSTRUCTION MATERIALS
- SKILLS/EDUCATION OF COMMUNITY
- MAINTENANCE OF STRUCTURES
- ACCESSIBILITY TO CITY
- PUBLIC TRANSPORT COST
- TRANSPORT NETWORKS

COMMUNITY

- AGE GROUPS
- CULTURAL/ETHNICAL DIVERSITY
- DISABLED PEOPLE
- EXISTING NETWORKS
- CIVIC ENGAGEMENT
- LABOUR GROUPS

COMMUNITY RESPONSIBILITIES

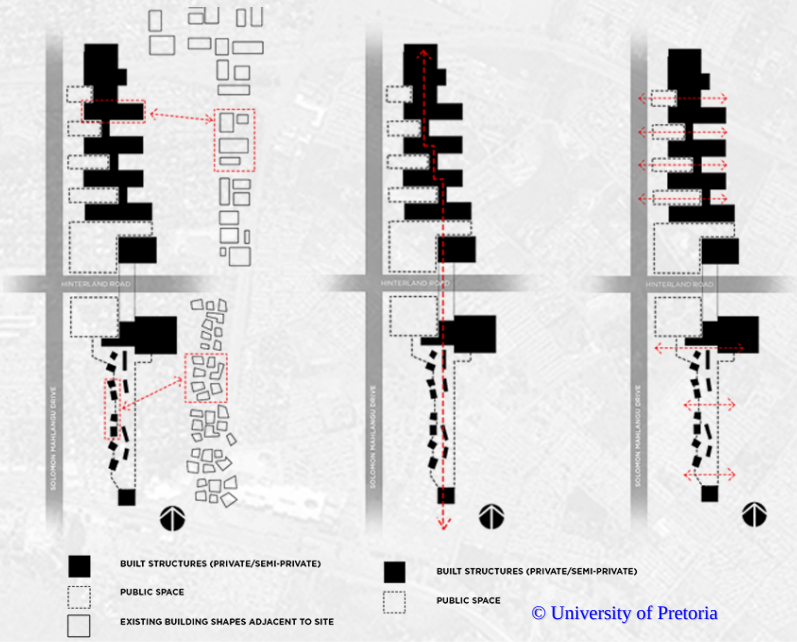
Manufacturing of components by community in isolation:
Assembled on site

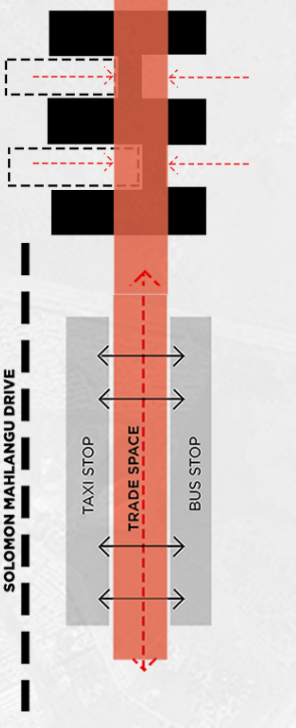


Typological Response

Energy Corridor

Public and Private integration





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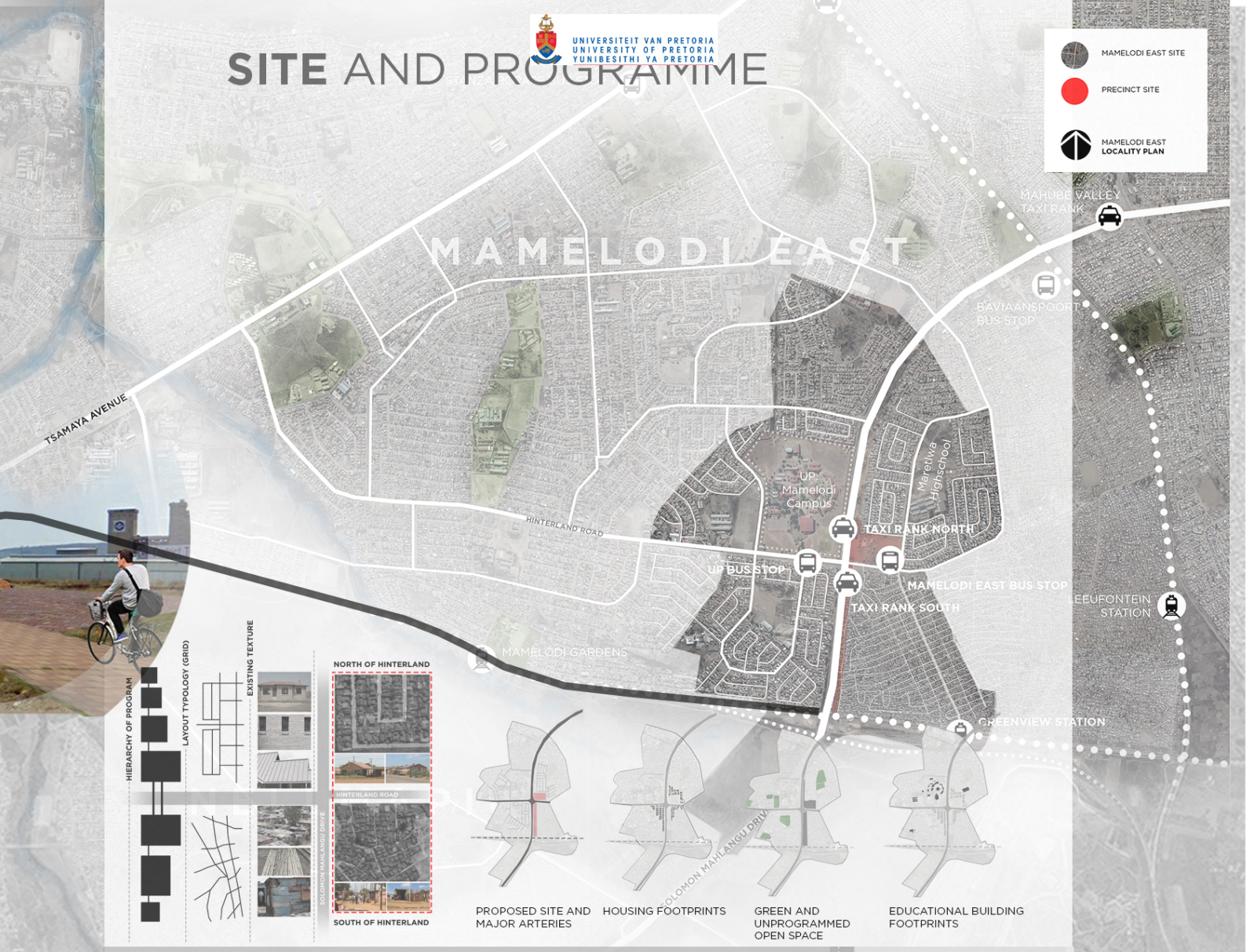
SITE AND PROGRAMME



THE COMMUNAL COMMUTE STAKEHOLDERS

PUBLIC STAKEHOLDERS

- Mamelodi community members/residents
- City of Tshwane Public Works
- Bus and taxi drivers
- Informal traders
- Recreational cyclists

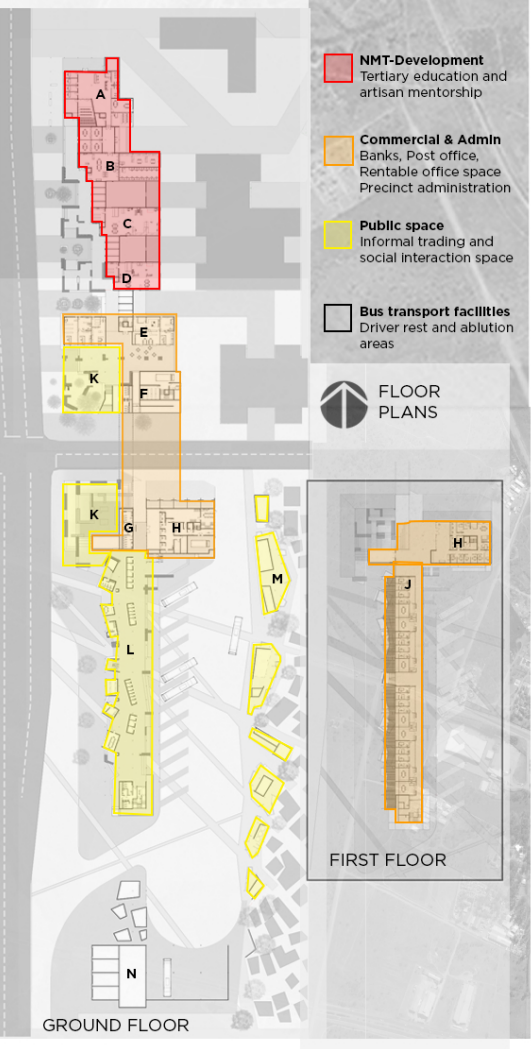
PRIVATE STAKEHOLDERS

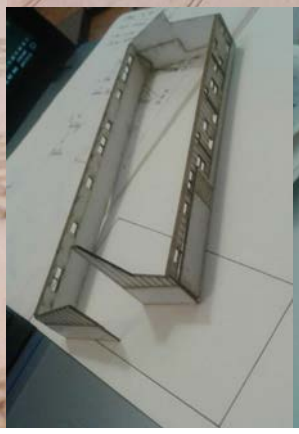
- Non-Motorised Transport centre staff & teacher
- NMT tertiary students
- Workshop studio master/mentor
- Mamelodi Taxi association members
- Bus transport administrators (ticket sales etc)
- Post office/Bank employees
- Office users

FUNCTION	USER	REQUIREMENTS
A - NMT school		4 x lecture offices, ablutions, exhibition space, lecture hall, 2 x classrooms, 4 x meeting rooms
B - Library & IT room		Library, IT facilities, study space with small kitchenette, security
C - Bicycle Workshop		Workshop with heavy machinery and drafting desks, store room, mentor platform
D - Accessory Workshop		Workshop with light machinery and assembly desks, store room, mentor platform

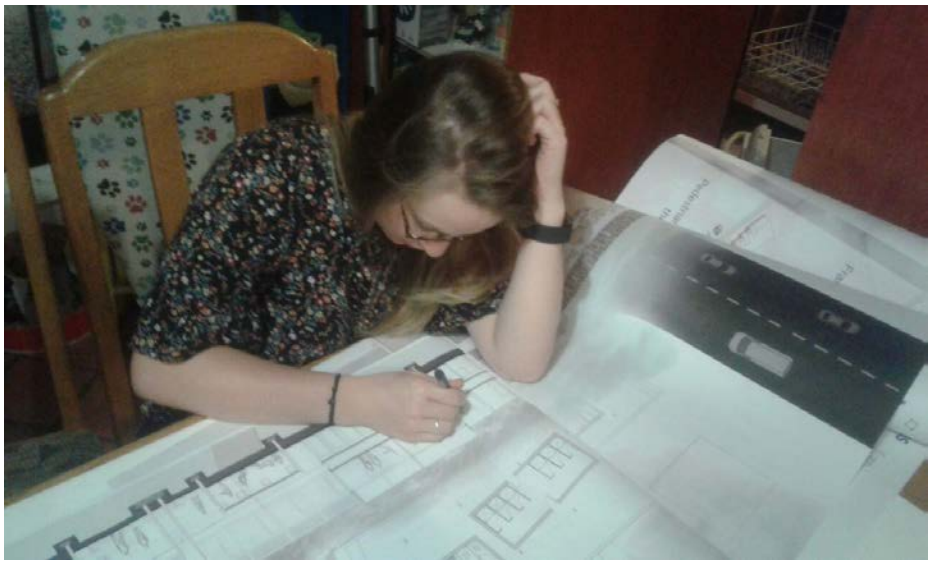
FUNCTION	USER	REQUIREMENTS
E - Retail		2 x Retail units with flexible floor space for up to 6 units, Vertical circulation shaft with lift and stairs, security room
F - Post Office		Post and cash delivery garage, security office, store room, Safe vault, offices, public interface
G - Public Ablutions		Female ablution, Male ablution, Disabled bathroom, Family bathroom
H - Bus ticket office		Bus ticket offices, Employee break-out space, offices, security, Safe vault, Cash-in-transit garage, ATM facilities, Banking facilities
J - Rentable offices		Rentable office space with flexible layout, Emergency fire escape, security office, ablutions

FUNCTION	USER	REQUIREMENTS
K - Public square		2 x squares at street corners with mass benches for seating/trading, bicycle locking space
L - Public trading spine		Public benches, informal trading rentable units, taxi association facilities including storage, boardrooms, kitchen, boardroom and ablution facilities
M - Community facilities		Water collection and filtration room, bath house with showers, public ablutions, potable water storage tanks
N - Car node		Bus driver rest facilities including overnight rooms, ablutions, recreation room. Car workshops, Bus parking, bus workshop





-THE SUPPORT CREW-



CHRISTIANE GERBER

SOPHIA VENTER

TARYN O'BRIEN & ARJEN VAN RENSSEN

06

CONCLUSION

07

CONCLUSION

As framed in the introduction of this dissertation, the **intention** was to create a public space where community members embarking on their daily commute to and from work could gather and be exposed to various programmatic nodes. **In addition to the formalization** of already existing transport nodes, **secondary nodes** intended to **support** the day-to-day needs of community members.

The **response** initiated from addressing the issue of equitable access, through providing the community with a **choice** for **transport medium**, all conveniently located within an accessible precinct that **extends beyond** the programmatic boundaries of transport, guiding the user through an extended range of commercial and retail activities.

By giving the community these **choices**, the city **becomes more accessible.** It further extends the choice for transport through the **NMT-facilities**, providing **low-cost** alternatives to public transport in combination with the urban-scale plan of a dedicated pedestrian-and cycling lane between Mamelodi and Pretoria CBD.

The linear site adjacent to a busy public transport route allowed the architecture to take form of a **series of unique nodes** that represent the programmes within the project, bound by a public axis that separates the pedestrian movement from the vehicular movement. The **flow of energy** along the axis also sparked and provided **infrastructure** for economic trading opportunities which are dependent on a **vast amount of pedestrian movement** past their stalls. The nodal interventions still allow for each sub-programme to maintain its **unique qualities**, although a **cohesive whole** is formed by the connection of the nodes with a public activity spine, also providing a base for future adaptation and expansion.

Considering the appropriate making of architecture, **simple construction** of relevant local building materials provided opportunities for the community to **participate** and learn invaluable skills which can equip them to further **expand** and grow the nodal precinct. Off-site manufacturing and assembly of different building components allowed communities within Mamelodi to develop different components and assembling them on-site. This further allowed the project be rapidly erected, saving expensive construction costs and serving as a **platform for interaction** between specialists within the fields of the different building components and the community that becomes the primary users of the space.

By expressing this transport-hub as an **extended perforated public space**, the building becomes a **manifestation** of what **accessibility should truly be -** a space facilitating free and safe movement within it for all, where users can openly interact with its public programmes to ‘receive and transmit information and goods’. Where the *‘level of a city is measured in proportion to the capacity of its circulation’,* this public transport facility therefor **defines the city’s circulation** on a small-scale blueprint for a bigger and better city-scale level of access.

…"In this system, one element influences and substitutes for another. Telephone calls replace personal trips, and the flow of gas in a pipe makes hauling solid fuel unnecessary. Bus trips reduce car trips. The layout of streets affects the pattern of underground utilities, and the location of telephone cables depends on the method used to transmit power. Since one kind of communication can substitute for another, a circulation plan seeks an optimum balance of modes, not blind reliance on a single one. We are not wise to depend so heavily on the car, given the diversity of present needs and the unpredictability of the future."

(Lynch, 1960, p. 193)

08

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