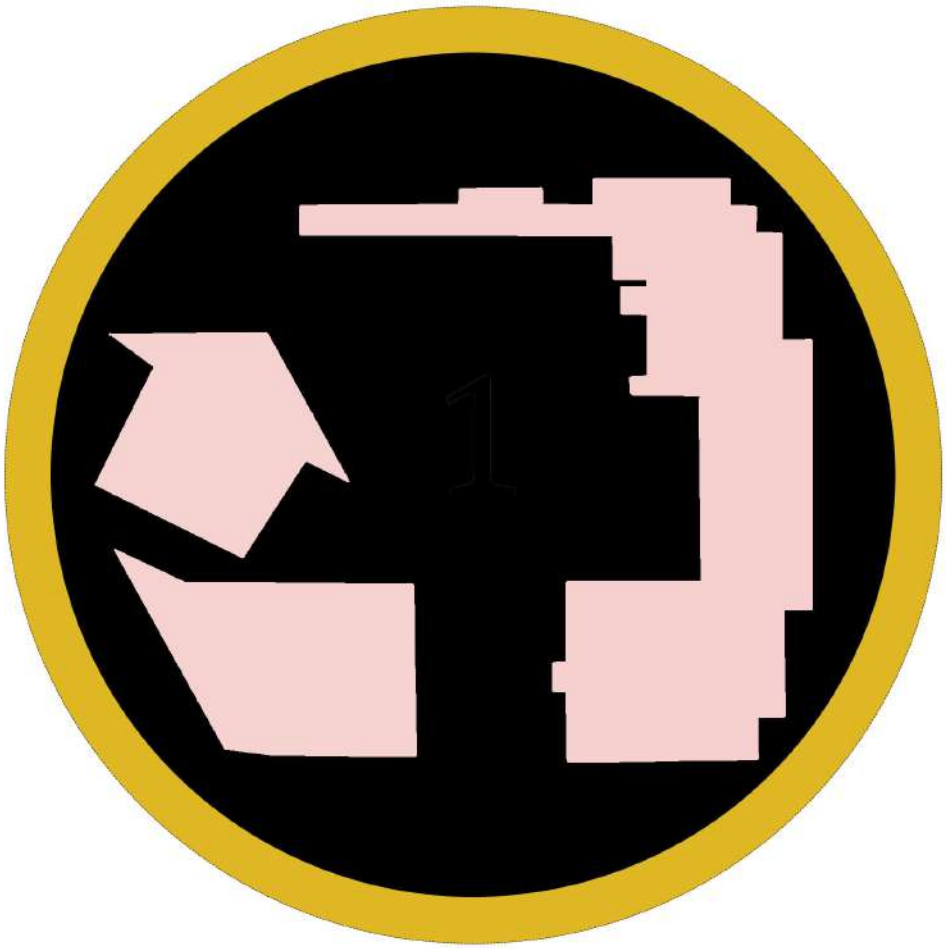
THE COMMUNITY MAKERY

FACILITATING THE UPCYCLING OF WASTE IN MAMELODI WEST



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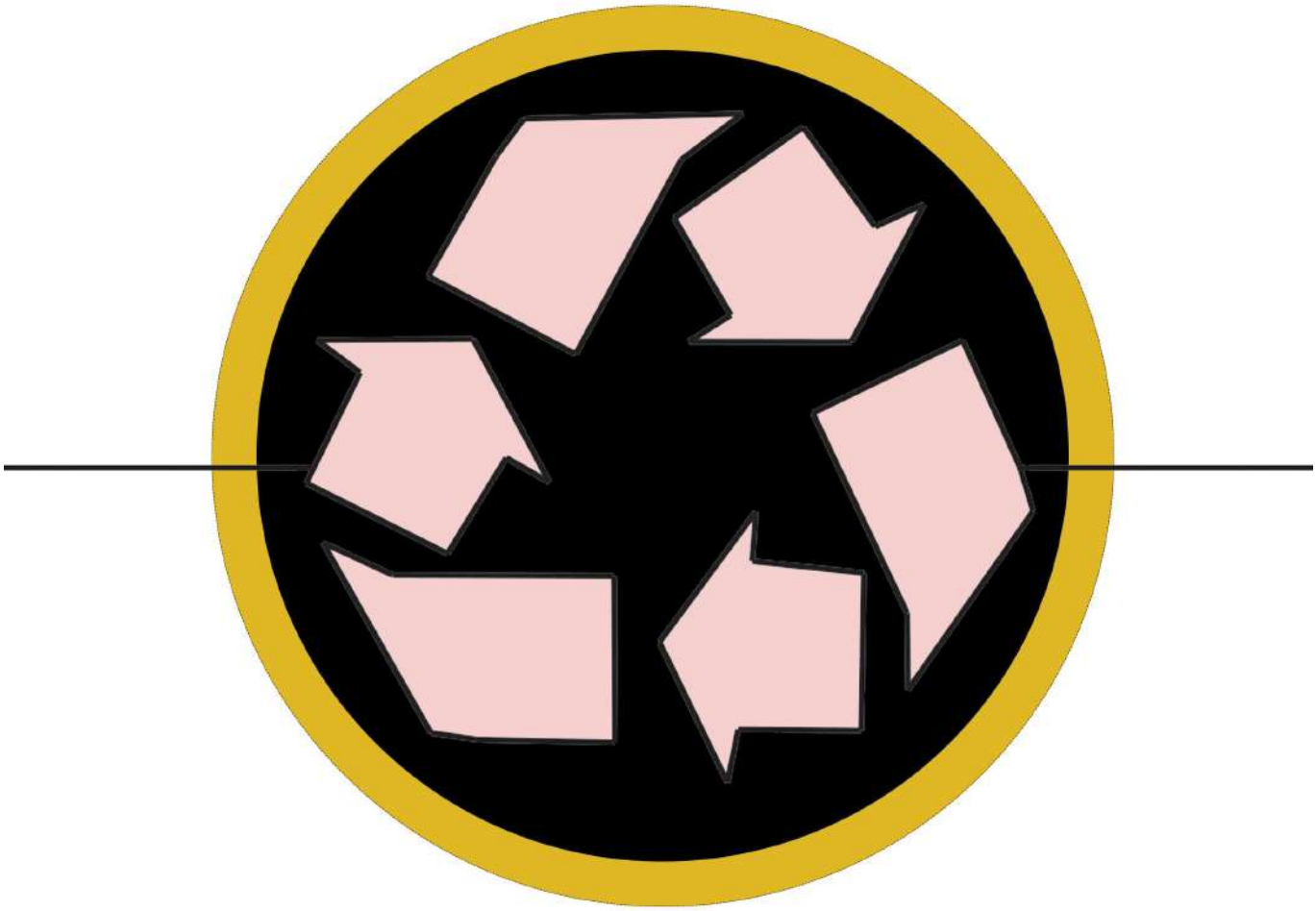

ABSTRACT

Humankind has over the years borrowed ideas from, and also taken from, nature. What was in the beginning an intention to survive eventually morphed into humankind striving for superiority. In recent centuries humans have begun to excessively mass produce inorganic items for their own use, while completely disregarding the impact of waste build-up on the environment. Today waste is a major concern and, in the current global warming crisis, there is a need to deal with overflowing landfills and extreme amounts of waste products. This study is focused on the upcycling of waste products, such as plastic waste, paper waste and glass waste, in order to produce building materials.

The Mamelodi West area was initially set out according to the principles of the model apartheid city, with natural buffers along the northern and eastern boundaries. Later on the railway and industrial area boomed in the southern region, and thus the area today presents a diversity of amenities and uses. The industrial region of Mamelodi West contains a wide range of job opportunities and modes of income; however, there is a clear divide between the residential sector and the industrial sector.

A clear need exists for a tangible link to be established between the industrial region and the residential area of Mamelodi West. With an architecture that could materialise into a haven for Mamelodi residents, as well as aid in reducing the waste crisis threat, there is opportunity to solve not one but two issues in the Mamelodi West area.

Upcycling is a process in which materials that have already been used are transformed into items of a higher value the second time around (Sung 2015:28). Through the process of upcycling the amount of energy and material used is limited, and it is therefore a feasible option regarding the global warming crisis.

In this dissertation the reuse of waste and how its carbon impact can be minimised, are explored. Ways in which waste can be recycled and reused within the context of Mamelodi West, as well as the relationship between nature, people and the environment, will be investigated. The focus will be placed on the notion of nature's evolution and how temporality influences the built and natural environment.

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Community centre for recycling waste, making, education & seling.

Submitted in fulfilment of part of the requirements for the degree Master in Architecture (Professional). Department of Architecture, Faculty of Engineering, Built Environment and Information Technology, University of Pretoria
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SITE LOCATION:
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CLIENTS:
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THEORETICAL APPROACH:
Lost spaces theory and Leferbvre's theory on hierarchical spaces.

ARCHITECTURAL APPROACH:
Upcycling, adaptive architecture, waste re-purpose

DECLARATION

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

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

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

DIPNA BHANA

ACKNOWLEDGEMENTS

Firstly I would like to thank my study leader, Abre Crafford for assisting me throughout the year. His passion and leadership has made this dissertation possible. His support, patience and guidance is truly appreciated. Secondly to my year coordinator, Prof. Arthur Barker for his guidance, instruction and willingness to handle any issues that may occur during the course. To Karlien van Niekerk for taking time to edit my dissertation and for always being so positive and willing to help.

Finally to my parents and brother for their constant support and unconditional love throughout my life. For their advice and guidance which has gotten me here today. Thank you for your encouragement to always strive for more and for pushing me beyond my limits.

THE COMMUNITY MAKERY

FACILITATING THE UPCYCLING OF WASTE IN MAMELODI WEST

DIPNA BHANA

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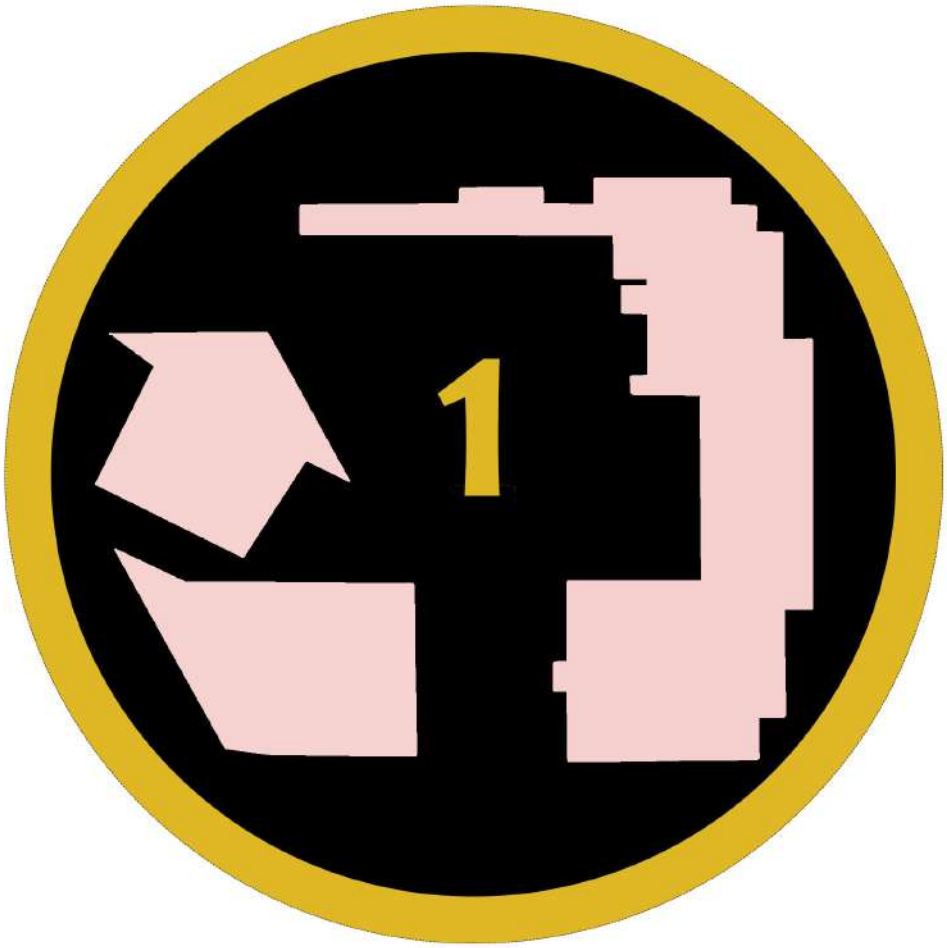
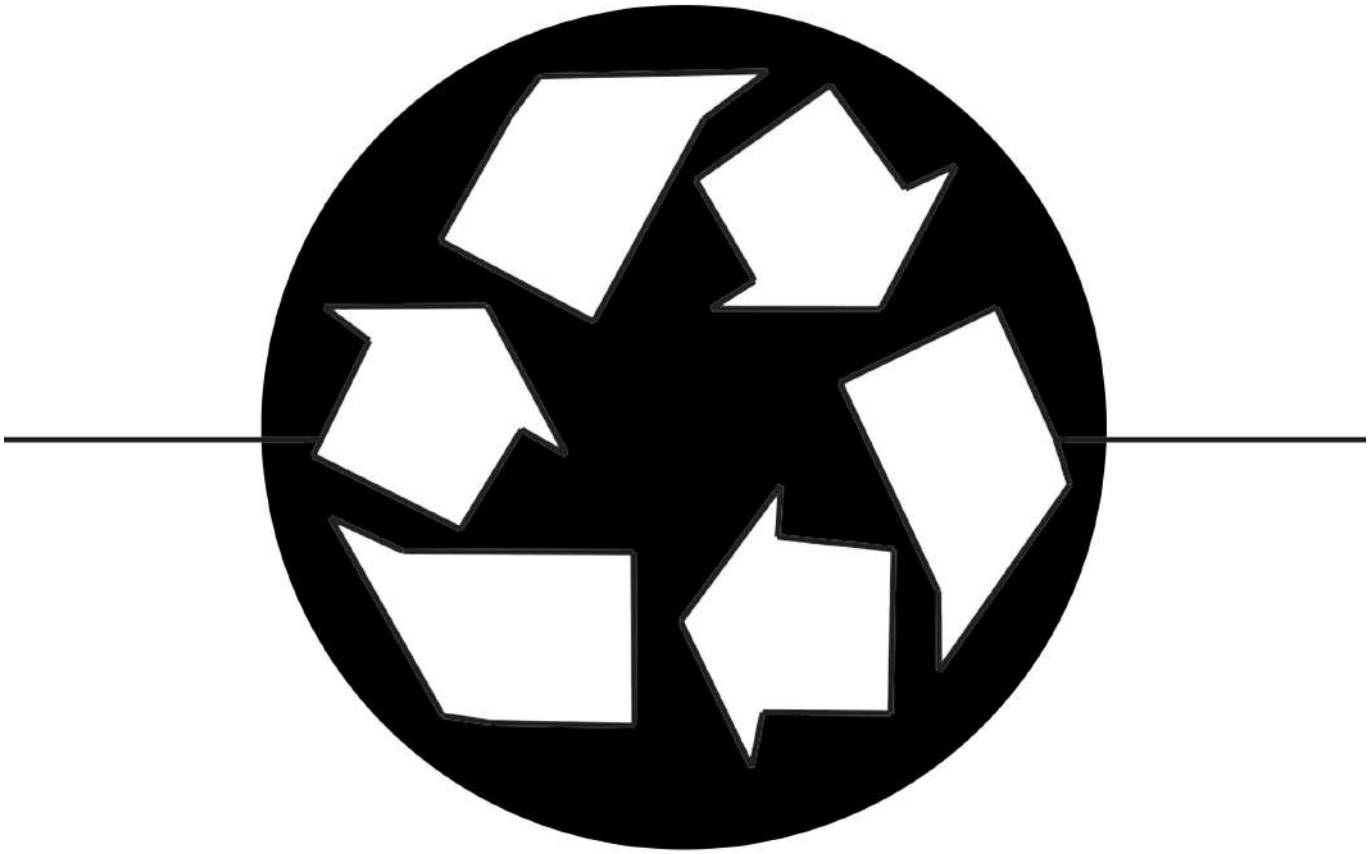




1.1 WASTE AND LANDFILLS

This chapter gives a brief introduction to the background and context, the identified issues and research problems, the limitations and delimitations, the intention with the dissertation, the methodology, and the overarching contribution of the study to architecture.

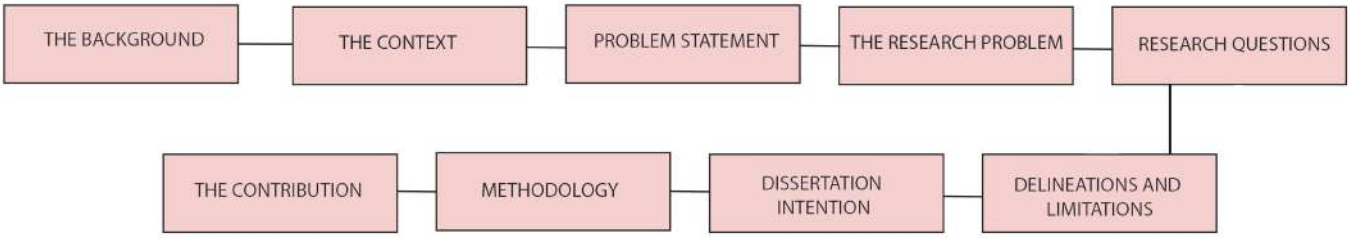


Fig. 1.1: The focus of the chapter (Author 2019)

1.1.1THE APARTHEID SYSTEM

Translated directly into English, the term 'apartheid' means 'apartness'. In 1948 it was assigned to the law of separating people of diverse races in South Africa (Clark & Worger 2013:3). The separation of black and white people in South Africa has permeated the country's history through time, and has left behind divided towns and cities. In 1948, the electoral victory of the National Party resulted in vast population redistributions and major changes in the spatial planning of the urban form (Christopher 1997:311-323), and from the 1950s onwards there were mass population movements which were defined according to racial groups. Apartheid legislation was finally revoked in 1994, but today South Africa still exhibits these shifts within the urban fabric (Christopher 1997:311-323).

Fig. 1.2: The issue (Author 2019)

1.2 THE RESEARCH PROBLEM

1.2.1 THE GENERAL ISSUE

South Africa is currently experiencing a shortage of landfill sites, which is leading to further pressure on the already overloaded recycling system (Dludla 2018). The National Environmental Management: Waste Act 2008 (Act No. 59 of 2008) was promulgated on 1 July 2009. The main intentions of the Waste Act are to "promote an integrated approach in dealing with waste which focuses on prevention, minimization and responsible disposal of waste." (Recycle Paper 2018). The shortage of landfill sites in South Africa is a major issue, and municipalities are forced to travel greater distances in order to dump waste (Dludla 2018).

1.2.2 THE URBAN ISSUE

It is stated that six jobs are created by taking 10 000 tons of waste to landfill, while thirty-six jobs are created by recycling the same amount (Van Niekerk 2005), therefore implying that it is easier to separate the different types of waste before they are thrown away. However, due to the immense amounts of waste existing in landfills already, there is a definite need for the recycling of this existing waste. Mamelodi houses one of five main waste dumps in Pretoria. Situated in the east of the township is the Hatherley Municipal Dumping Site, which is currently filled to capacity.

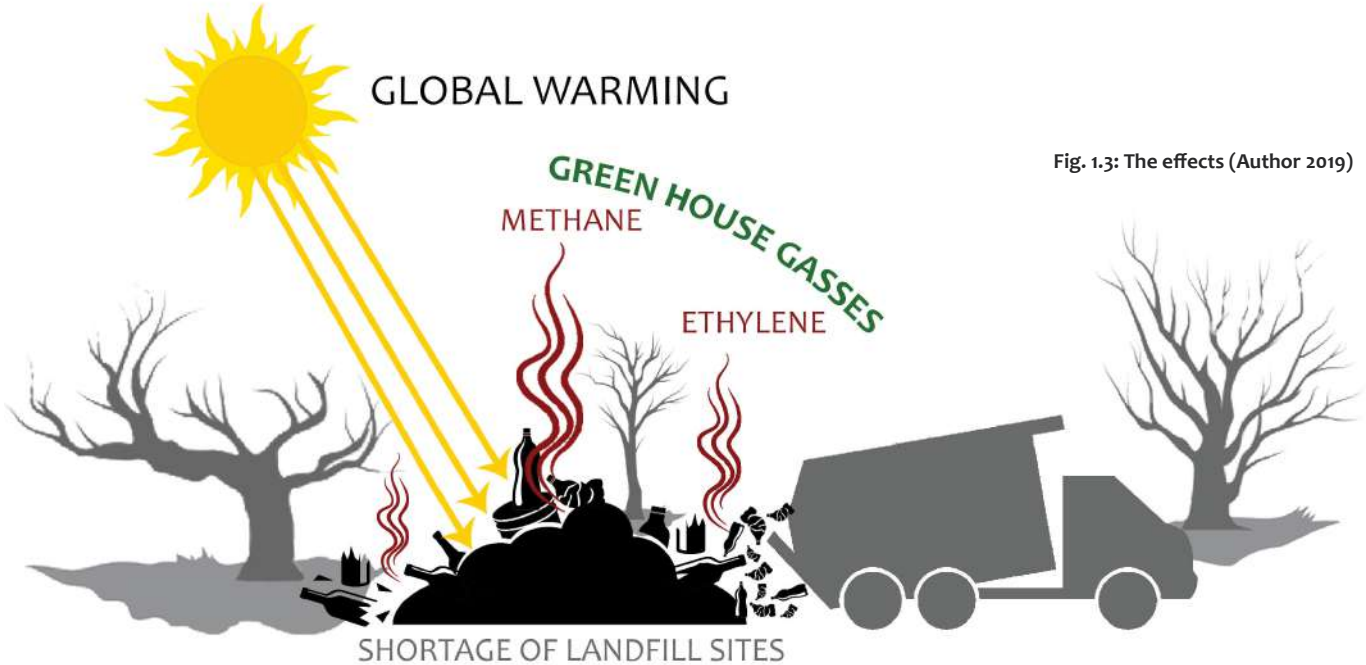


Fig. 1.3: The effects (Author 2019)

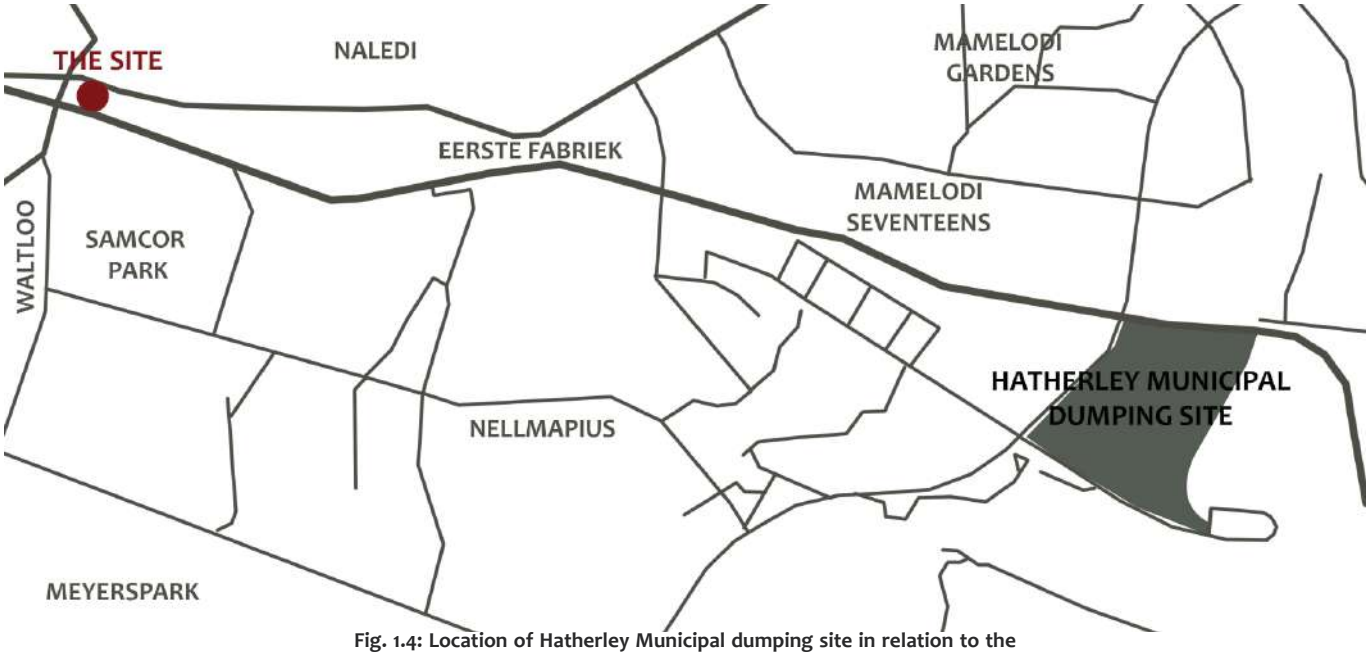


Fig. 1.4: Location of Hatherley Municipal dumping site in relation to the site (Author 2019)

1.2.3 THE ARCHITECTURAL ISSUE

Much economic interest is focused on Mamelodi West, and the area is also an independent transportation hub. Due to a high percentage of mass migration occurring there, the aim with this dissertation includes making Mamelodi an independent suburb. The need exists to investigate the rich heritage of Mamelodi through the spatial legacy of the apartheid and post-apartheid eras. Through intensification of the area (see explanation on p. 34--35 , possibilities are created towards developing it into an independent suburb which could limit mass migration.

Fig. 1.5: Breaking solid forms by intensification (Author 2019)

This dissertation aims to facilitate a waste management plant that provides educational classes in waste management and promotes job creation. The waste management classes and workshops would equip the locals with skills in how to recycle glass, plastic and paper, and how to turn waste into building materials for use in local housing.

Fig. 1.6: Diagram of the waste management plant (Author 2019)

Fig. 1.7: High density Vs low density (Author 2019)

1.3 PROBLEM STATEMENT

Waste is a major concern and in the current global warming crisis, the overflowing landfills and extreme amounts of waste products need to be dealt with.

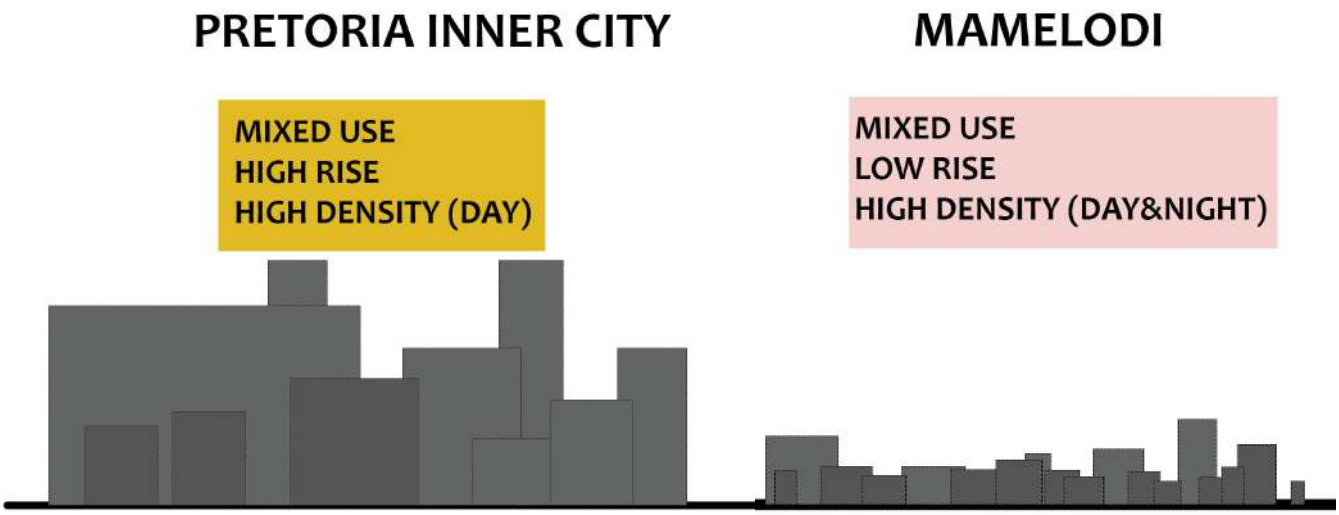


Fig. 1.8: The inner city in relation to Mamelodi (Author 2019)

1.4 RESEARCH QUESTIONS

The research questions that originated from the issues and problem statement are the following:

- How can a link be formed between the industrial sector of Silverton and the residential suburb of Mamelodi?
- How can jobs be created in Mamelodi which would bring income to Mamelodi West?
- How can the waste issue be solved while benefitting Mamelodi West?

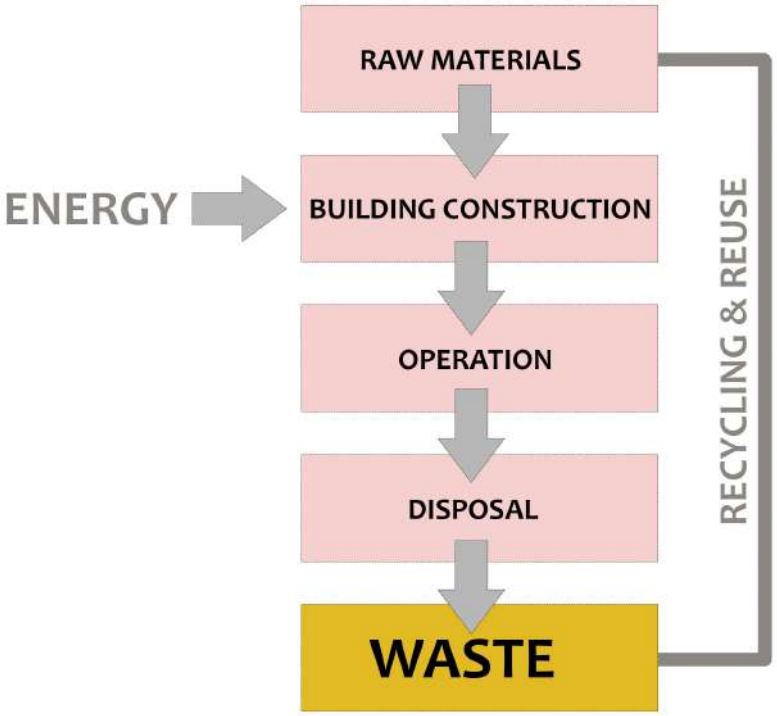


Fig. 1.9: The research question (Author 2019)

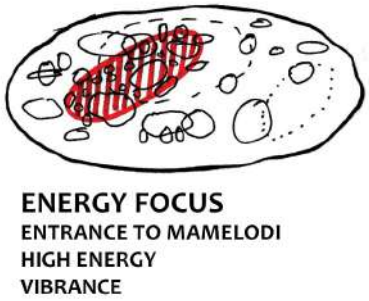


Fig. 1.10: Energy focus sketch (Author 2019)

1.5 LIMITATIONS AND DELIMITATIONS

1.5.1 Assumptions

Since Mamelodi is still dependent on other parts of Pretoria for civic and corporate facilities as well as other amenities, residents are forced to travel outside of Mamelodi for work. Over the last few years, Mamelodi has gained a few civic facilities and infrastructure such as the Denlyn and Mamelodi Crossing malls and the New Tshwane Regional Mall. But are these sufficient to facilitate Mamelodi's independence?

1.5.2 Limitations

Mamelodi, in its vastness and scale, can be an overwhelming place for visitors. Due to fact that in post-apartheid South Africa residents now living in Mamelodi were forcefully removed from the inner city of Pretoria, it is assumed that Mamelodi has become their home, and that elderly residents do not want to relocate.

1.5.3 Delimitations

The delimitations in this dissertation are concerned with the vastness of Mamelodi and therefore only a certain area will be studied. Since the concept is focused on the inflow and outflow of waste, a vast array of experiments and data would be required before conclusions can be made.

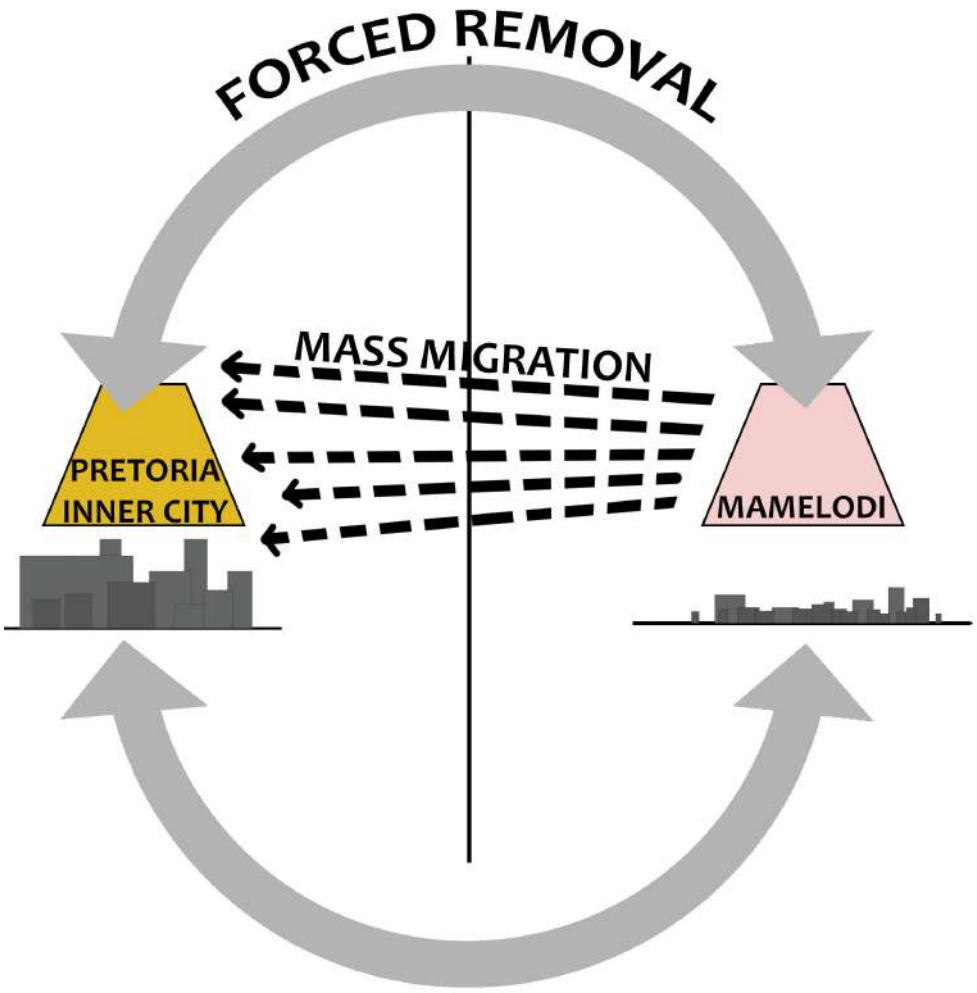
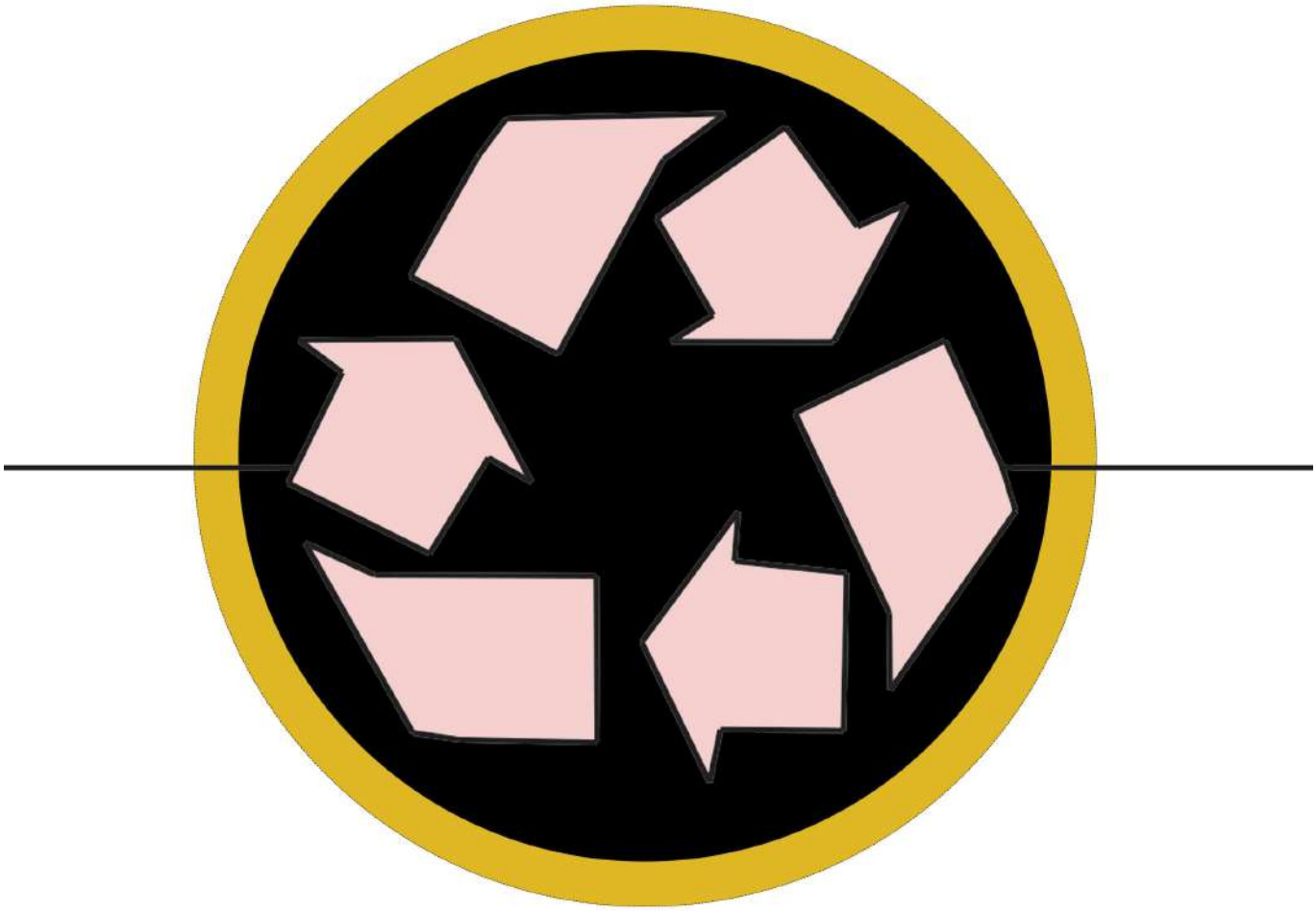


Fig. 1.11: Mass migration (Author 2019)



1.6 THE RESEARCH METHODOLOGY

1.6.1 MAPPING

Mapping entails the investigation of the current site conditions, as well as those of neighbouring sites, in order to understand the overarching issues and challenges of the existing typology. Site interpretations will be investigated further.

1.6.2 THEORETICAL EXPLORATIONS

A study of past and current journal articles and papers on architectural theories can strengthen the outcomes and intentions of this paper.

1.7 PRECEDENT STUDIES

Precedent studies investigate design ideas contained in successful current and historical built projects. These can be in the form of contextual, formal, functional and technological which have the potential to strengthen an argument or idea.

1.8 FURTHER ANALYSIS

1.8.1 QUALITATIVE ANALYSIS:

- Systematic observations of the location, surrounding context, pedestrians, traders and consumers
- One-on-one interviews with people who live in Mamelodi as well as visitors to Mamelodi
- Distribution of survey flyers to informal as well as formal shops

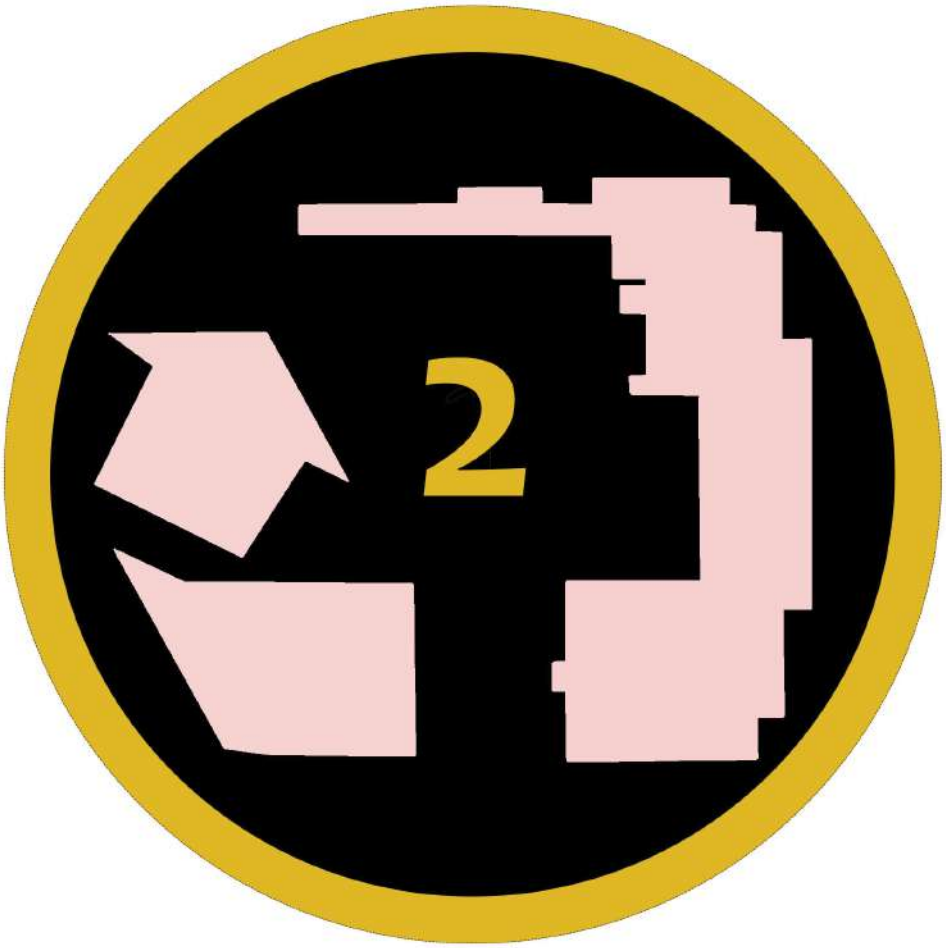
1.8.2 QUANTITATIVE ANALYSIS:

- Data collection
- In-depth interviews
- Research
- Case studies

1.9 THE CONTRIBUTION OF THE STUDY

In the dissertation, nature is introduced into the built environment and vice versa. The waste issue is a major problem that exacerbates global warming, and therefore this dissertation will contribute to ideas that could solve the waste issue, as well as inform on how waste can be used to make building materials to meet the housing demand in South Africa.

CONTEXT & HISTORY



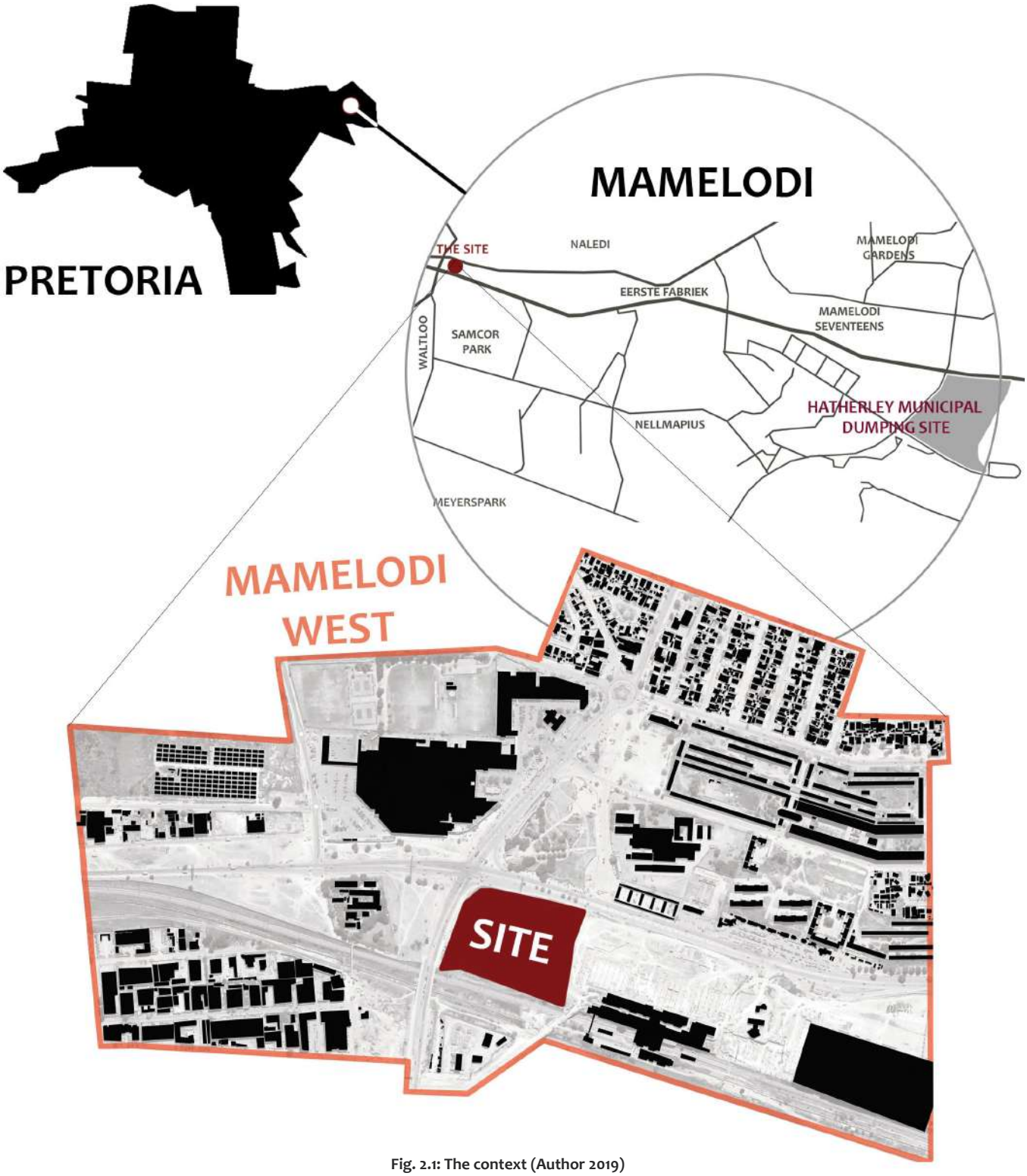


Fig. 2.1: The context (Author 2019)

2.1 VLAKFONTEIN TO MAMELODI

BACKGROUND

A study conducted by Walker, van der Waal, Chiloane, Wentzel, and Moraloki, (1991) states that Pretoria was founded in 1855 and that a vast number of 'blacks' lived within the city and closer to their places of work. Maps from 1902 illustrate dwellings in Marabastad and Schoolplaats, areas that were defined as 'black' locations. In 1923, Lady Selborne was declared a residential area of mixed race but was proclaimed in 1958 as a 'white' residential area. This proclamation forced 'black' people to move to Mamelodi and Atteridgeville (Walker et al. 1991). The context of this dissertation is the area of Mamelodi.

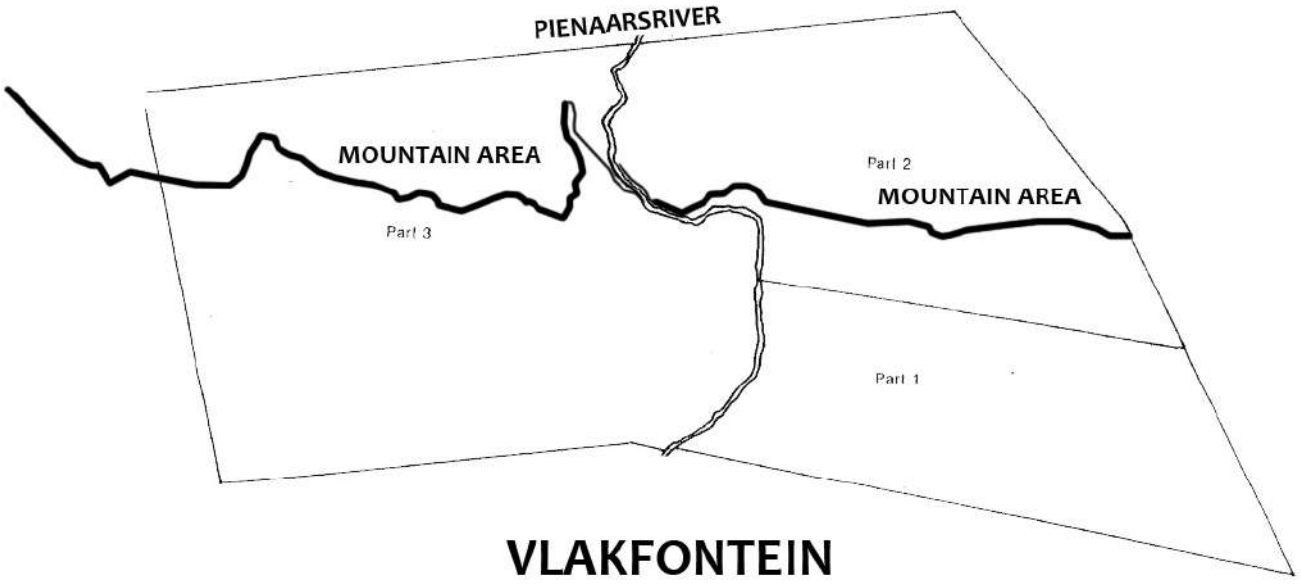


Fig. 2.2: The division of the Farm Vlakfontein (Deeds Office, Pretoria) (Adapted by Author, 2019)

THE HISTORY OF MAMELODI

Mamelodi is located at the base of the Magaliesberg, with its main axis ranging along an east-west direction (Walker et al. 1991). Mamelodi was initially referred to as Vlakfontein. A register in the Pretoria Deeds Office states that Vlakfontein may initially have been owned by C Jansen, and was then sold to David R Opperman in 1861 (Walker et al. 1991). In 1874 Vlakfontein was divided into three main parts, as illustrated above.

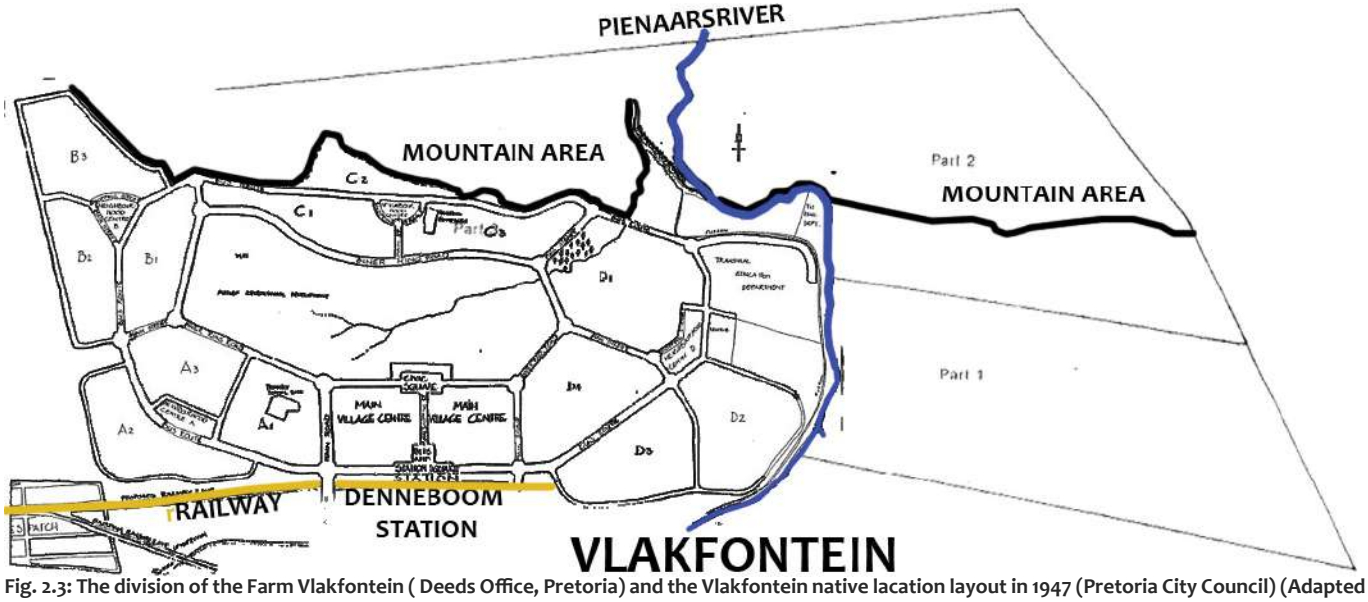


Fig. 2.3: The division of the Farm Vlakfontein (Deeds Office, Pretoria) and the Vlakfontein native lacation layout in 1947 (Pretoria City Council) (Adapted by Author, 2019)

The context of the chosen site is Mamelodi West. As mentioned before, Mamelodi was initially set out according to the principles of the model apartheid city, with the northern and eastern boundaries allocated along the natural buffers, and the railway and industrial area located in the south.

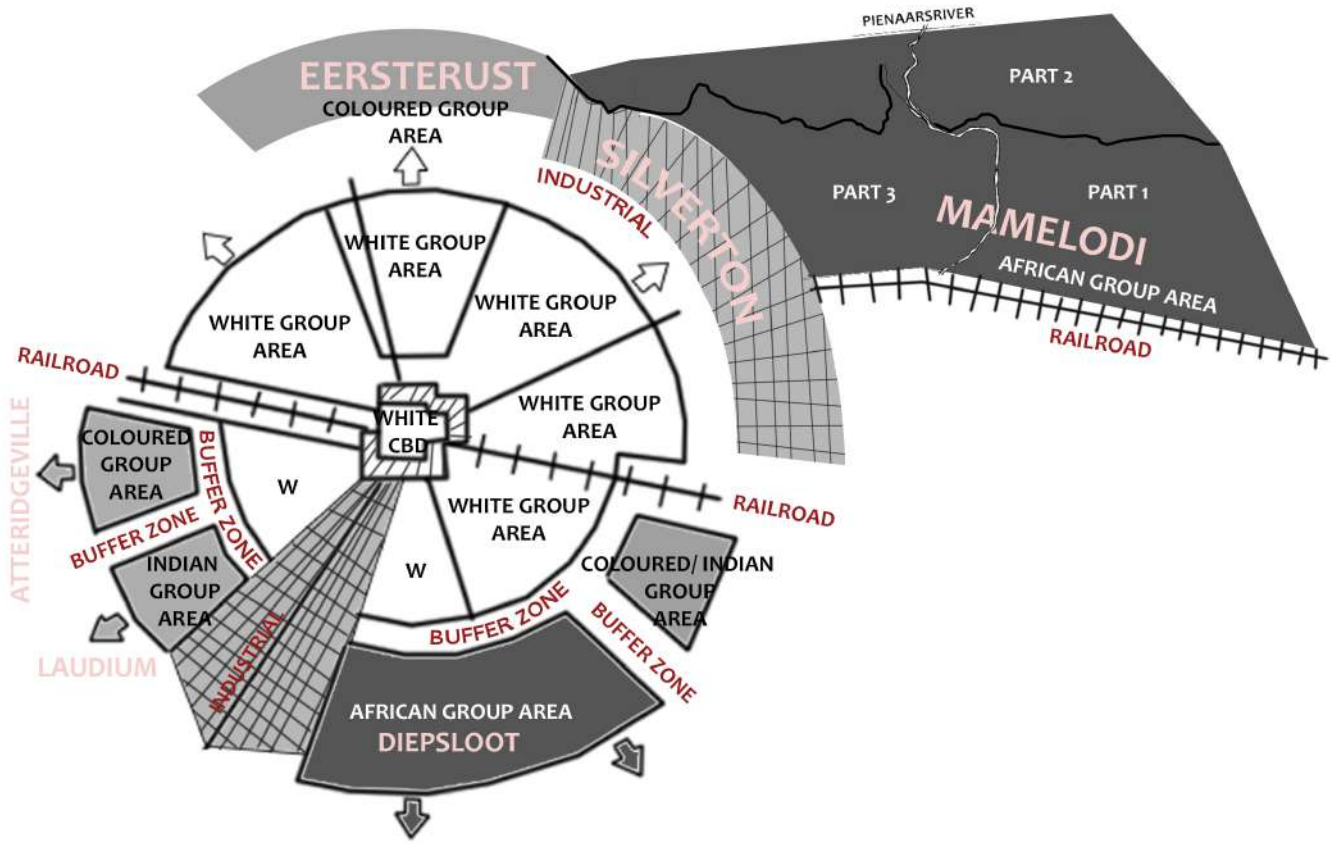


Fig. 2.4: Figure: The model apartheid city image adapted (Author 2019)

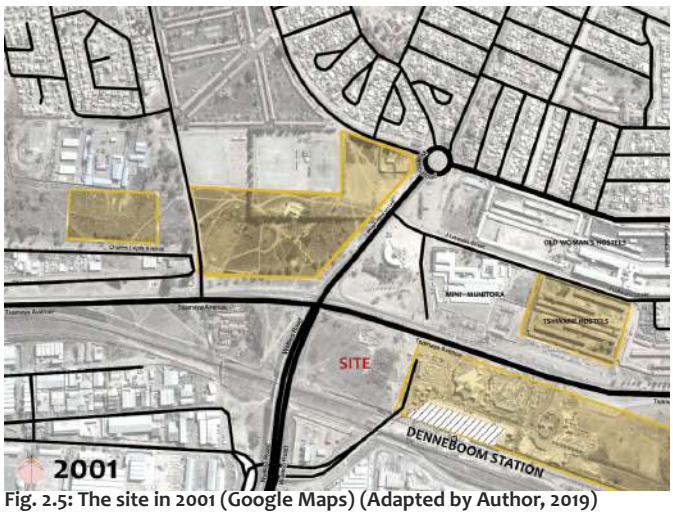


Fig. 2.5: The site in 2001 (Google Maps) (Adapted by Author, 2019)

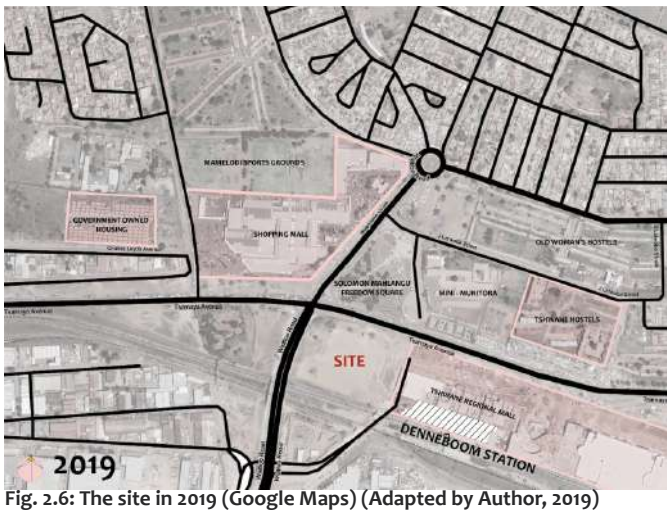


Fig. 2.6: The site in 2019 (Google Maps) (Adapted by Author, 2019)

2.2 MAPPING LENSES

Fig. 2.7: Open spaces situated around the site are mapped according to the amount of 'lost spaces' and green spaces. The lost spaces are illustrated in brown. These spaces hold high pedestrian activity and movement patterns. The green spaces are illustrated in green. These spaces hold less pedestrian activity and are either closed off or are sports fields (Map from Univerisy of Pretoria Geography Building) (Adapted by Author, 2019)

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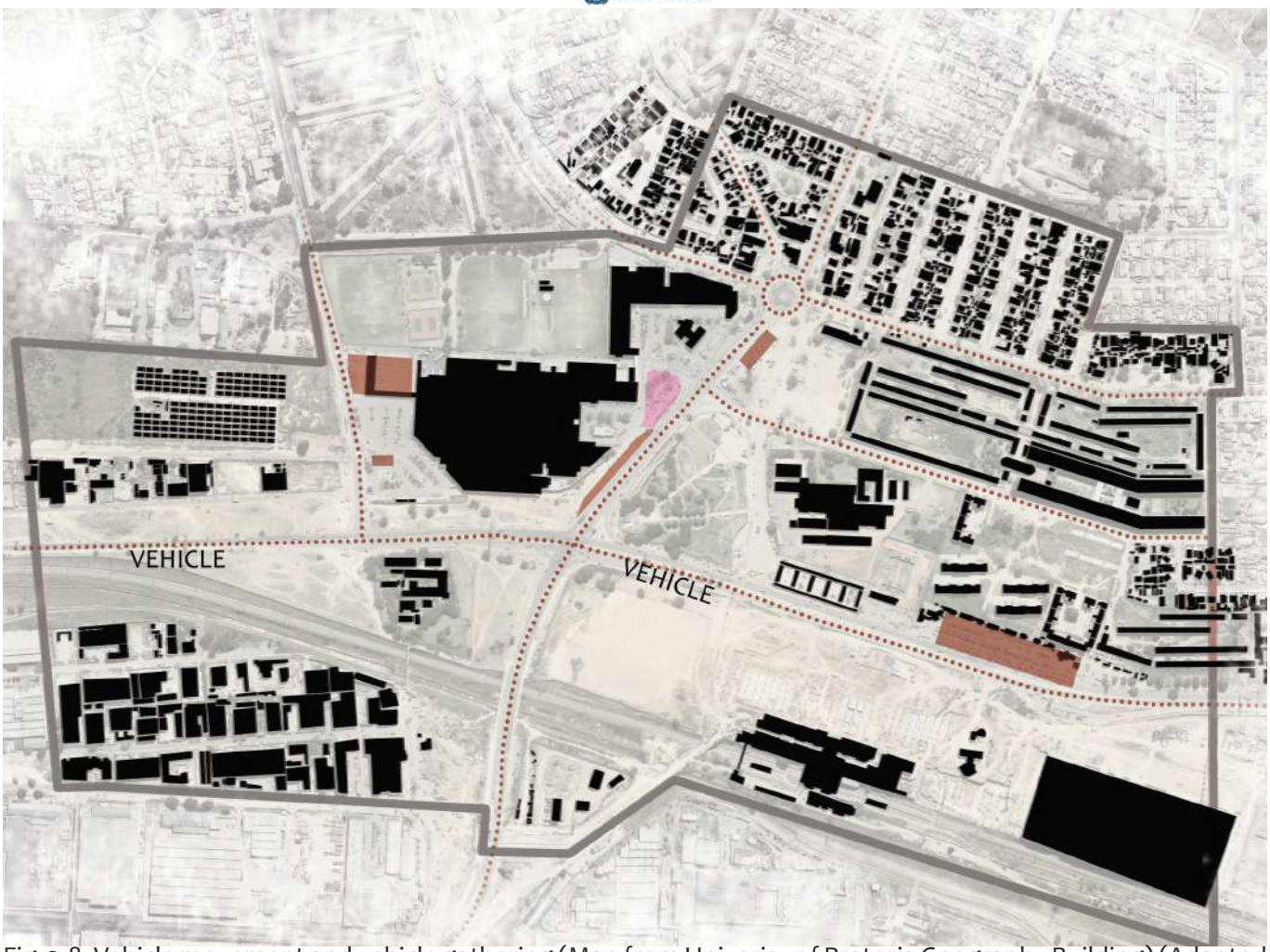

Fig. 2.8: Vehicle movement and vehicle gathering (Map from Univerisy of Pretoria Geography Building) (Adapted by Author, 2019)

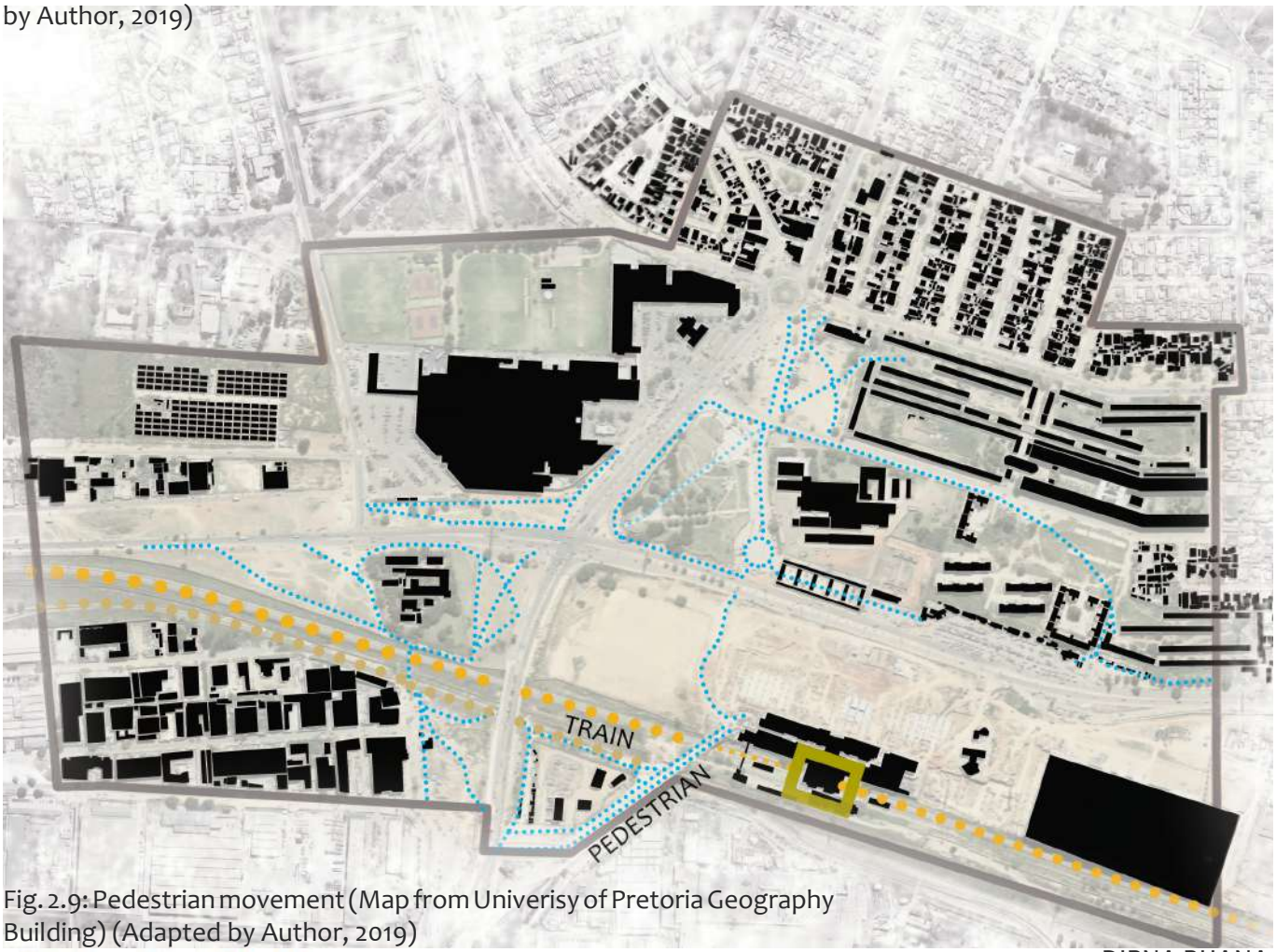

Fig. 2.9: Pedestrian movement (Map from Univerisy of Pretoria Geography Building) (Adapted by Author, 2019)

Fig. 3.3 Open spaces situated around the site are mapped according to the amount of 'lost spaces' and green spaces. The lost spaces are illustrated in brown. These spaces hold high pedestrian activity and movement patterns. The green spaces are illustrated in green.

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Fig. 2.10: Areas of waste dumping (Map from Univerisy of Pretoria Geography Building) (Adapted by Author, 2019)

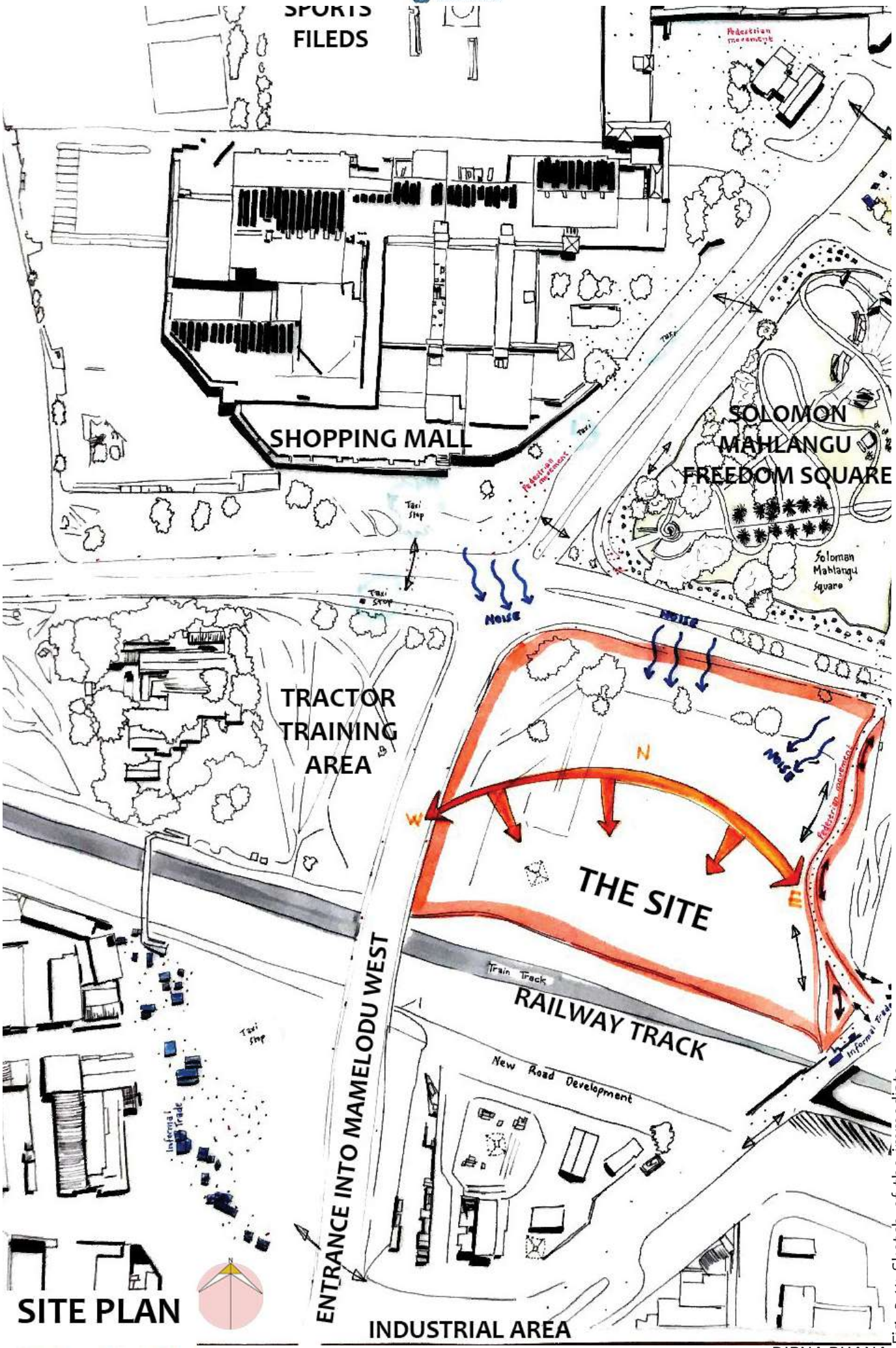

Fig. 2.11: Sketch of the immediate context (Author 2019)

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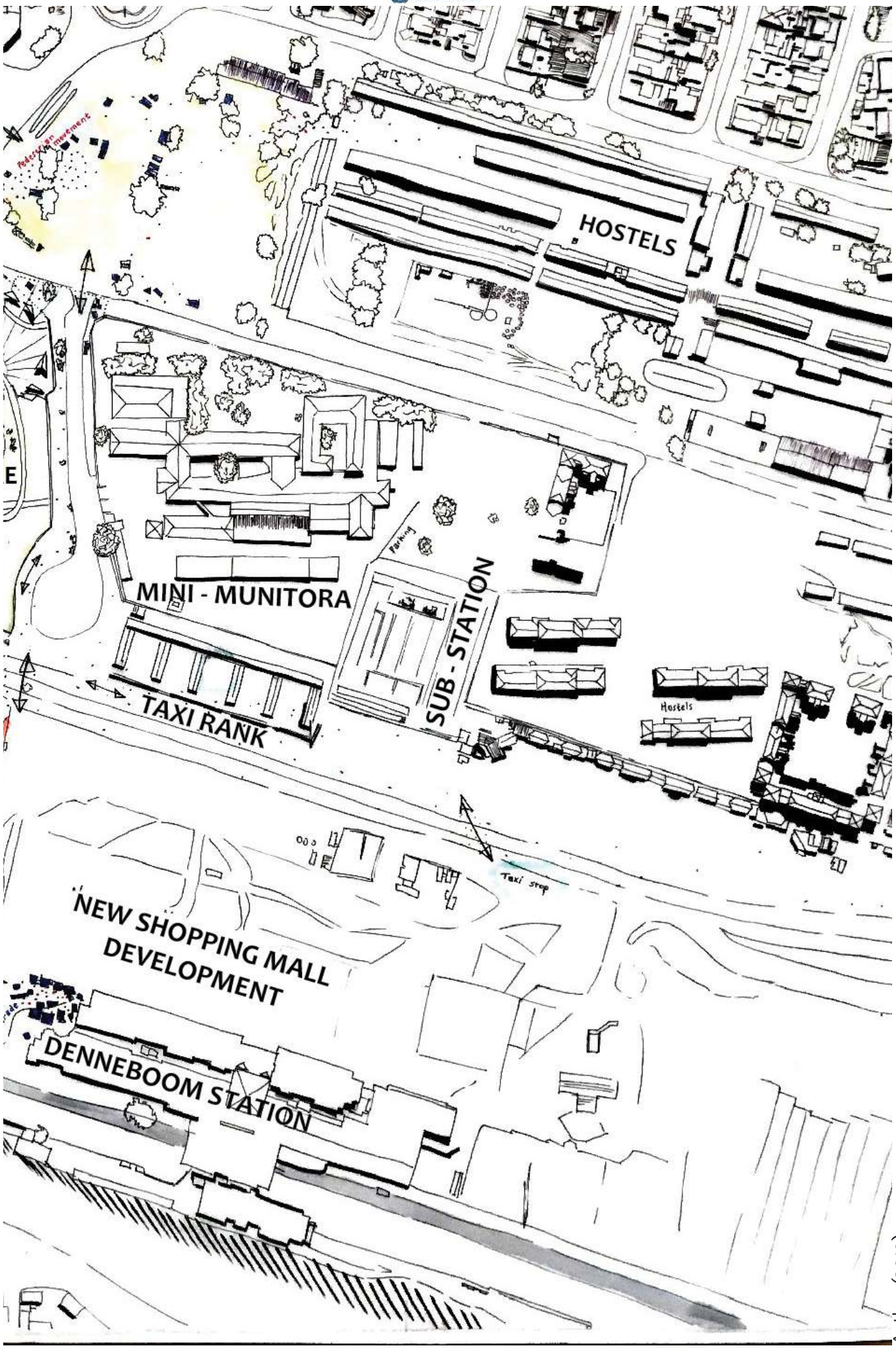

Author (2019)

2.3 URBAN ANALYSIS

URBAN ANALYSIS

Illustrated above are the main areas surrounding the selected block which is indicated in yellow. These include the historical women's hostels, the new Solomon Mahlangu Freedom Square, and two malls.

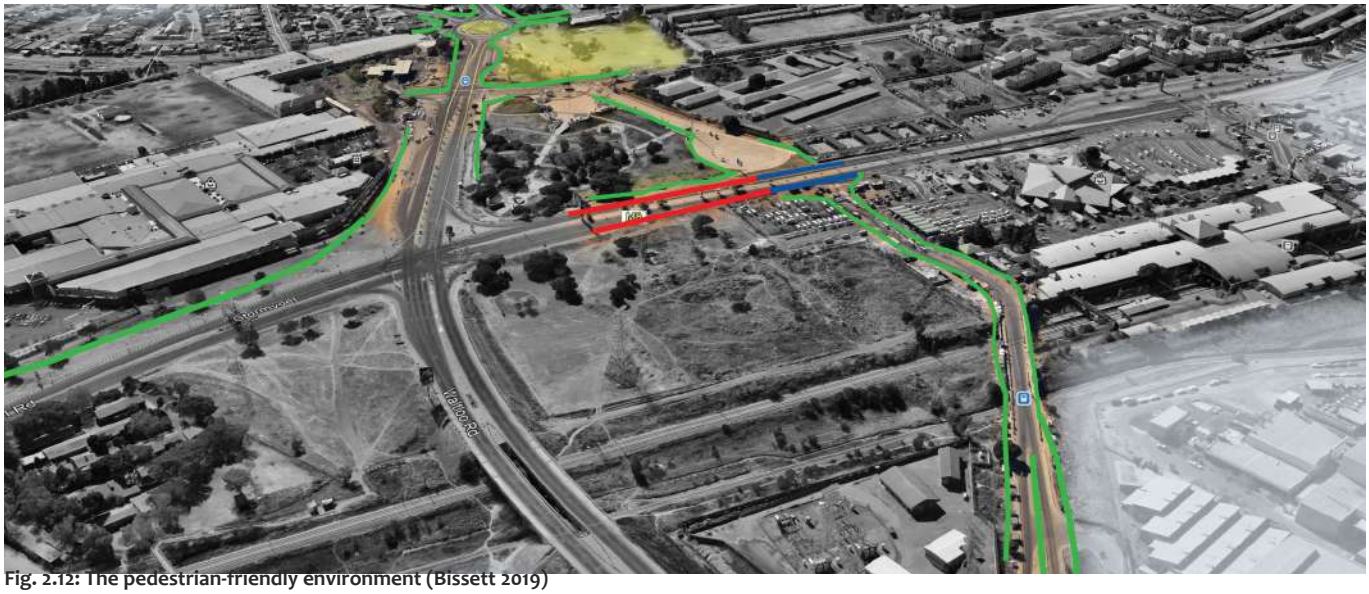

Fig. 2.12: The pedestrian-friendly environment (Bissett 2019)

The framework was divided into three main categories. In the first category the aim is to create pedestrian friendly environments by enhancing social infrastructure, thus allowing for green public spaces (Bhana, Bisette, Marais, Mtetwa, and Schmidt 2019).

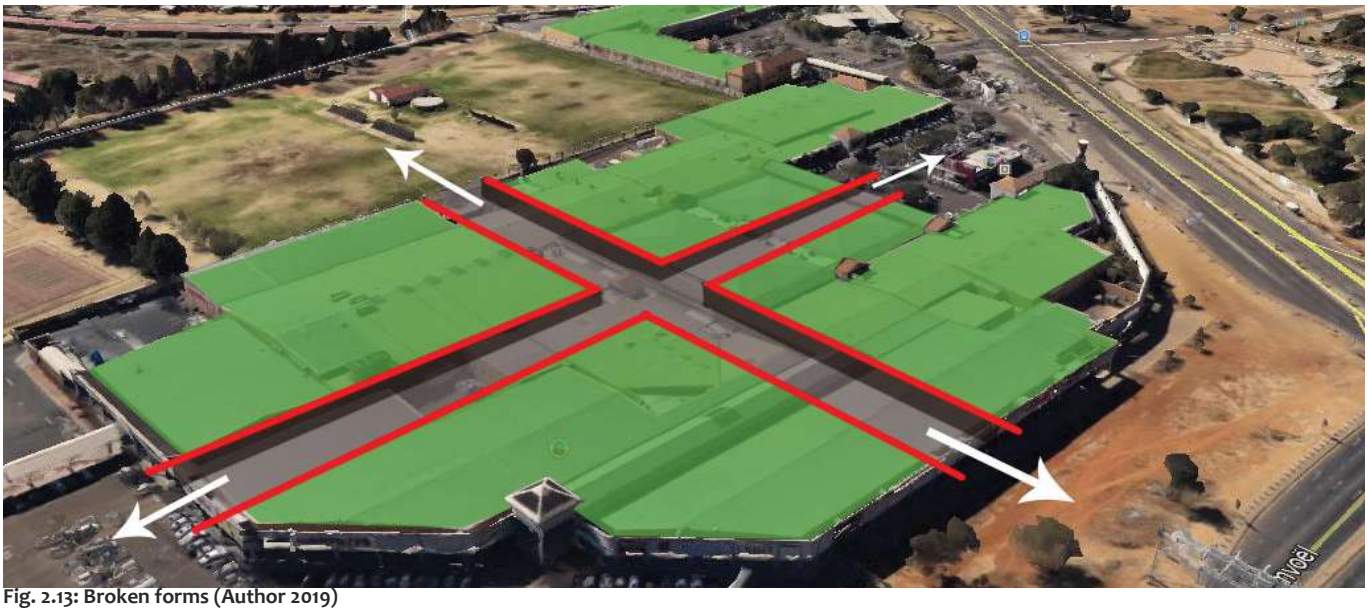

Fig. 2.13: Broken forms (Author 2019)

In the second category the focused is on broken forms and the breaking up of large masses by including 'free green spaces' and promoting low-cost or social housing. The aim is to increase the density of the social housing vertically (Bhana et al. 2019).

In the third category focus is placed on the landmark effect. The landmark effect defines the street edges. Different options were explored, including an increase in height scales from three to five storeys, to emphasize the existing trade activities that occur on the street edges (Bhana et al. 2019).

Fig. 2.14: The landmark effect (Author 2019)

Intensification is an overarching principle which entails increasing the activity and population diversity of the area with the aim of increasing those facilities needed to create a well-rounded society – not only increasing the number of people living there, but also providing a wider diversity of activities. According to the concept of intensification, four main topics were focused on, namely 1. civic/ corporate facilities, as well as 2. encouraging small businesses and entrepreneurship, 3. pedestrian-centred environments, and 4. education and housing, with a further focus on subcategories as illustrated in the image above (Bhana et al. 2019).

Fig. 2.15: Intensification diagram (Author 2019)

2.4 THE SITE

Fig. 2.16: (Photography by Author, 2019)

Fig. 2.16.1: Existing heaps of plastic, paper and glass waste mixed with sand

Fig. 2.16.2: Existing pedestrian movement through site

Fig. 2.16.3: accumulation of water on site

Fig. 2.16.4: Land area compressed due to high volume of traffic

Fig. 2.16.5: Informal activity

Fig. 2.16.6: Vehicle movement through site

Fig. 2.16.7: Informal trade located near Denneboom Station

Fig. 2.16.8: Waste heaps

Fig. 2.16.9: Waste heaps near new Tshwane mall

CONTEXT AND HISTORY

The site was selected for the number of facilities found in the area as well as the access to transportation and short walking distances between facilities. It was observed that the highest level of community facilities can still be found at the original entrance to Mamelodi. Due to the apartheid-era buffers and boundaries, the land still appears to be largely unchanged (Bhana et al. 2019).

Within the context, spaces which are unprogrammed seem to be more readily appropriated by the community, as they allow for a mixed-use approach. These spaces accommodate a variety of uses such as the selling of fresh produce and tyres, and even waste dumping and organic waste burning. It was observed that Informal trade takes precedence where there are people and movement rather than space constraints (Bhana et al. 2019).

Fig. 2.16.10: Existing site and 'lost space'

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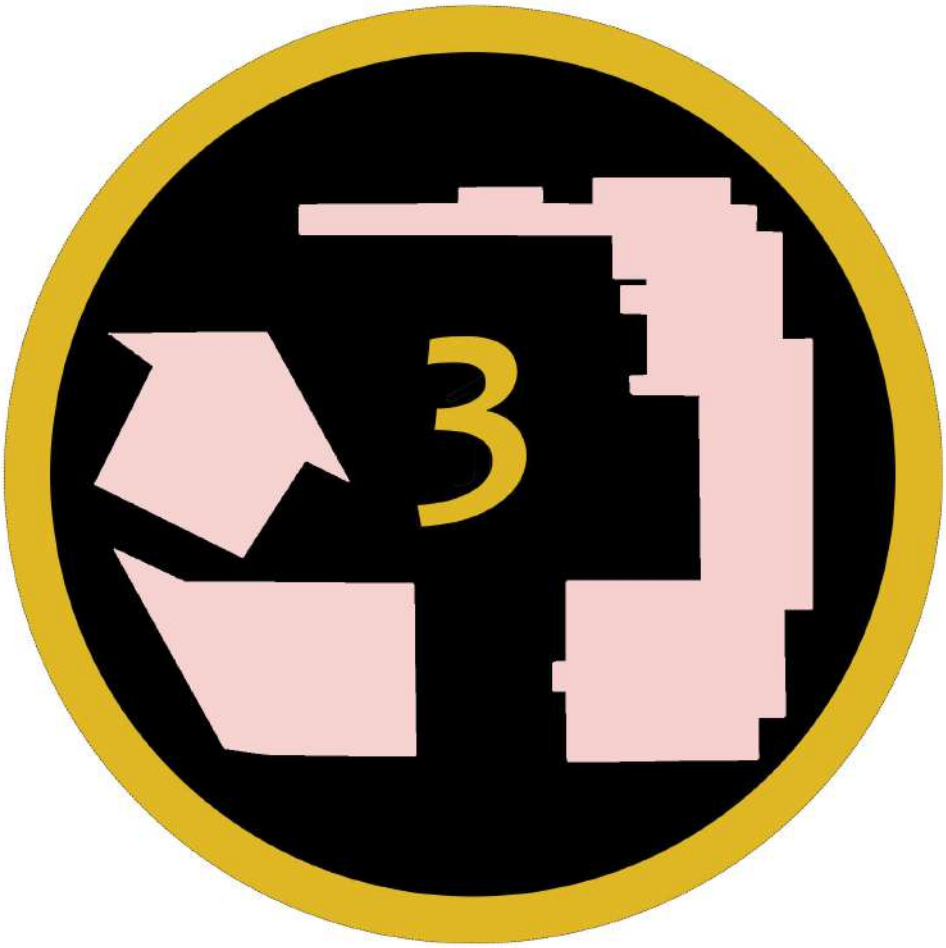
Fig. 2.16.11: Denneboom Station railway

CONCLUSION

The industrial area in the south still employs a large percentage of people from Mamelodi and provides employment in low-skilled labour. Overall, Mamelodi is separated from Pretoria and has the potential to become an independent township on its own (Bhana et al. 2019).

PROGRAMME



3.1 THE APPROACH

THE APPROACH

An analysis of the existing urban condition was conducted, with three core categories as the main focus. In order to enhance the social infrastructure, it is essential to promote pedestrian-friendly environments, while allowing for an increase in green public spaces – this is the focus of the first category. According to Rodríguez, Brisson and Estupiñán (2009), studies based on relationships between street usage and the built environment mostly emphasise the presence of amenities such as rubbish bins, benches, bicycle lanes, traffic lights, crosswalks and attention to edge conditions. These amenities involve broader sidewalks, crossing aids and a mix of land uses which support a higher level of pedestrian activity (Rodríguez et al. 2009).

The second category is focused on broken forms, i.e. breaking up large masses such as shopping malls and promoting more free green spaces for the community (Bhana et al. 2019). According to Swanwick, Dunnett and Woolley (2003:94-106), emphasis greatly needs to be placed on the 'compact city' in the form of high-density holdings as a future city model, with importance directed towards the benefits of green spaces and urban parks. Due to the number of green spaces located in South Africa relative to its former racially divided settlement patterns, it is evident that the more affluent areas, which were initially assigned to the white suburbs, consist of a high percentage of green spaces and a lower density of housing, whereas, in contrast, the former defined townships have a low percentage of green spaces with a low density of housing, albeit a high area percentage per person (McConnachie & Shackleton 2010:244-248).

The third category, the landmark effect, focuses on defining the street edges, increasing height scales from three to five storeys, and addressing different options to emphasize the existing trade that occurs on the street edges (Bhana et al. 2019). According to Rüetschi, Caduff, Schulz, Wolff and Timpf (2006), landmarks are visual objects or buildings usually near entrances or at points of reference. They are mainly used as external reference points which can easily be seen at a distance.

Fig. 2.16.10: Existing site and 'lost space'

3.2 SITE ANALYSIS

BACKGROUND

The first inhabitants of the Vlakfontein area were farmers and herdsmen, but they were later on employed by De Eerste Fabrieken in the Zuid-Afrikaansche Republiek Beperkt [The South-African Republic Limited]. Walker et al. (1991) states that these residents were known to be the first industrial workers located in the Transvaal area. De Eerste Fabrieken later became known as the Hatherley Distillery, which subsequently grew into a bottle-making factory where the sand from the Pienaars River was used to make glass (Walker et al. 1991).

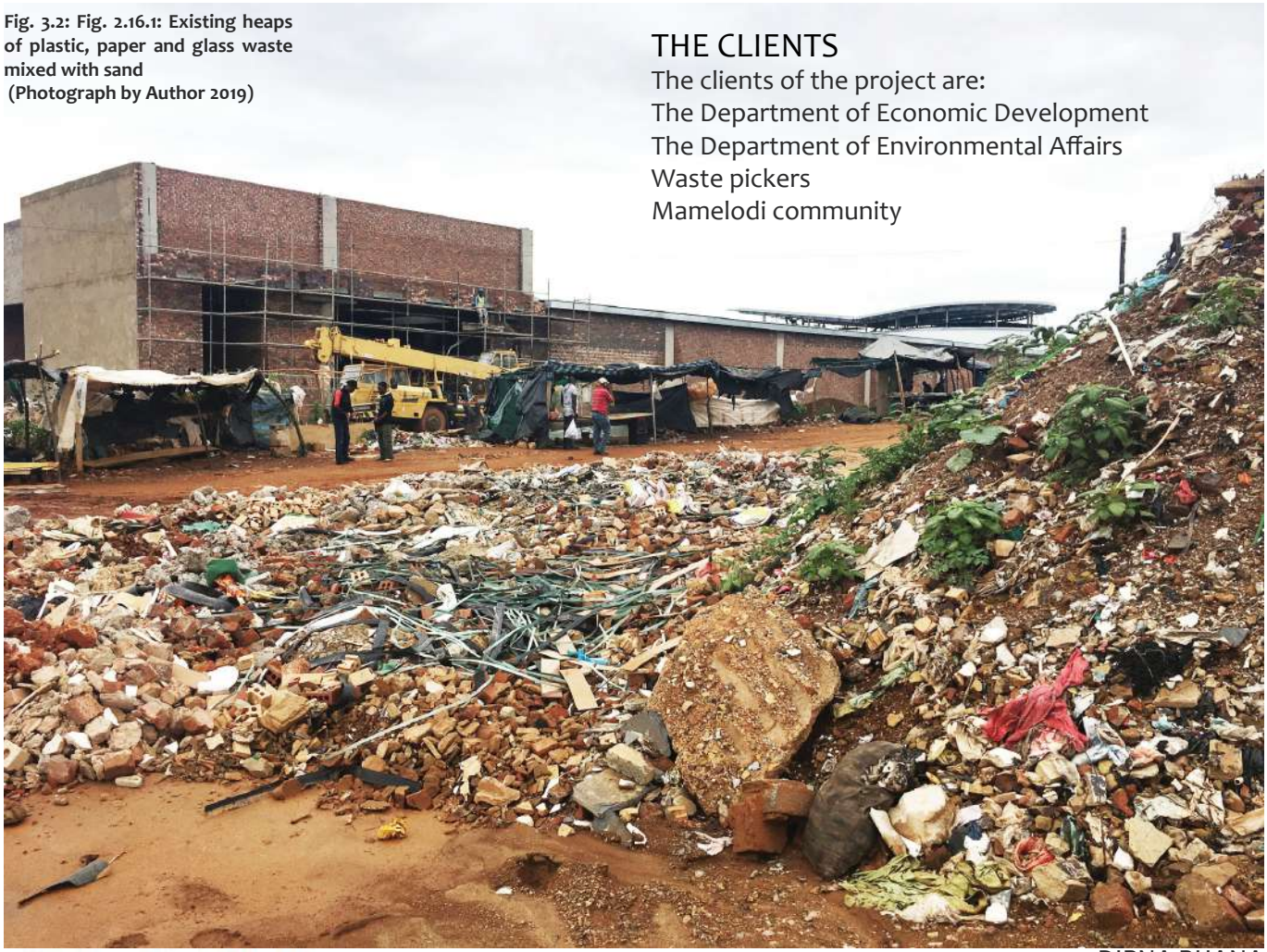
Today Mamelodi West has spread closer to Silverton, which is a predominantly industrial area.

A huge landfill that is situated in Mamelodi is the Hatherley Municipal Dumping Site at which, according to Mosidi Ngati, the City of Tshwane's head of landfill Management, approximately 2 000 000 m3 of waste is dumped annually. The Mamelodi township is blighted by vast amounts of littering which, according to Garg and Mashilwane (2015), is due to the lack of environmental education and 'laziness' because of not having efficient rubbish bins. Although Mamelodi has a certain percentage of professional, skilled, educated people, a greater percentage of people are unskilled and depend on the government for survival (Garg & Mashilwane 2015).

Fig. 3.2: Fig. 2.16.1: Existing heaps of plastic, paper and glass waste mixed with sand (Photograph by Author 2019)

THE CLIENTS

The clients of the project are:
The Department of Economic Development
The Department of Environmental Affairs
Waste pickers
Mamelodi community



3.3 THE OVERALL PROGRAMME AND SUBPROGRAMMES

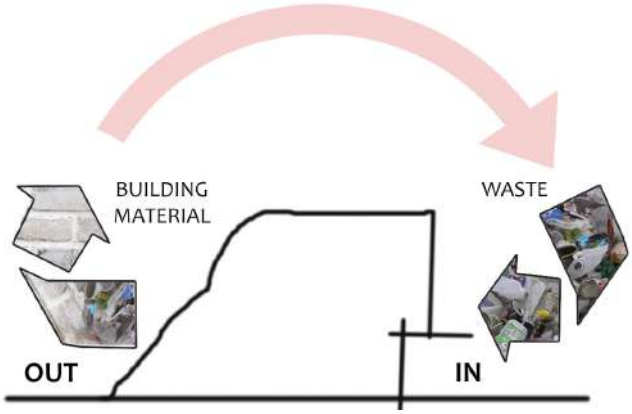


Fig. 3.3: The input and output cycle (Author 2019)

THE INPUT AND OUTPUT CYCLE

The programme comprises three main categories, namely Recycling, Making & Education. Recycling will focus on the high levels of waste – such as paper, glass and plastic – which is disposed of daily by the shops in and around the malls. The unused organic material could be sorted and added to a wormery where compost could be produced, that could in turn be used to improve the organic carbon levels of the soil (Paulin & O'Malley 2008).

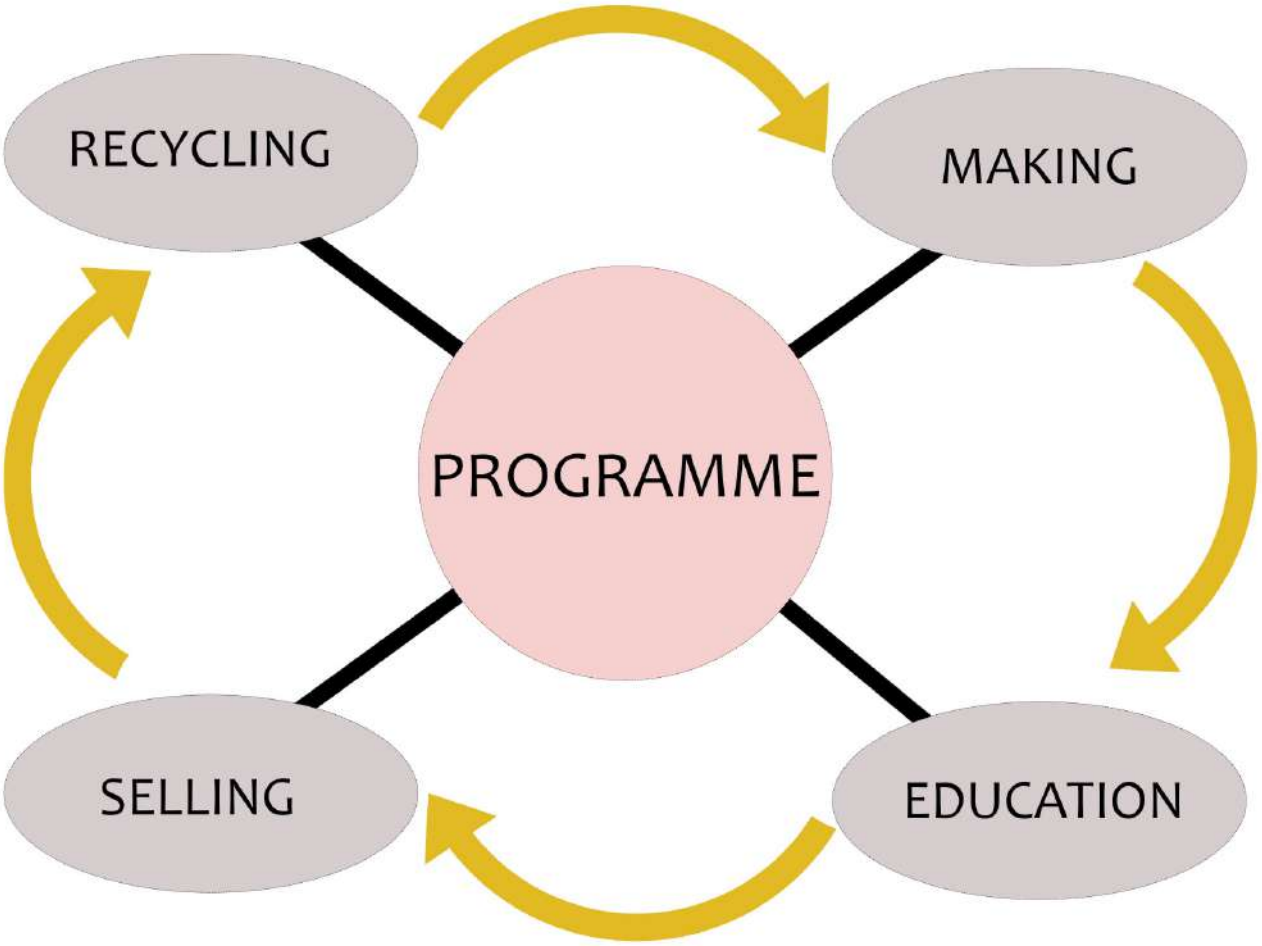


Fig. 3.4: Programmatic diagram (Author 2019)

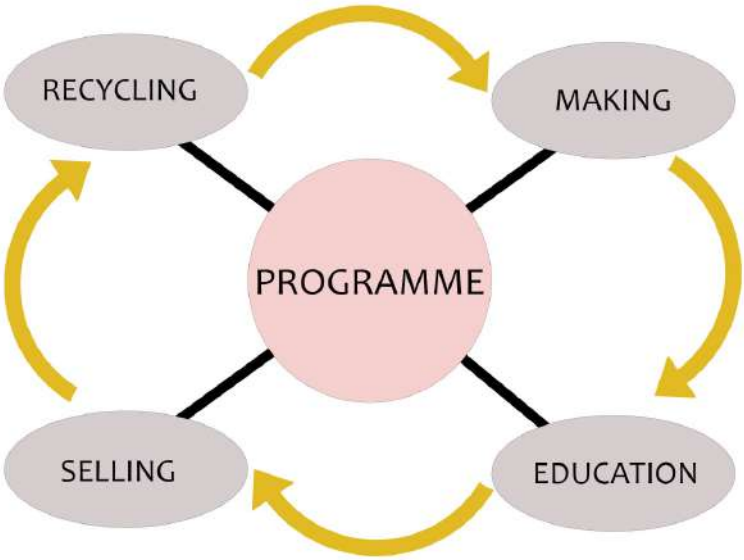


Fig. 3.5: Programmatic diagram (Author 2019)

Making will take the form of service provision, such as a repair centre, where machines that have broken down can be fixed or in turn can then be used for another purpose. It is essential to bring in knowledge and to exchange skills. Through the process of making, the growing of plants or fungi can be highly beneficial. Plants such as turmeric and ginger possess medicinal properties and have anti-inflammatory compounds which could be provided to the public in exchange for five single-use plastic bags, for example.

Education will entail an exchange of knowledge and ideas with adults, teenagers and children through the process of give and take. Night classes will be encouraged, as this would open up availability and access to the working class as well. Accounting, finance and crafts will be focused on in these classes in order to raise the education rate and empower the community.

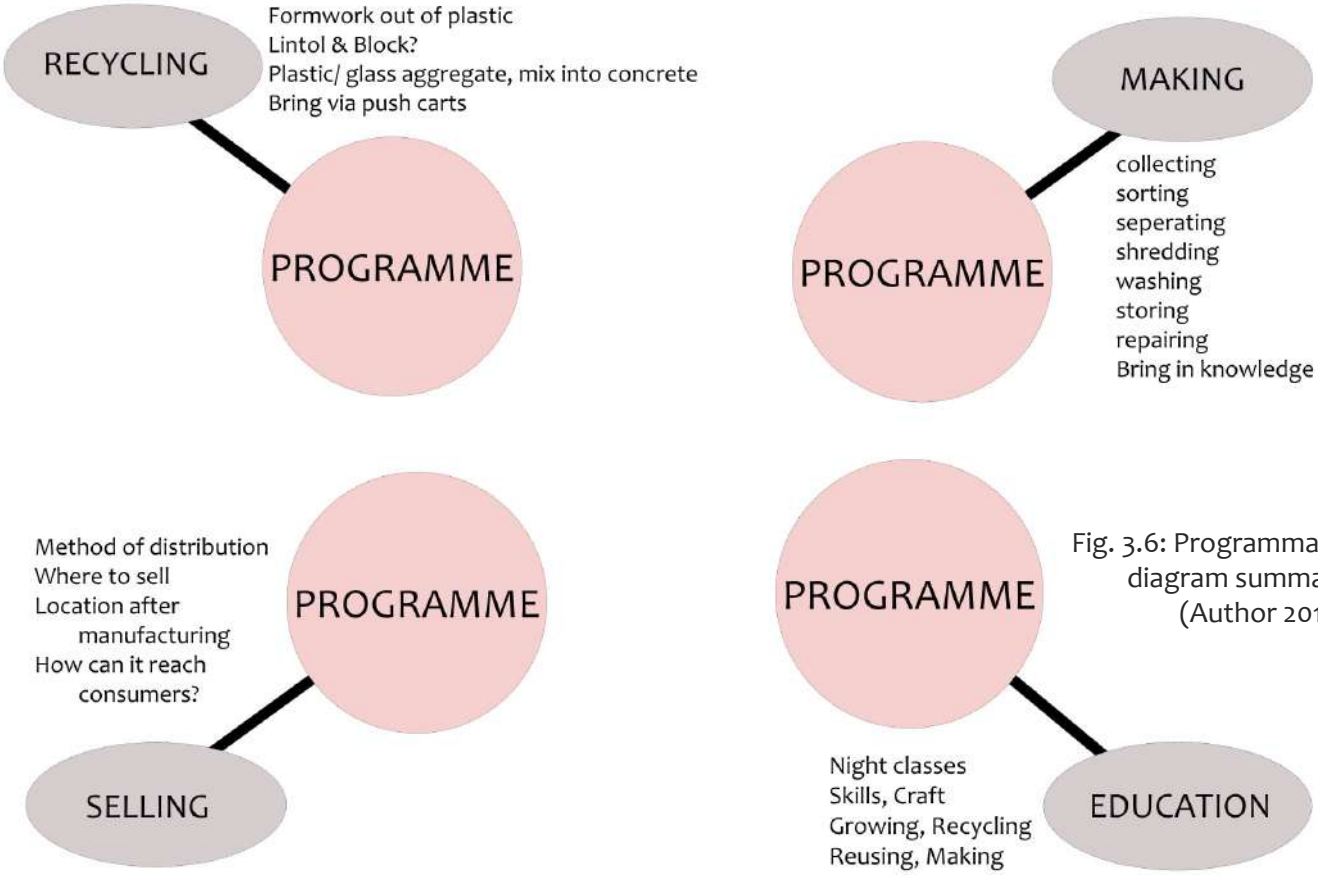


Fig. 3.6: Programmatic diagram summary (Author 2019)

PROGRAMMATIC DIAGRAM

The programmatic diagram illustrates the cycle of upcycling, making, educating, selling and back to the upcycling of waste products.

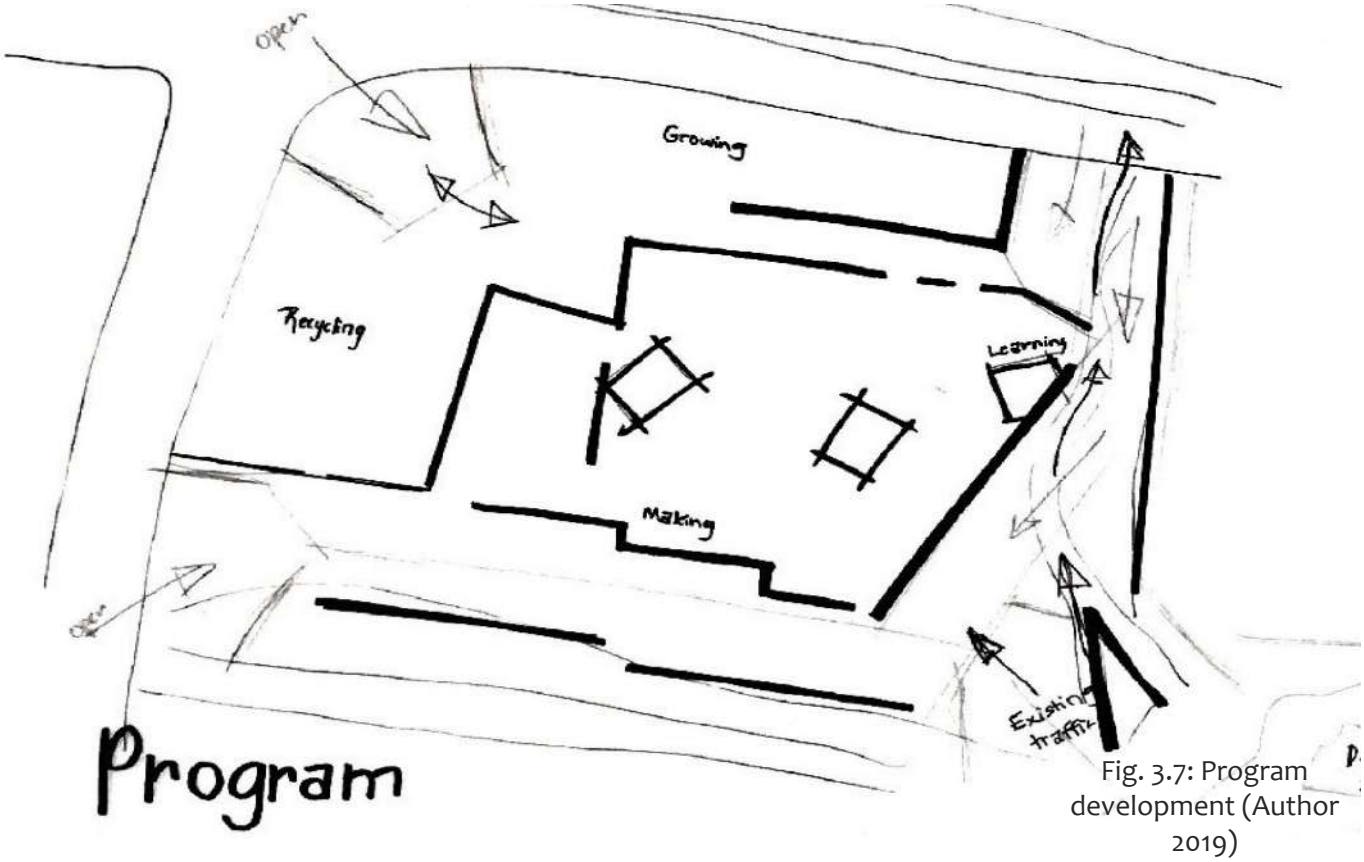


Fig. 3.7: Program development (Author 2019)

SCHEMATIC DIAGRAM

The programmatic diagram was converted into a schematic diagram which highlights the main services and pedestrian movement patterns. Furthermore, the three main waste groups were illustrated, with each activity associated with it as well as the hierarchy of the spaces required.

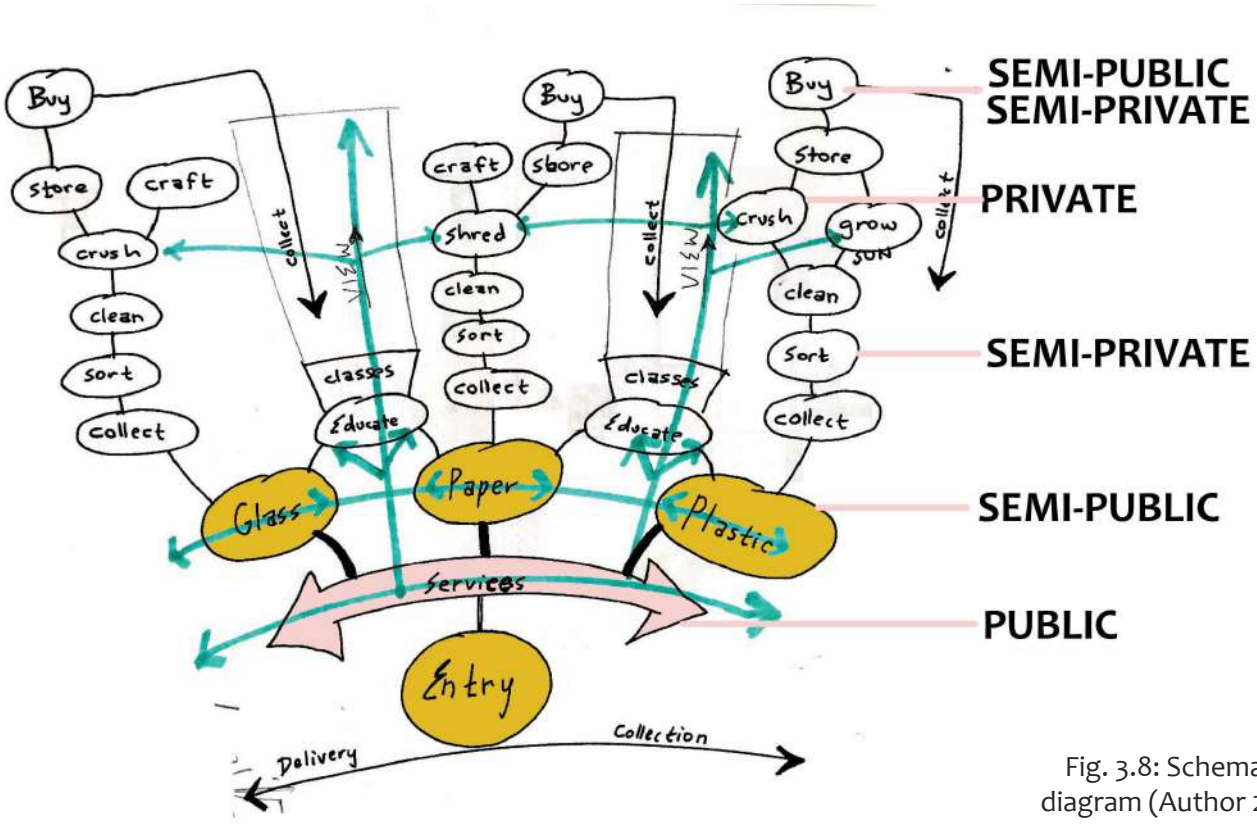


Fig. 3.8: Schematic diagram (Author 2019)

3.4 MATRIX DIAGRAM

The schematic diagram was then converted into a matrix diagram which clearly reflects the importance of the programme in relation to who/what, i.e. human and other factors . For example, the waste collectors play a major role in the collecting of waste, while playing a small role in its distribution. Overall, the programme that appeared to be very important is the viewing areas, where education and learning are promoted by displaying all the processes associated with upcycling to the public.

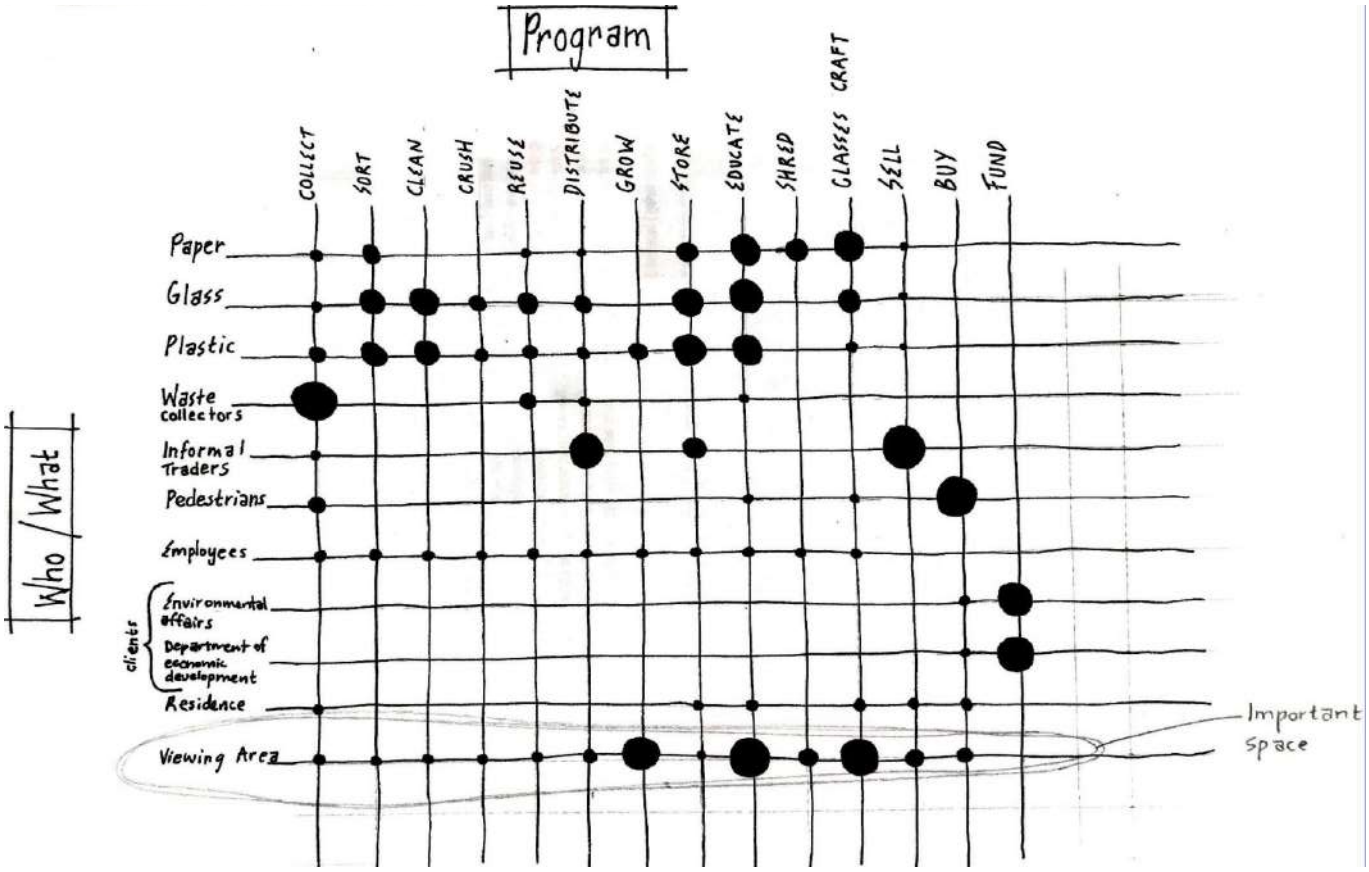


Fig. 3.9: Matrix diagram (Author 2019)

3.5 FORMAL LANGUAGE

The formal language is based on the programme, which emphasises the structure and ordering of the programmes.

Fig. 3.10: Formal language (Author 2019)

Since the community makery consists of multiple programmes, the diverse use if grids and walls allow for flexible internal spaces that can change in time.

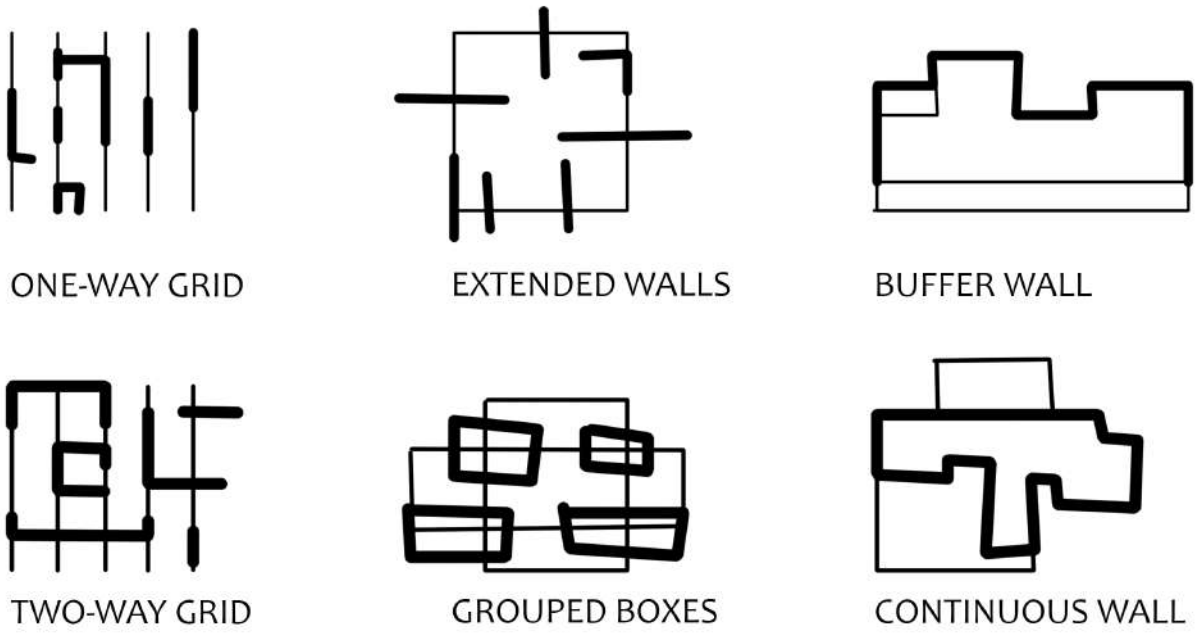


Fig. 3.11: Development of grids and walls (Author 2019)

3.6 FORMAL PRECEDENT

Precedents that were studied were Frank Lloyd Wright's buildings and grids . He mainly makes use of circular, rectangular and triangular grids in his design process.

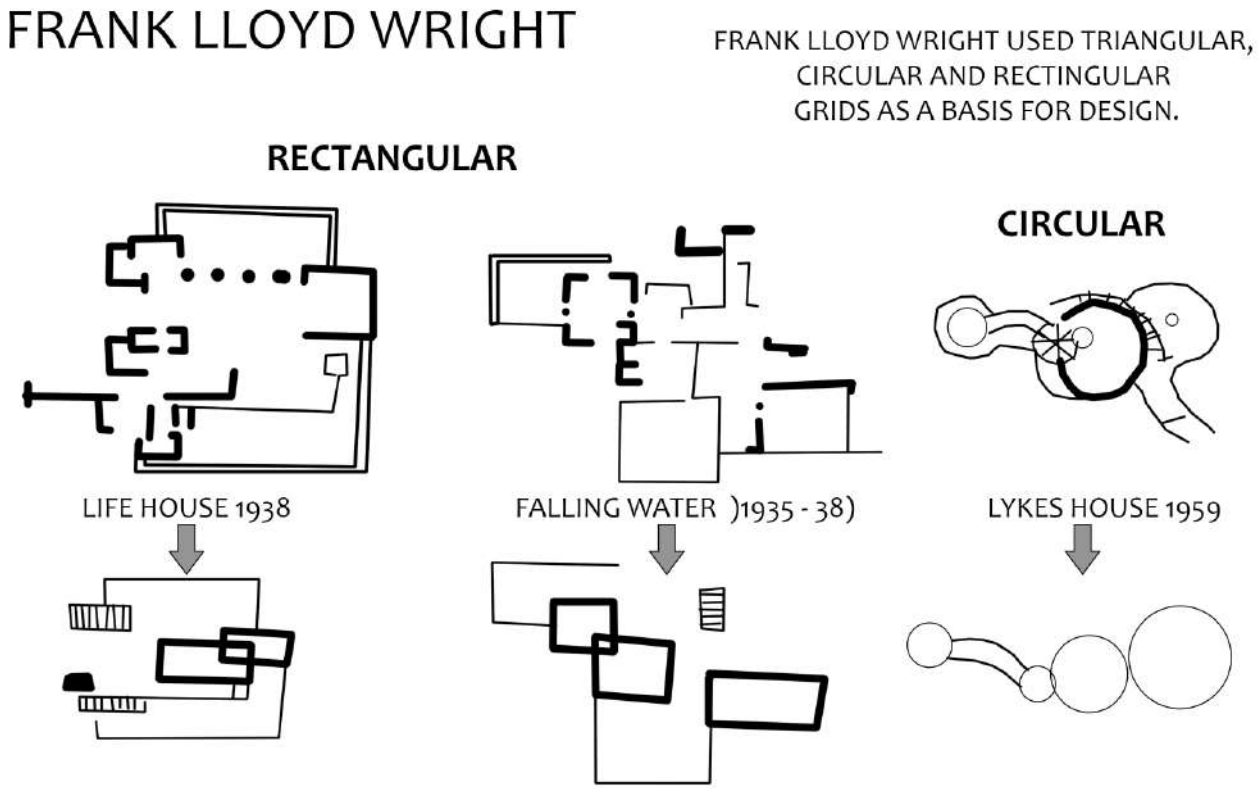


Fig. 3.12: Formal language: Frank Lloyd Wright (Author 2019)

The geometries of Wright were used as formative ideas while he used solid geometries to define the overall built form. Frank Lloyd Wright believed that geometries allow for the ordering of space that include both structure and space planning. Through the use of orientation, hierarchy, proportion, geometry and pattern, Wright managed to achieve the underlying form on which the superstructure is based on (Keane & Keane 2005).

3.7 THE FIRST CONCEPT OF THE CIRCULAR MODEL

Based on the proposed building as a system, the idea of a circular grid demonstrates the self-progressing nature of the programmes and functions.

The circular model is one that is well known throughout the world. In the round city of Baghdad, the mosque is placed centrally while the city radiates outwards from it. According to Lassner (1968:24-36), the growth of the city of Baghdad was based on the administrative centre belonging to the Abbasid empire, which then spiralled outwards into particular patterns determined by certain city uses.

According to Al-Hasani (2012:79), the circular city of Baghdad was constructed over a period of four years, incorporating geometric blocks and symmetrical streetscapes. With three main walls forming a hierarchy of spaces, the innermost wall established a separation between private and public spaces. It was known to be revolutionary in terms of urban planning (Al-Hasani 2012:79).

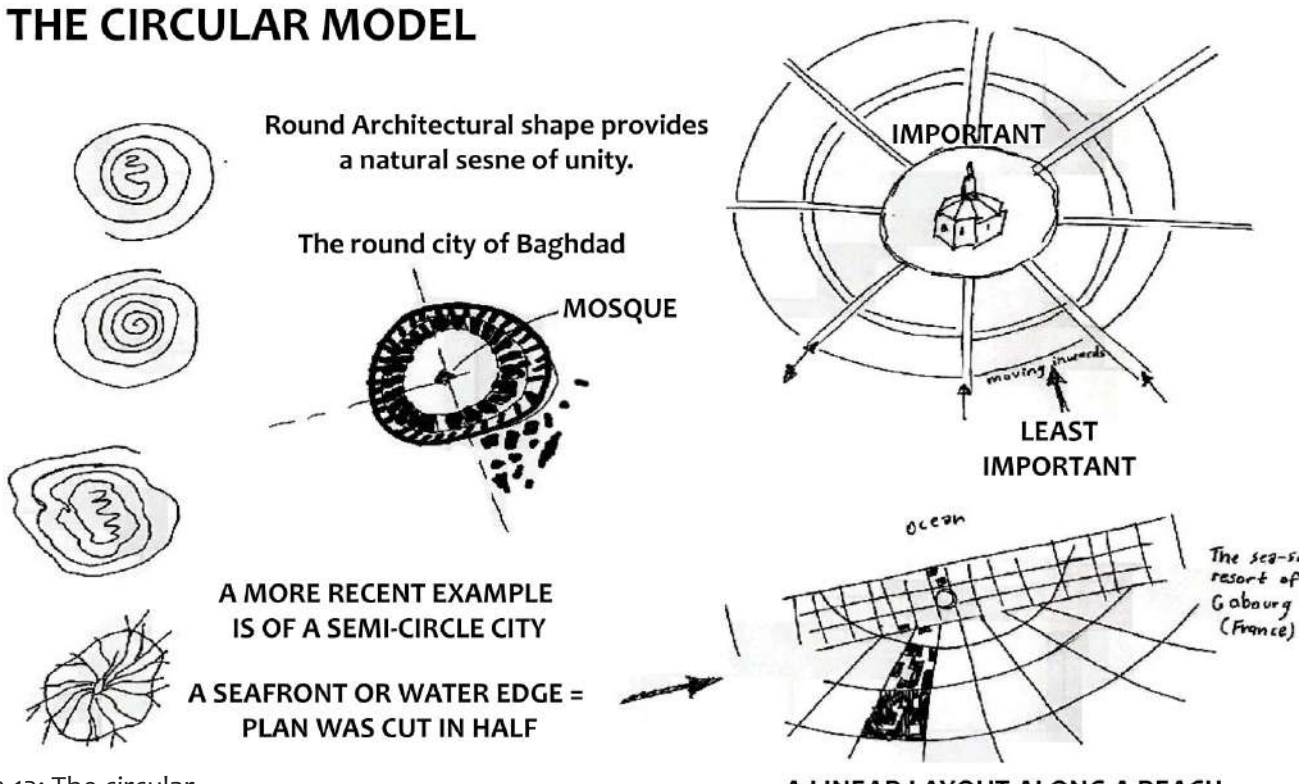


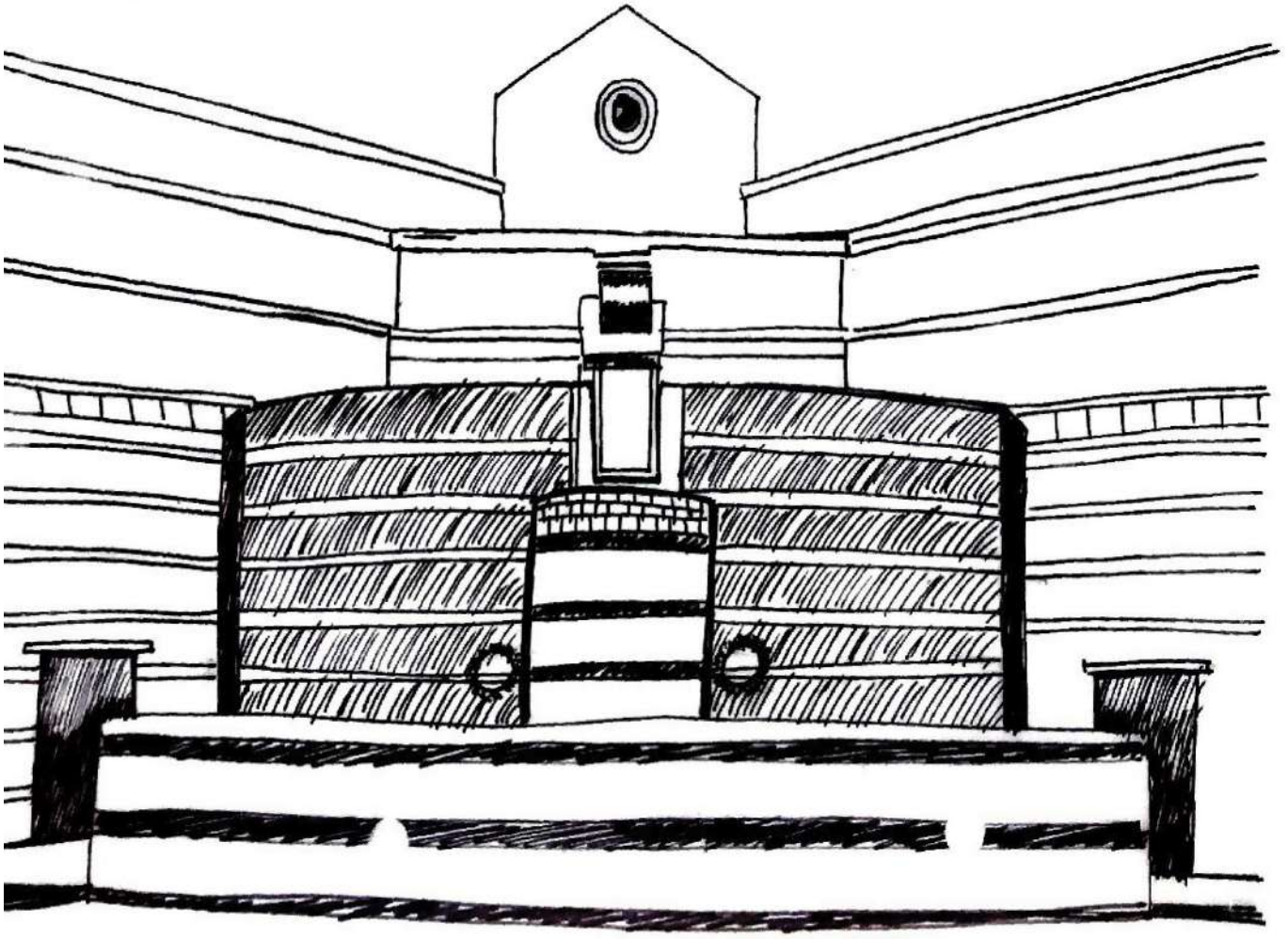
Fig. 3.13: The circular model sketch (Author 2019)

3.8 FUNCTIONAL PRECEDENT

The functional precedent studied was Jo Noero's St Paul's Anglican Church in White City, Soweto (1984). The church functions as a central core for social services and community gatherings.

The circular design ensures no person is seated further than 12 m away from the altar. In order to achieve this radial design the church was constructed out of concrete blocks and bricks forming light and dark bands.

The proposed dissertation design functions around the service route that forms the core of the building that houses the main functions.



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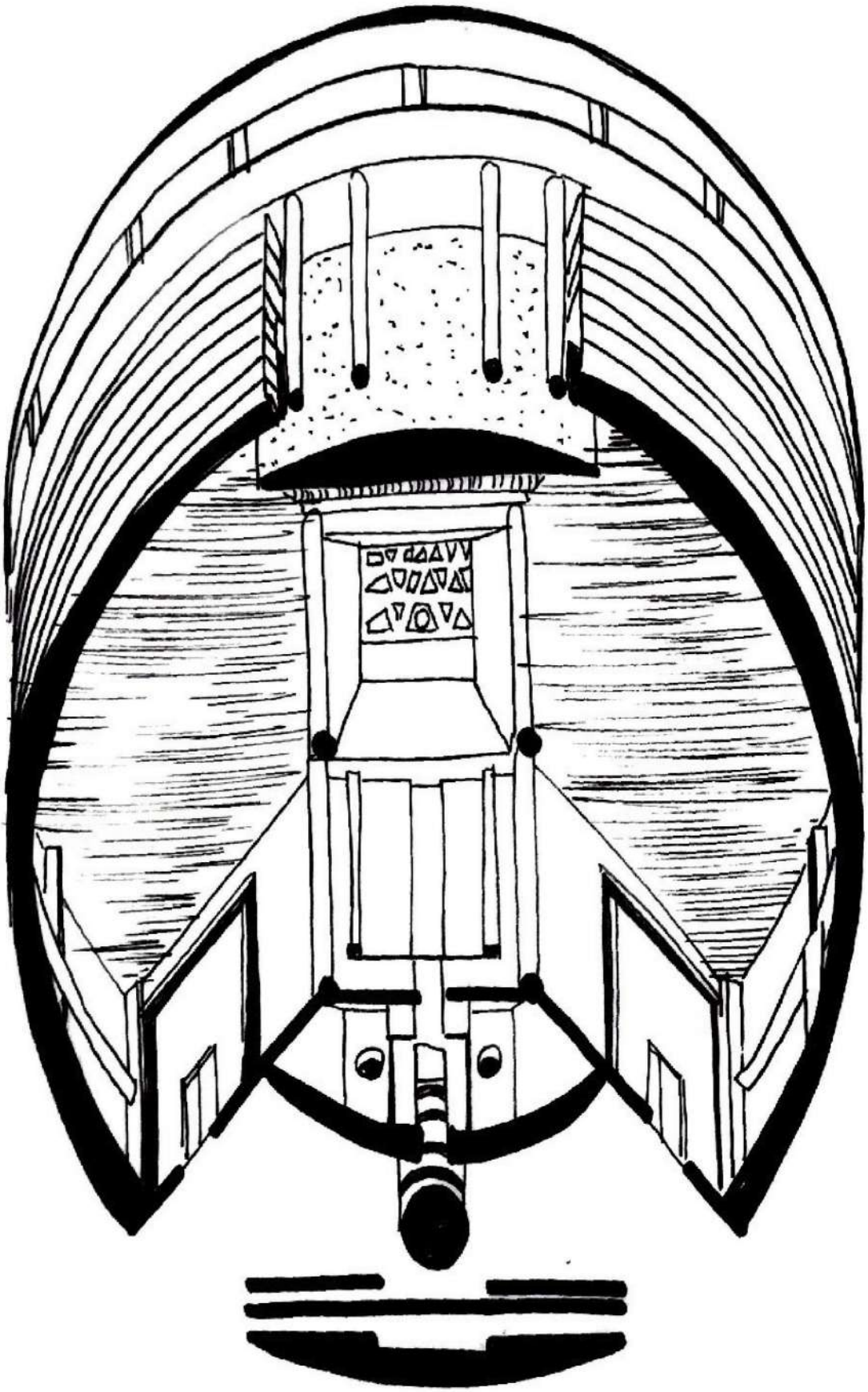


Fig. 3.10: Functional precedent: Jo Noero (Author 2019)

THEORY

Fig. 2.16.10: Existing site and ‘lost space’

4.1 THEORETICAL ARGUMENT

Fig. 4.1: Existing site and 'lost space' Sketch (Author 2019)

THEORETICAL ARGUMENT

Today's cities, suburbs and townships contain vibrant informal trade and service exchange activities; however, there are many spaces that had a purpose in the past but which have now become lost spaces (Sennett 1990).

The notion of 'lost space' was defined by Roger Trancik in his book Finding lost space (1986), in which he mentions that the term lost space refers to deteriorating or underused spaces which provide uncountable opportunities, as they have the potential to house a multitude of uses and promote suburbanization (Trancik 1986:2). Suburbanism results when a population shift takes place from bustling cities towards smaller towns or suburbs, and residents choose to commute to their places of work with the intention of living away from urban crime and where land is less expensive.

What are lost spaces?

According to Trancik (1986), lost space is defined as any land that is not maintained, such as abandoned yards, industrial complexes, empty military sites, and even public housing projects that need to be rebuilt because they no longer meet their intended purpose (Trancik 1986:4). In summary, lost space can be classified as antispace without a recognisable purpose which, in turn, has the potential to make a positive contribution and offer benefit to the surrounding communities.

Richard Sennet (1990), Centennial Professor of Sociology at the London School of Economics, highlights the notion of being aware and engaging with one's surroundings while being present in the moment. In his book The conscience of the eye: the design and social life of cities, he emphasises the blandness of cities, as their walls act as divisions that cut off the poorer neighbourhoods from the city. The chosen site in Mamelodi is situated between an industrial city and the 'poorer neighbourhood', clearly separated by a train track. Sennet proposes the idea of linking these two parts by revitalizing the 'reality of the outside, as a dimension of human experience'. Due to this reality of the outside, it is essential to include an outside gathering space which transitions pedestrians from the industrial sector towards the poorer neighbourhood (Sennet 1990).

THE LINKAGE THEORY

Trancik describes the linkage theory as the connection of lines within a city to a spatial datum design. This spatial design relates to q building edge, the flow of movement or even site lines. Linkage essentially is the connecting of all layers within a city or area thus creating a physical form. Trancik describes three primary forms of linkage in urban spaces as compositional forms, mega forms and group forms (Trancik 1986:106-107).

Fig 4.1.1: Compositional form: a single building which is compiled on a two-dimensional plane. This urban form implies spatial linkage rather than physical linkage. (Trancik)(Adapted by Author, 2019)

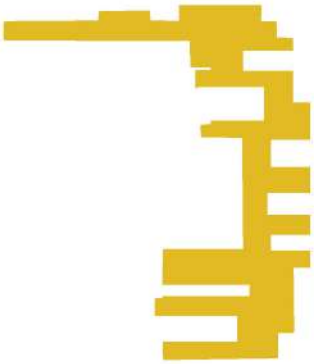


Fig 4.1.2: Mega form: Through a linea framework, physical structures are connected as it forms an open-ended system. During the 1950s to 1960s these forms were very popular. (Trancik) (Adapted by Author, 2019)

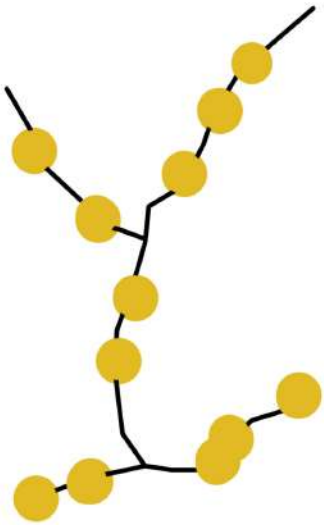


Fig 4.1.3: Group form: This linkage is organic in nature and contains an accumulation of open spaces. Historically villlages and towns formed in this manner. (Trancik) (Adapted by Author, 2019)

4.2 THE THEORETICAL APPROACH

The proposed design is for a waste upcycling centre that would uplift the community and provide educational night classes. Building materials will be manufactured through the upcycling of waste such as paper, plastic and glass, and will be used within the context of Mamelodi. In his book The everyday and everydayness (1987), Henri Lefebvre writes about the forms, functions and structures that have always existed. These include hierarchical functions such as private spaces transitioning towards public openness. For this dissertation design the focus will be placed on the hierarchy of spaces, as the 'collection and recycling process' of waste would be private and will transition towards the 'education process', which will take place in the semi-private area. The 'making process' will be displayed to visitors in the semi-public areas, and the 'selling process' will take place in the public area.

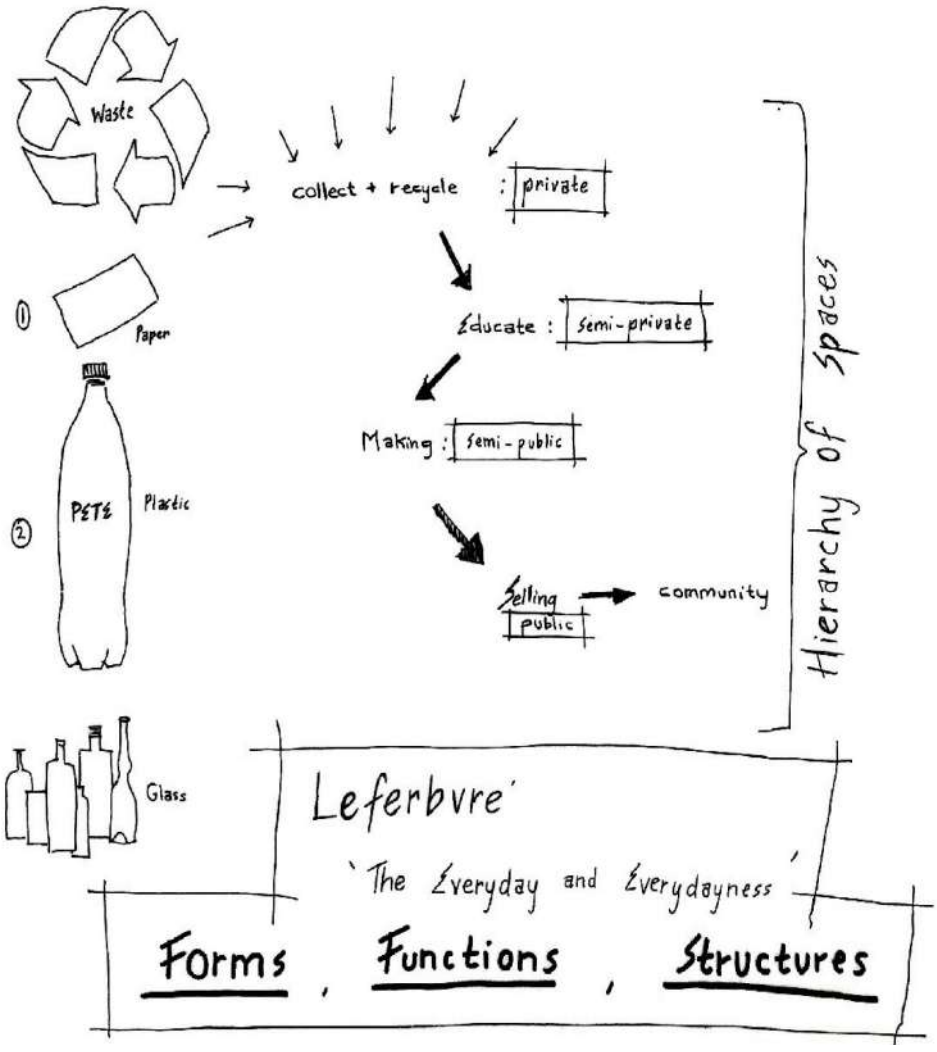
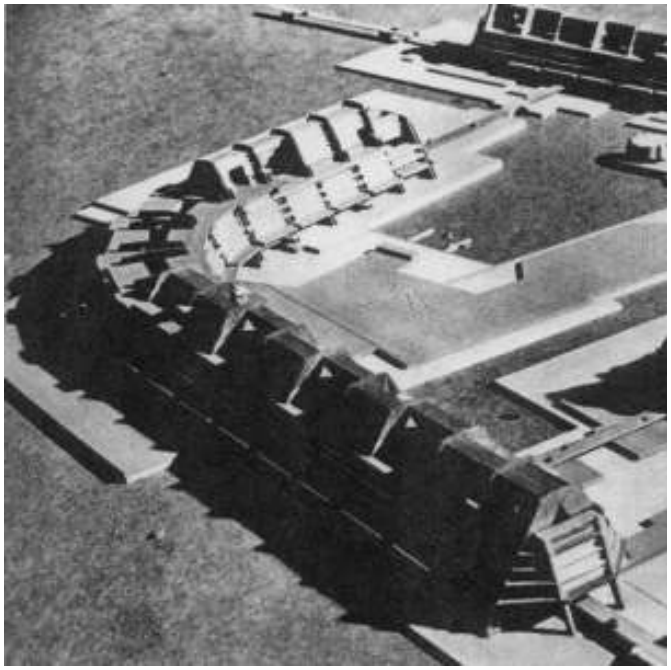


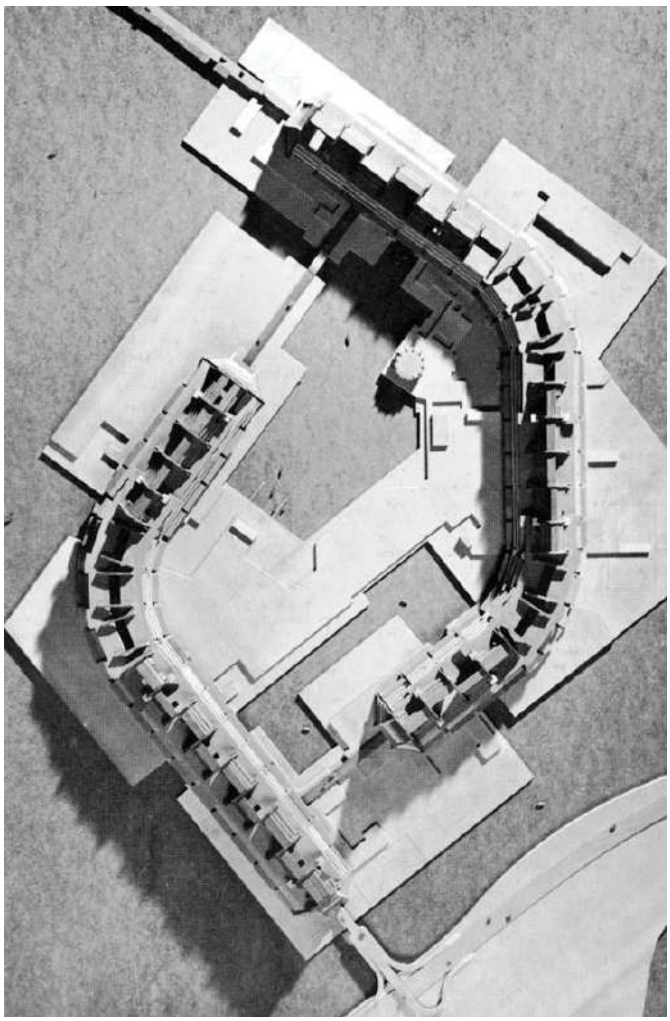
Fig. 4.2: Hierarchy of spaces. (Lefebvre) (Author 2019)

4.3 THEORETICAL PRECEDENTS

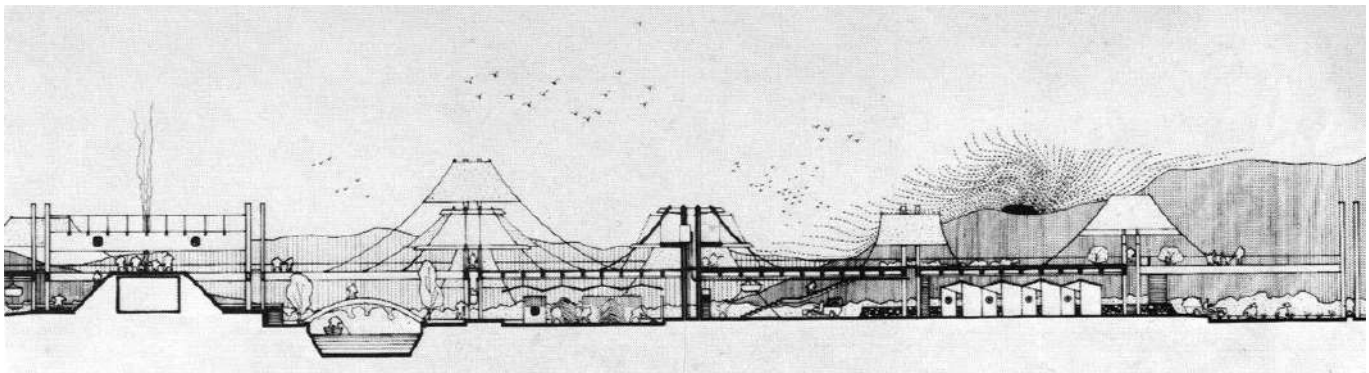
During the 1960s the linkage theory was extremely popular in the Kenzo Tange's designs. The project titled, New Community explores the possibilities of megastructures. This megaform incorporated horizontal linkages however lacked the potential of open outdoor spaces (Trancik 1986:108).

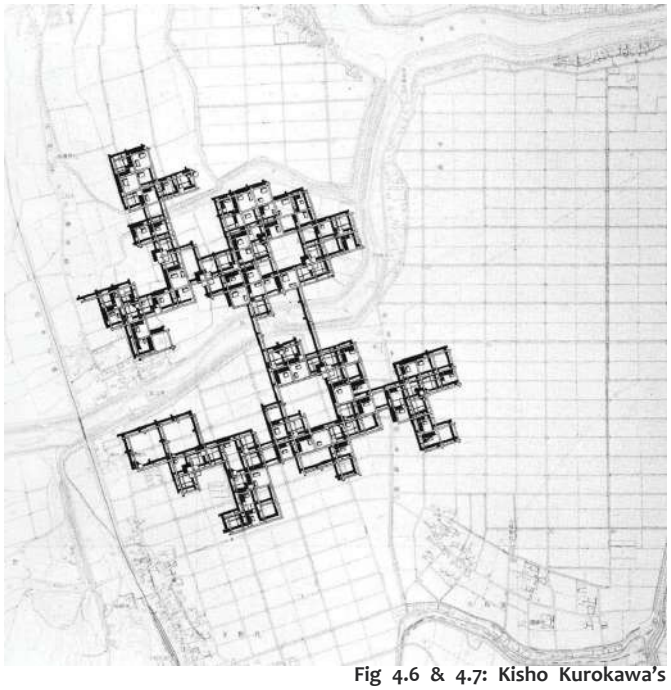
Fig 4.3 , 4.4 & 4.5: Kenzo Tange, Noriaki Kurokawa & the MIT students 1906 (Trancik 1986:108).





Another example of linkage theory is Kisho Kurokawa's Agricultural City designed in 1960. A grid structure of 500 x 500m which incorporated 100 x 100m blocks by which 200 people would fit per block was designed. This new agricultural town design was intended to be in Aichi which had previously been destroyed by the Ise Bay Typhoon in 1959. According to Kurokawa the natural growth of a city is dependent on the grid system. The growth of the community organically grows when required which is how the traditional rural settlements of Japanese history developed.





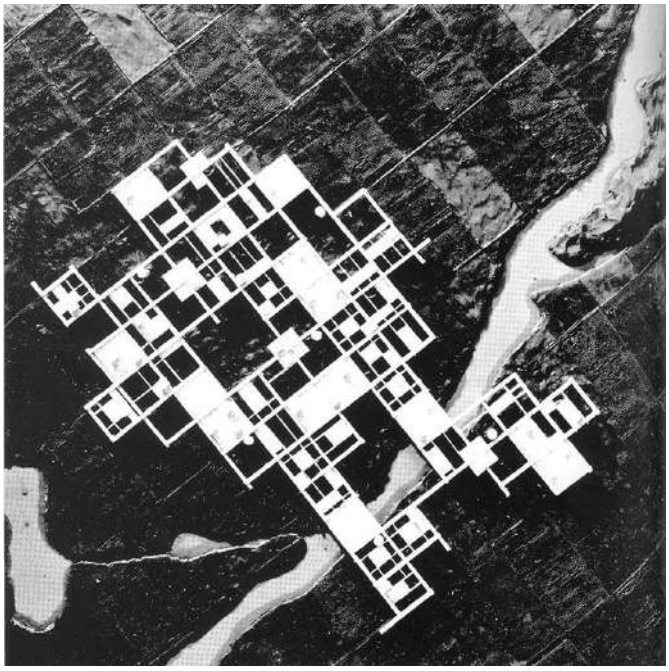


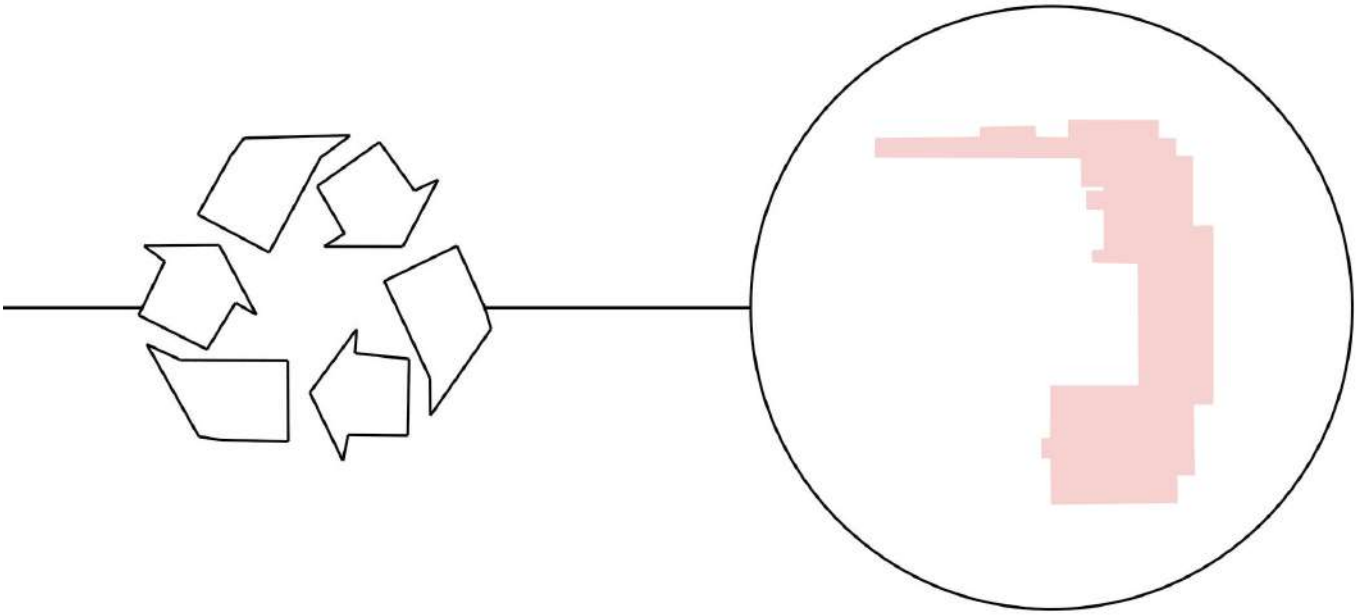
Fig 4.6 & 4.7: Kisho Kurokawa's Agricultural City designed in 1960 (Fabrizi 2015)

In concluson the theory of Lost spaces, although without a recognisable purpose has the potential to make a positive contribution and offer benefit to the surrounding communities. It is essential to document the existing informal activity that takes place in within cities and to design according to the community's needs.

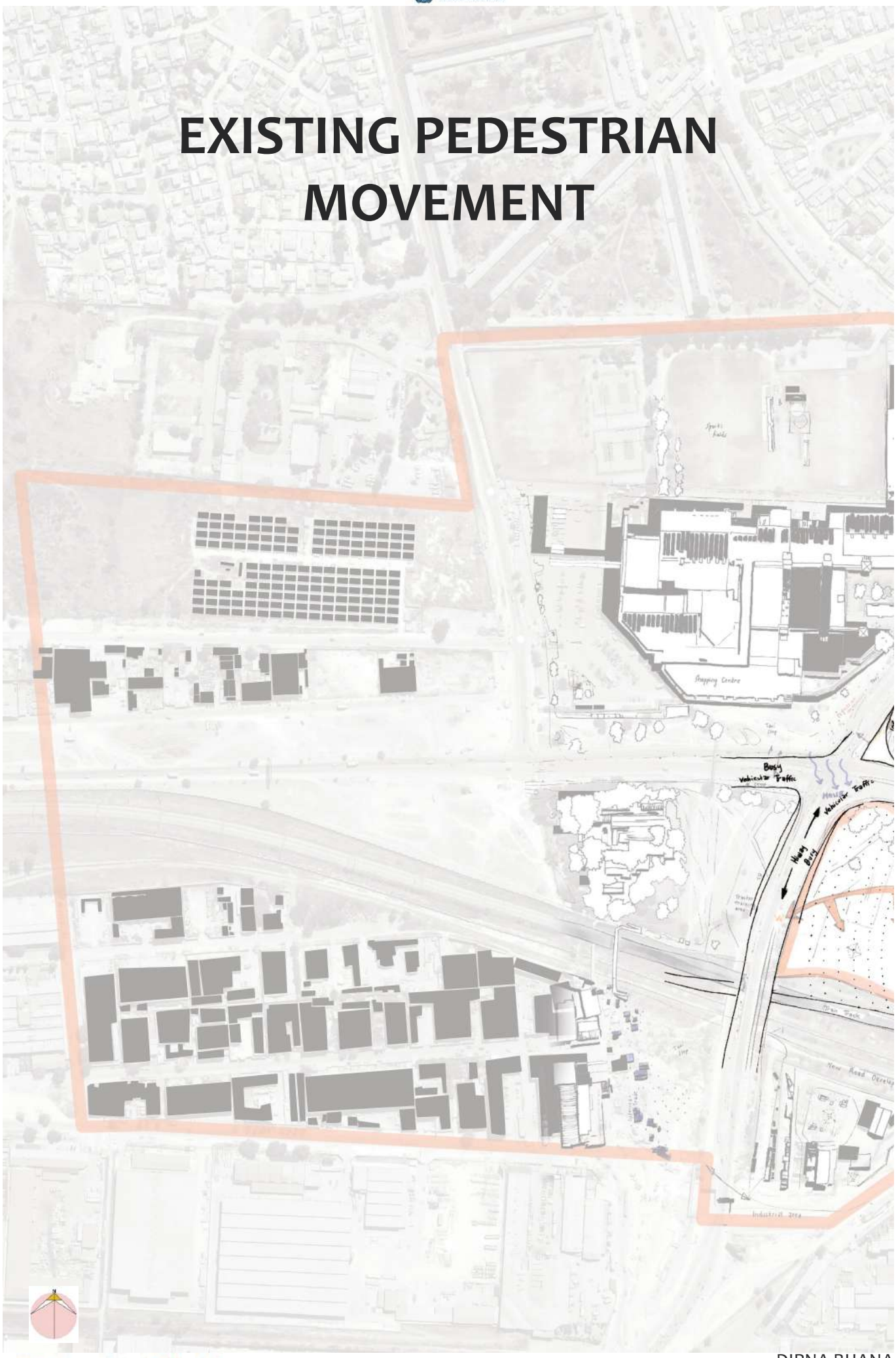
The linkage theory forms a dialogue between spatial networks and all layers within a city or area. In order for a space to adapt to current times, there needs to be a structural system in place that can enable free growth. This structural system in the form of a grid system can extend horizontally through the use of manual assembly.

Both theories work in conjunction to each other and therefore the key is to implement these layers collectively together in order to foresee positive design planning.

CONCEPT



EXISTING PEDESTRIAN MOVEMENT



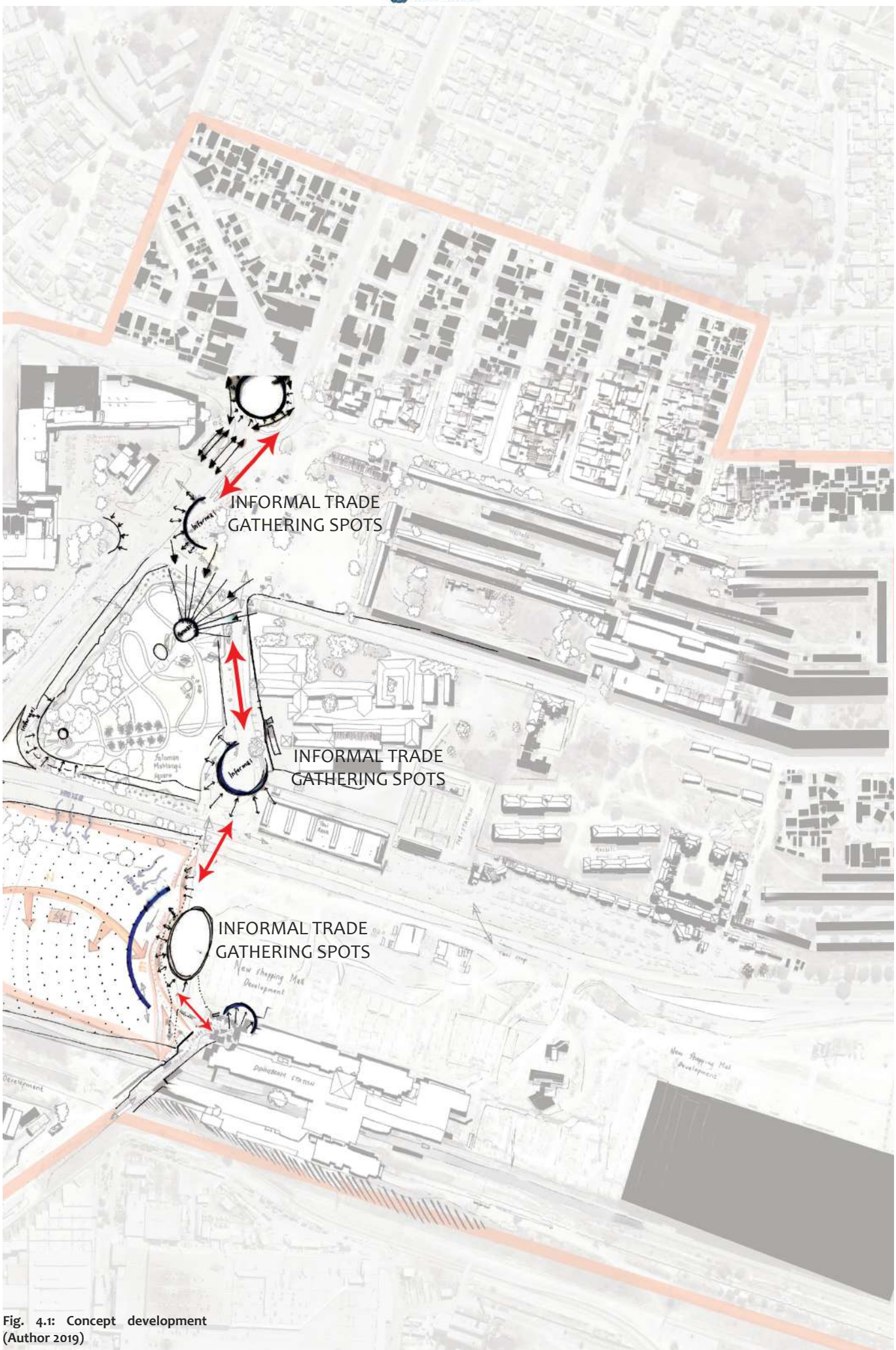


Fig. 4.1: Concept development (Author 2019)

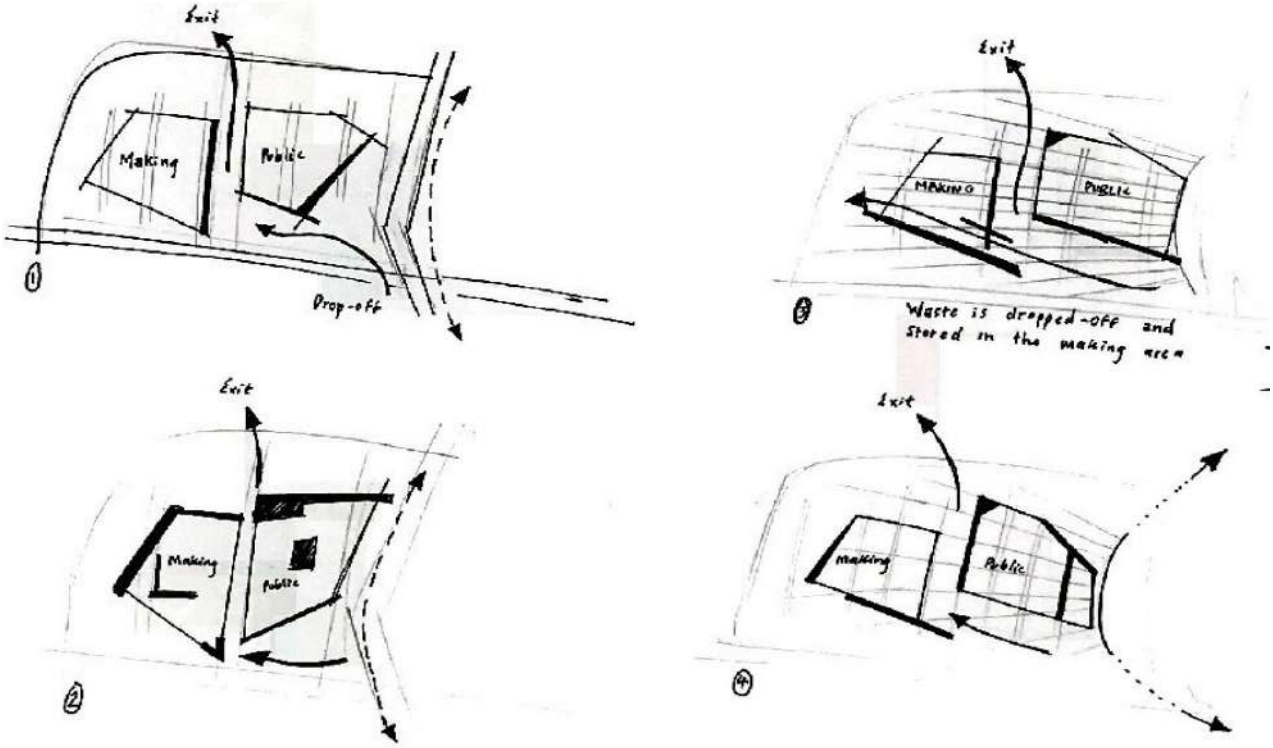


Fig. 4.2: Form dictated by transport and pedestrian movement (Author 2019)

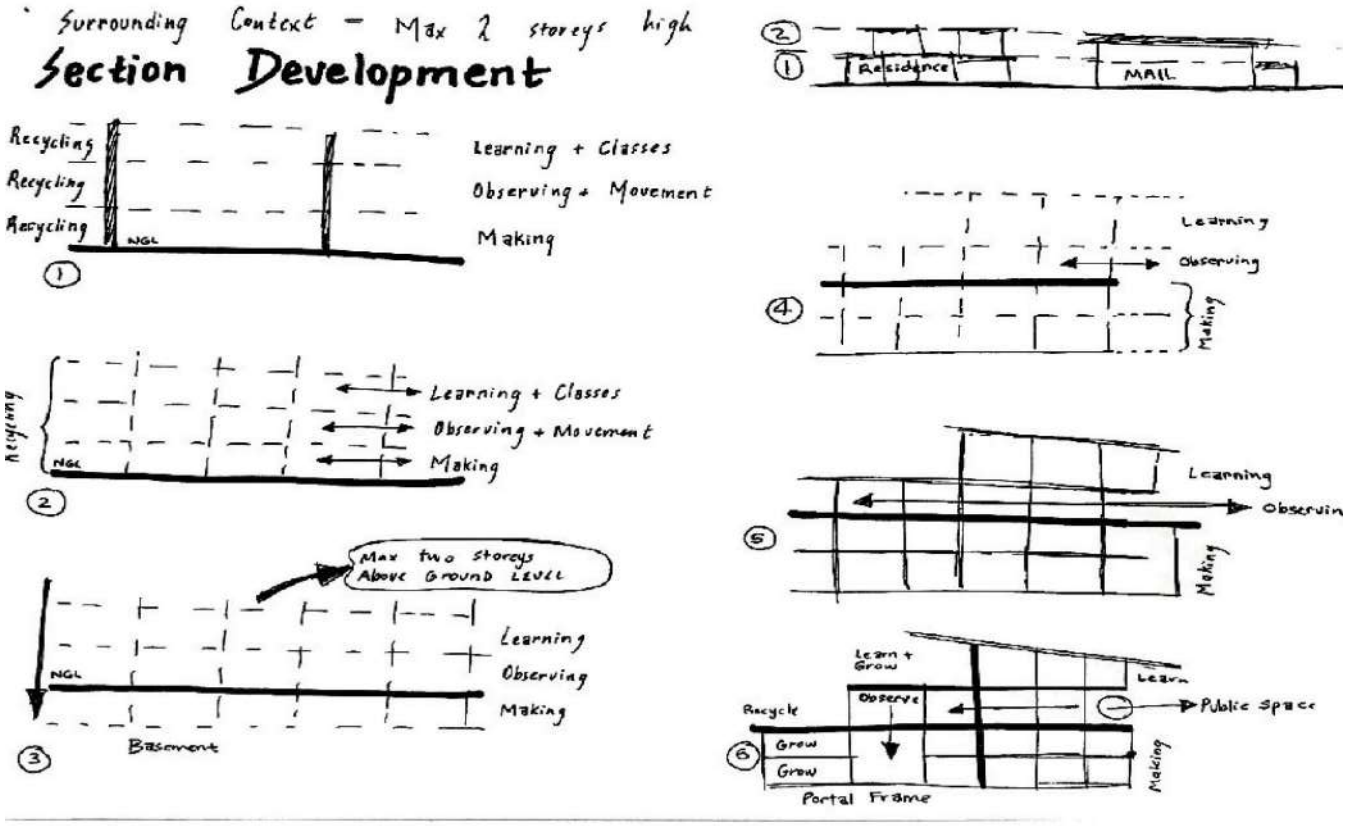


Fig. 4.3: The section development focuses on the inflow and outflow patterns of waste while being cognisant of pedestrian movement as well (Author 2019)

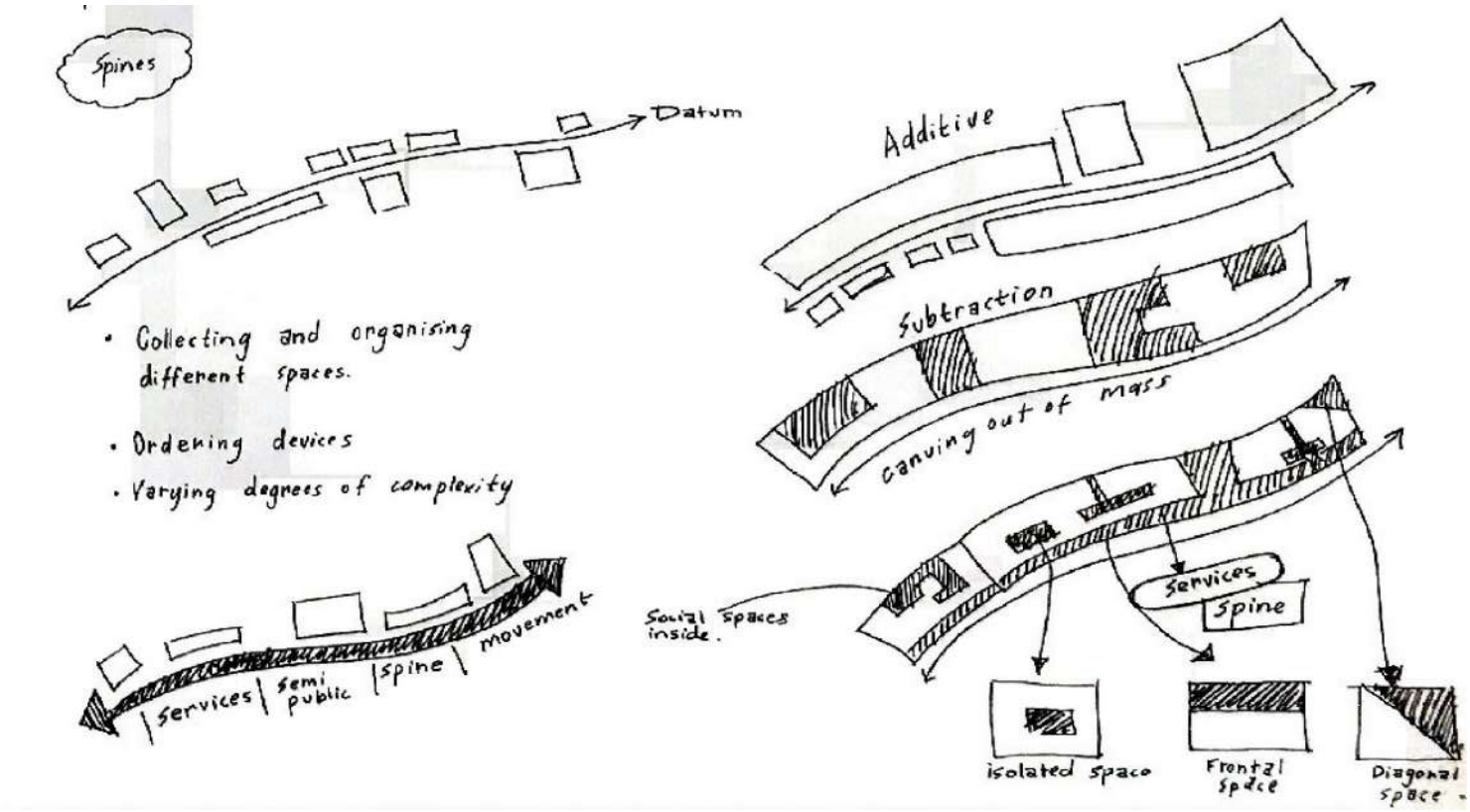


Fig. 4.4: The proposed design function on the service route as the core of the building where the main functions occur (Author 2019)

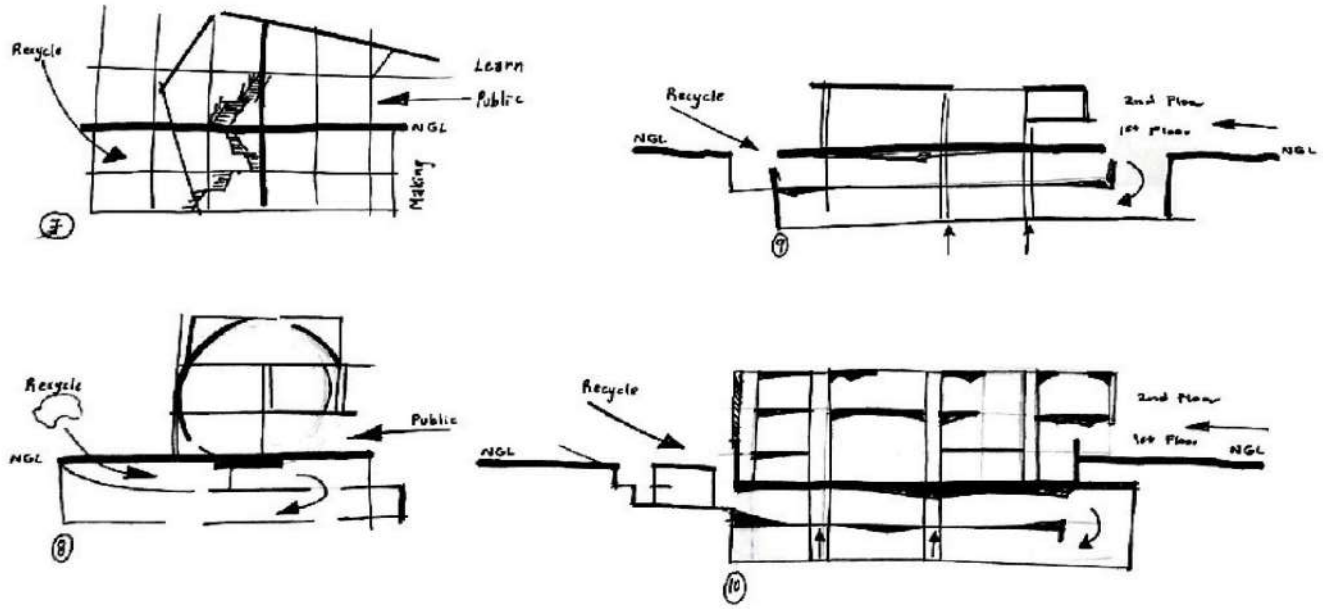


Fig. 4.5: Section development (Author 2019)

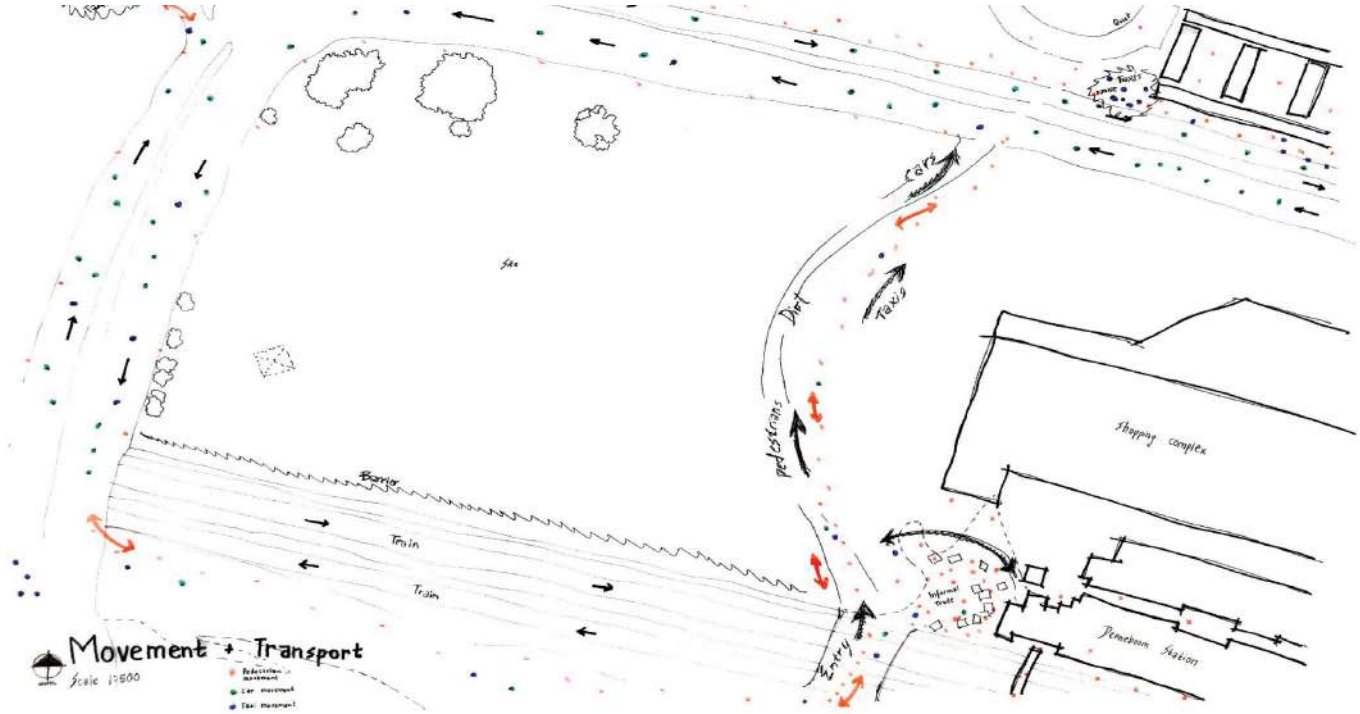


Fig. 4.6: Appropriated land uses and circular movement plan (Author 2019)

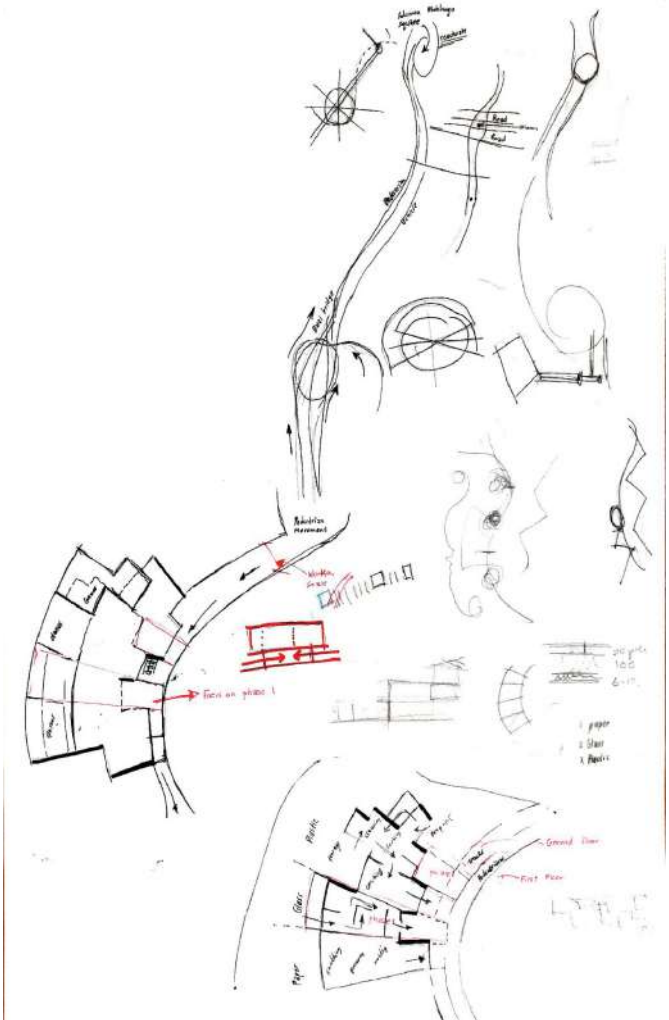


Fig. 4.7: Pedestrian movement informs initial form of building (Author 2019)

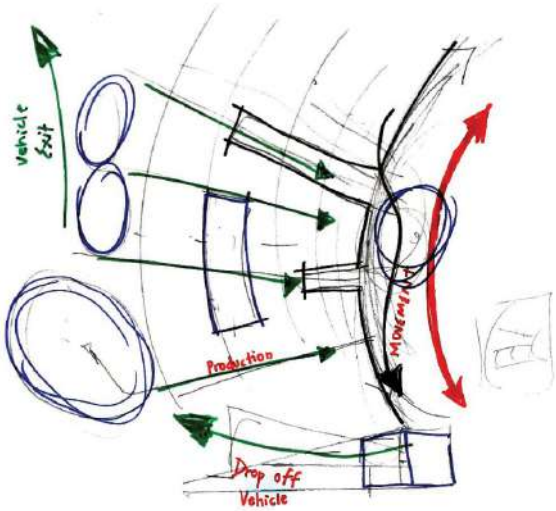


Fig. 4.8: A self-feeding system. Input and output system (AUTHOR 2019)

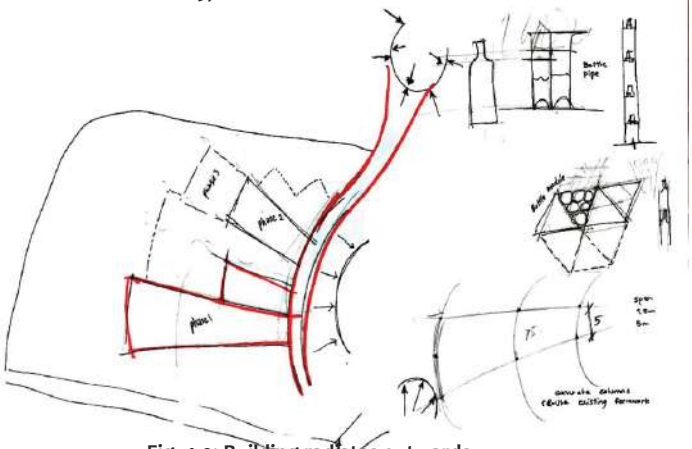


Fig. 4.9: Building radiates outwards as production gives back to community (Author 2019)

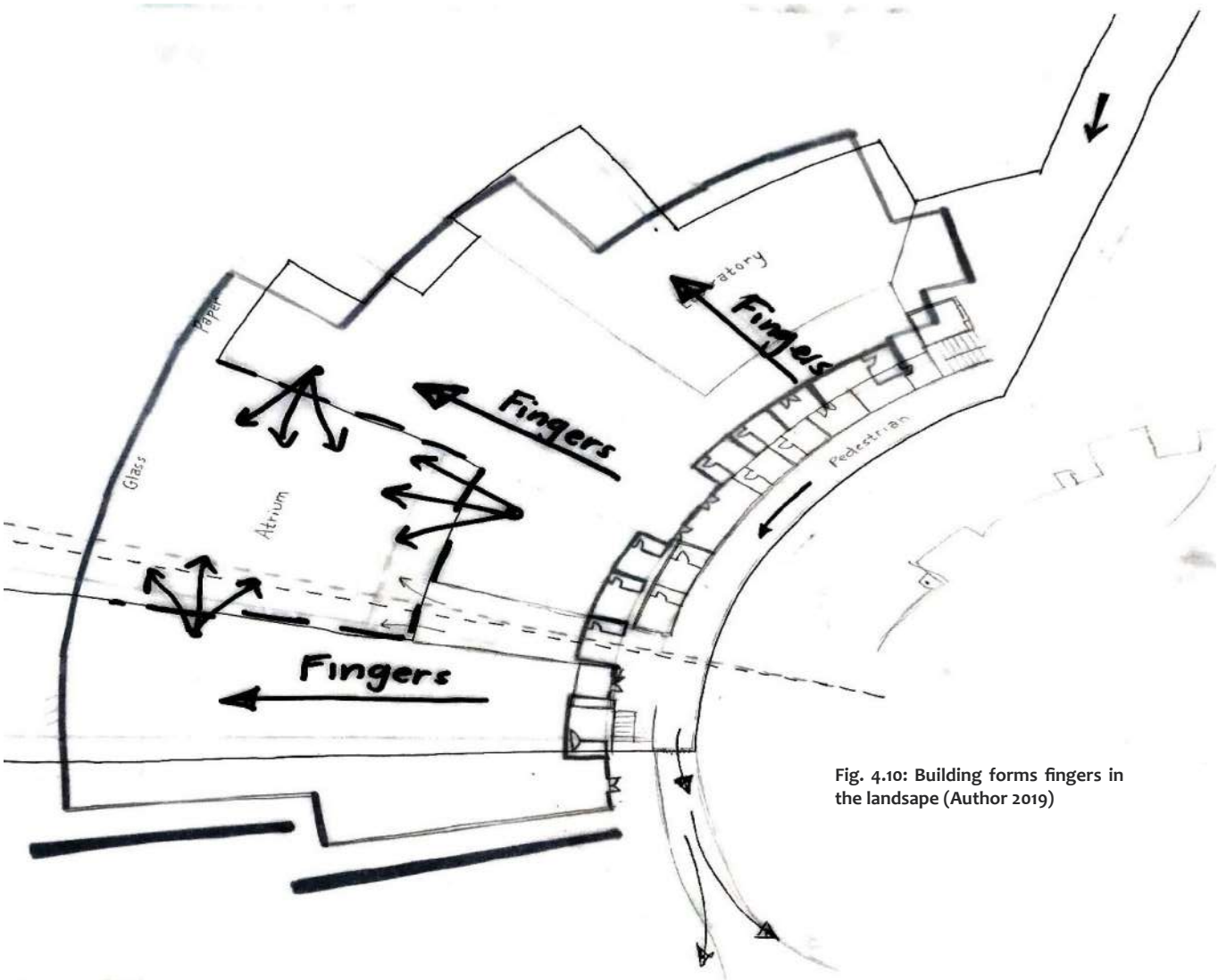


Fig. 4.10: Building forms fingers in the landsape (Author 2019)

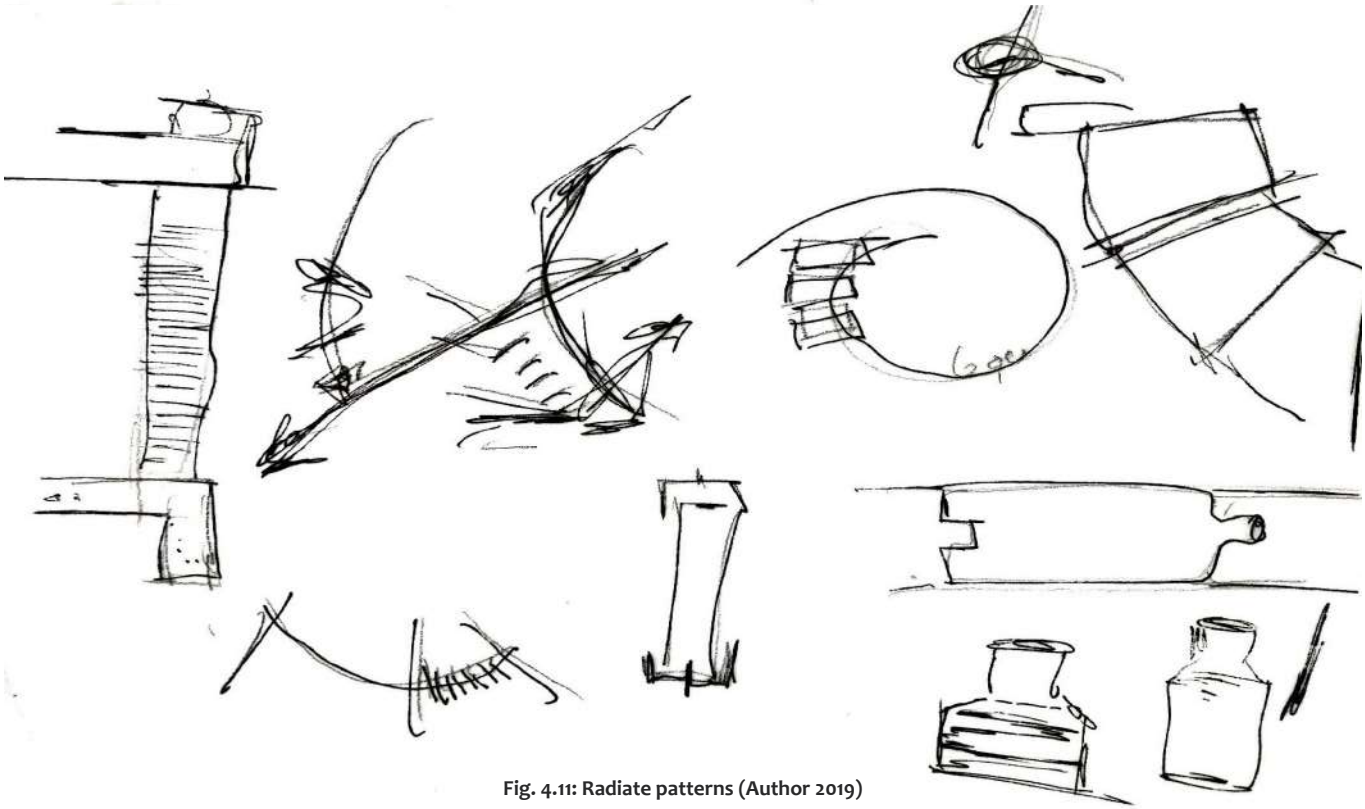


Fig. 4.11: Radiate patterns (Author 2019)

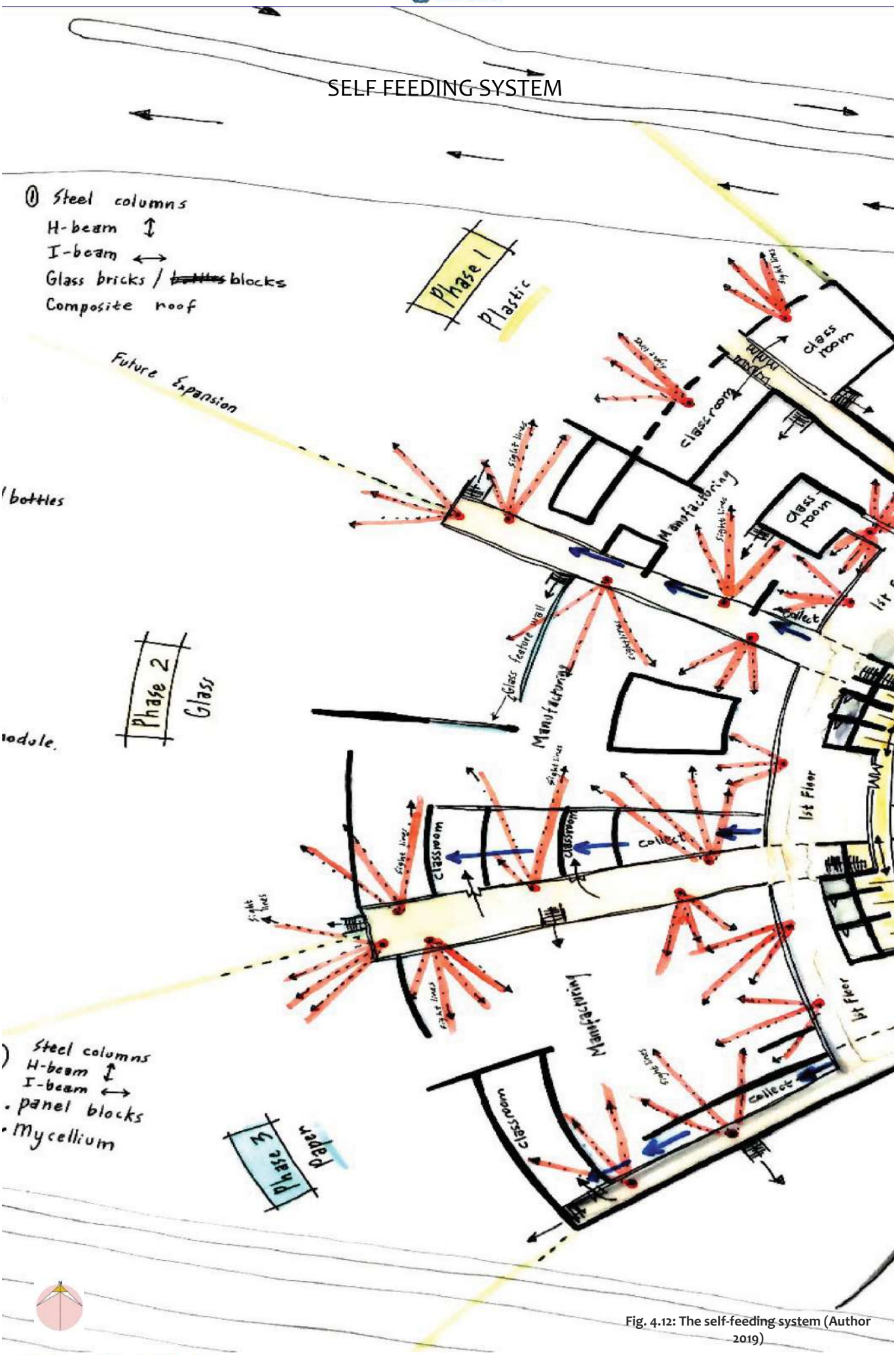
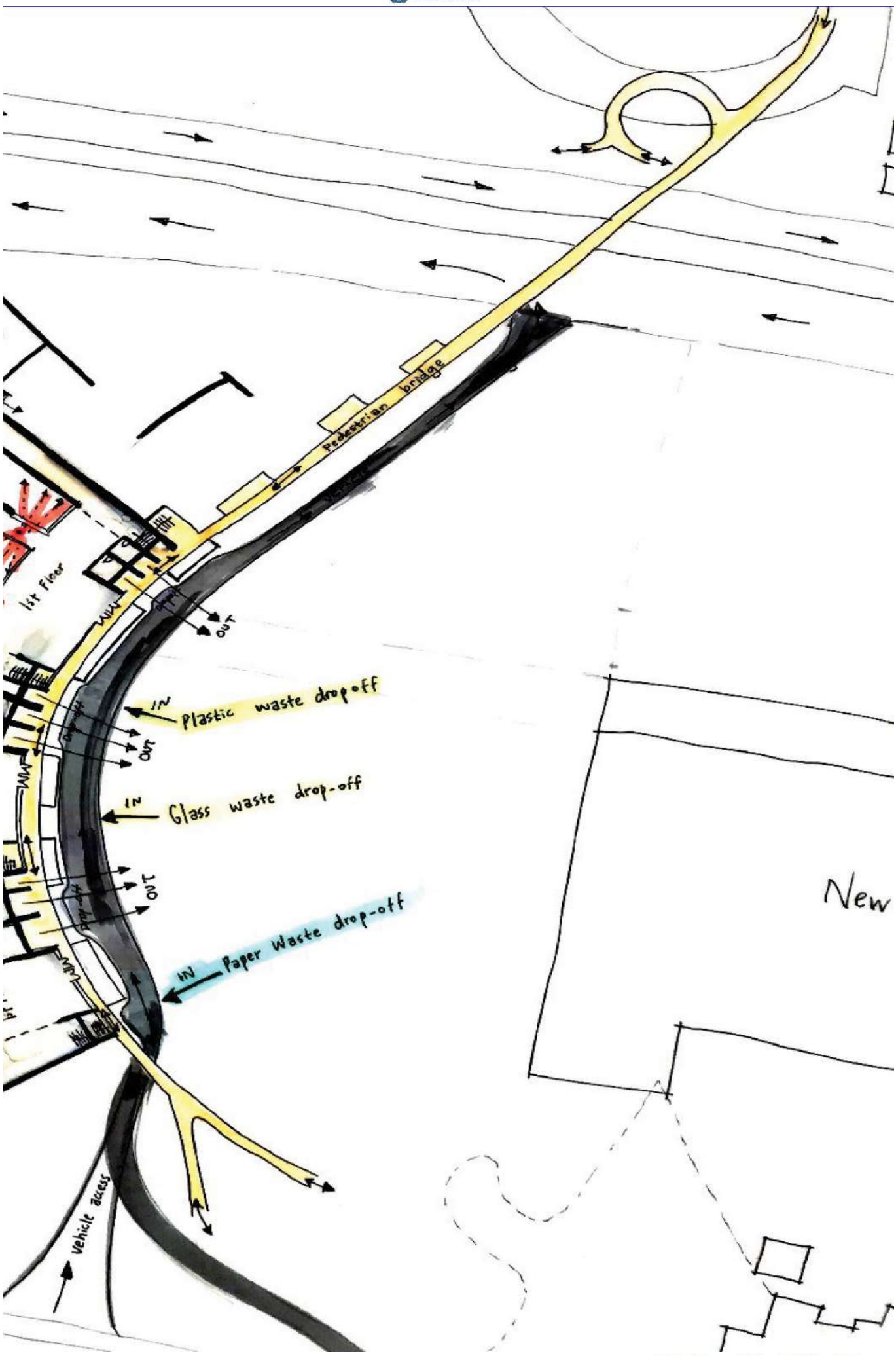
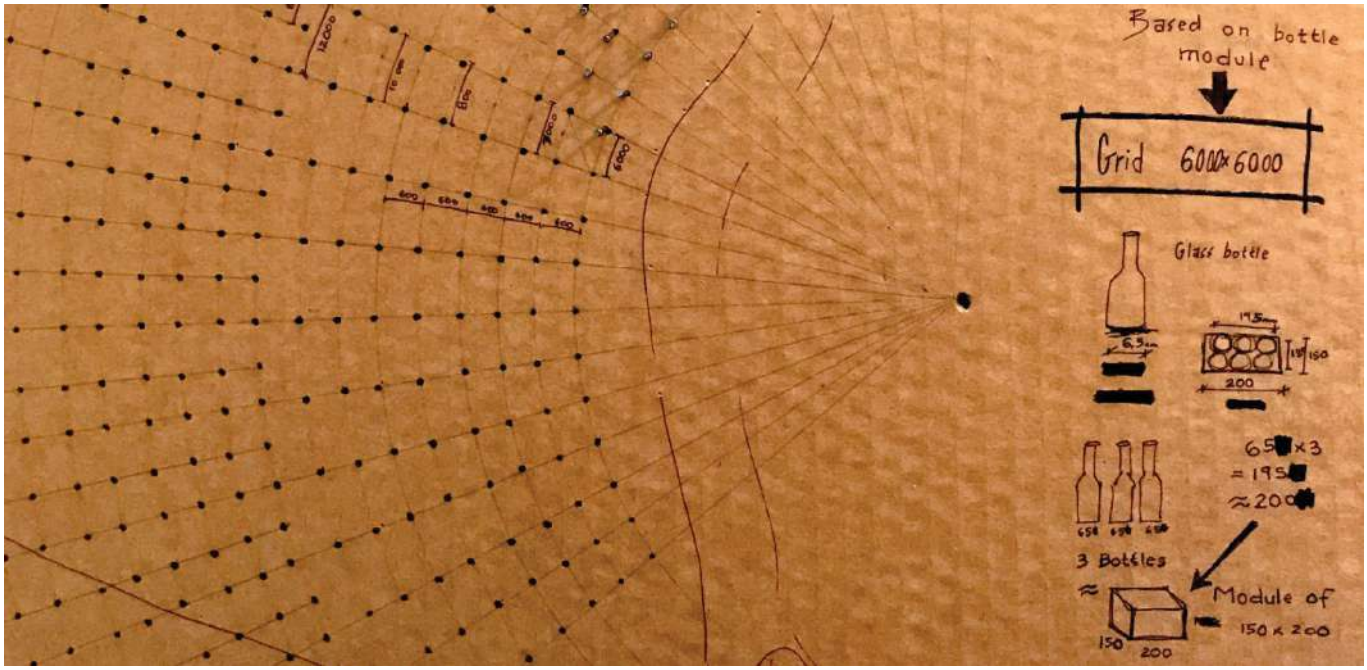


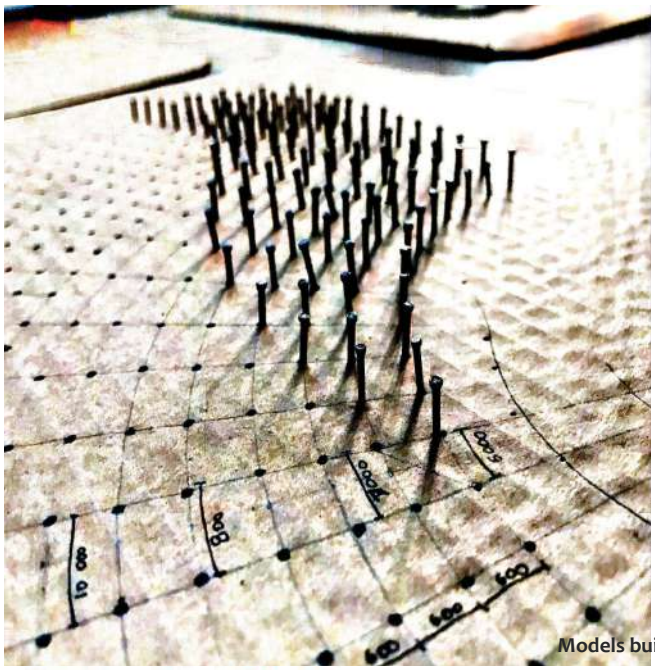
Fig. 4.12: The self-feeding system (Author 2019)

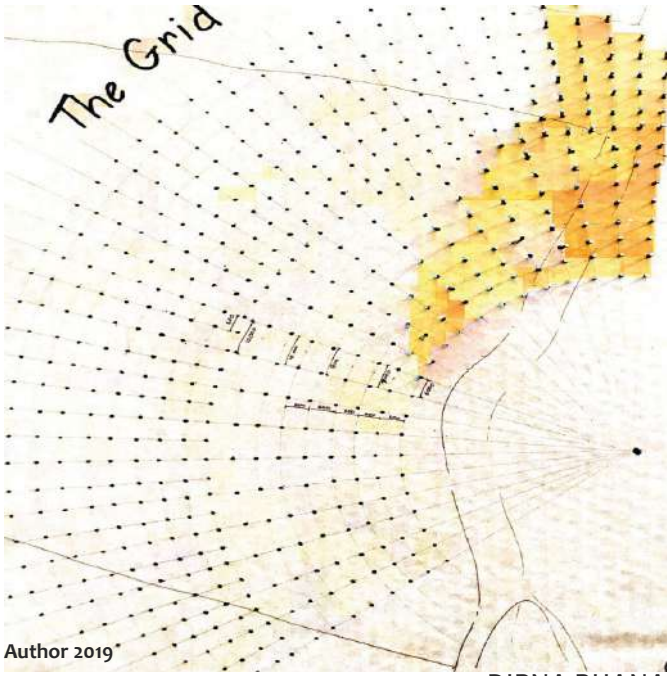


5.1 MODEL DEVELOPMENT

Model 1
The radial grid was derived from the standard sizes of steel as well as vehicles being able to maneuver within the grid.

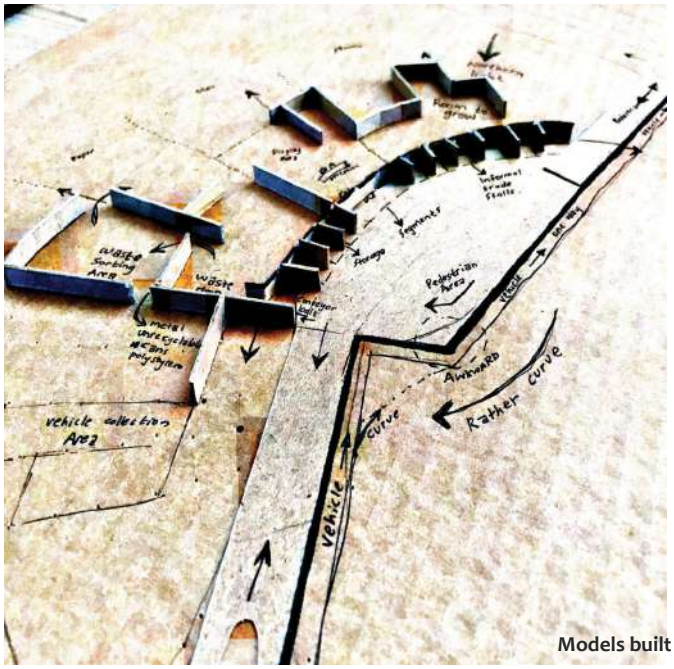




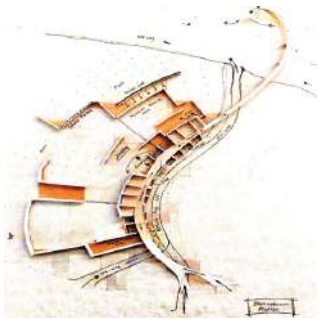


Models built by Author 2019

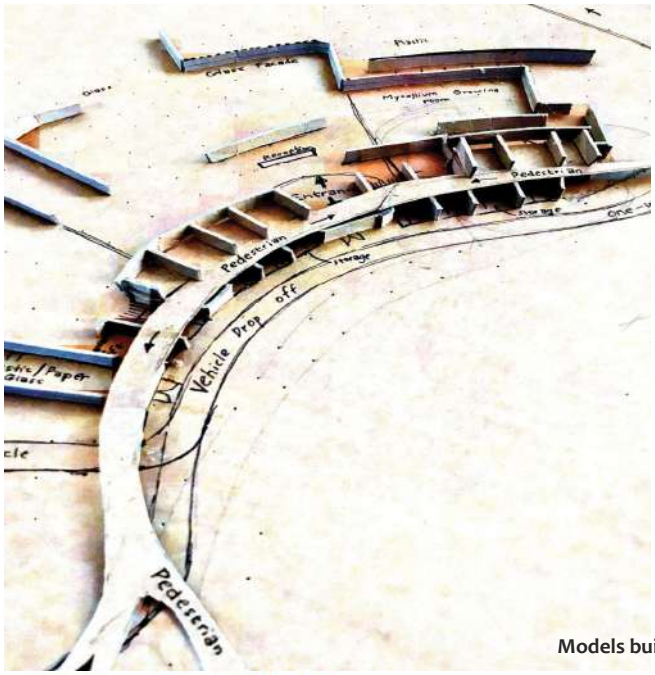
Model 2
The initial design entailed the pedestrians and the vehicles on one level with the three programs branching out as fingers. This finger approach allows for the building to continue to grow in the future as demand and supply grows as well. This design illustrates rigid angles which prove to be awkward.

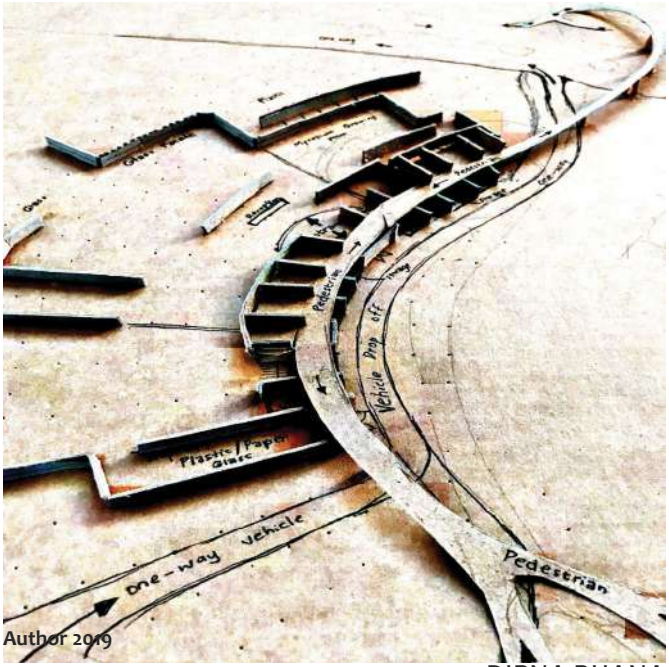


Models built by Author 2019

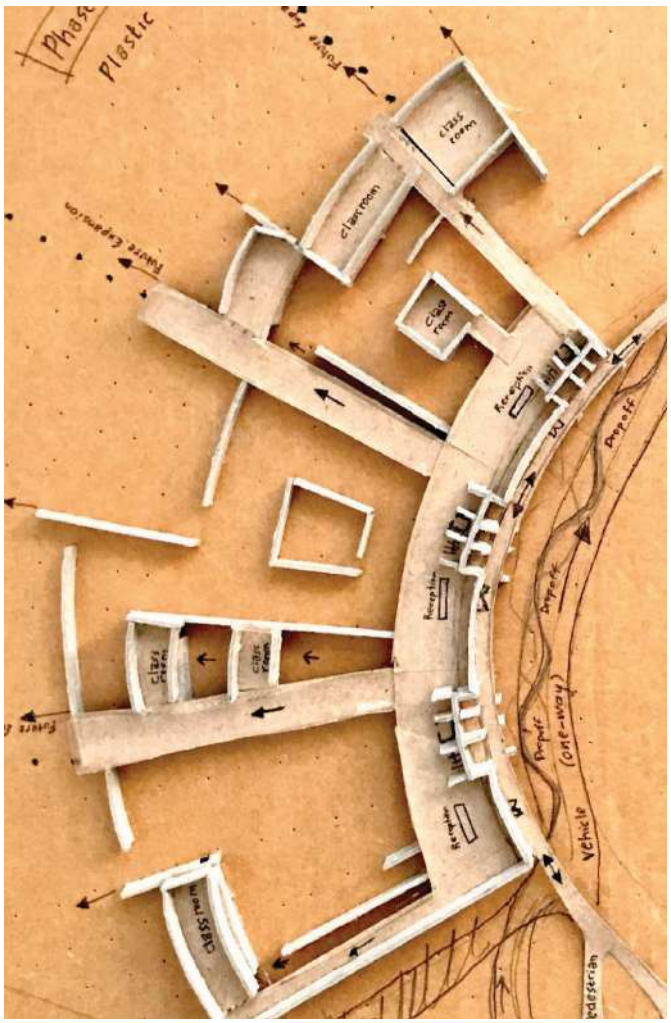


Model 3
This model breaks the pedestrian and the vehiclar levels apart while turning towards a more fluid movement as it leads into a turning circle that is not used by vehicles.

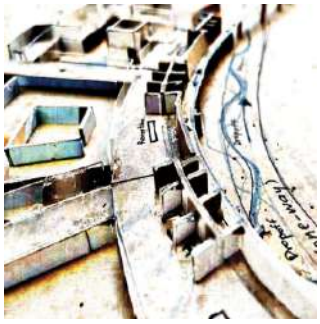


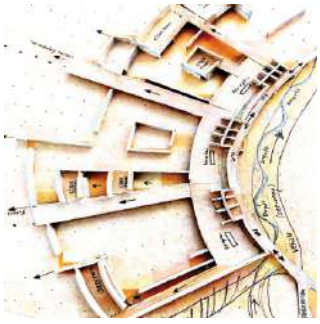


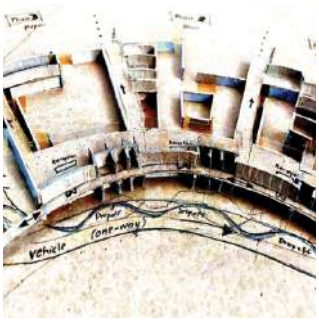
Models built by Author 2019

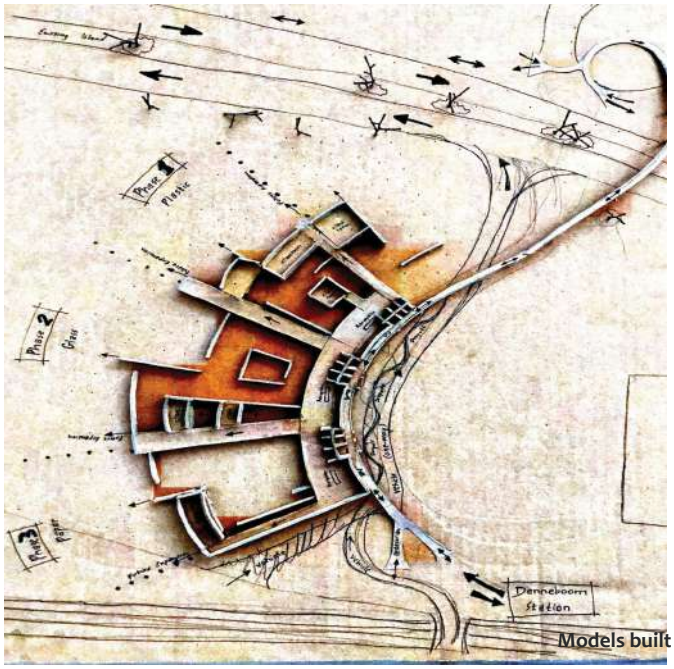


Model 4
This model separates that three programs into phases while phase 1 is where the plastic will be upcycled and has the more room for laboratory and tests. Phase 2 is where glass will be manufactured which requires less room for crushing the glass and phase 3 is where the paper will be upcycled which requires even less room.









Models built by Author 2019

5.1 MODEL DEVELOPMENT

The main issue of the radial form was that it did not address the street condition and edge. Although conceptually the form was dictated by the inflow and outflow scheme, it was not practical in its function.

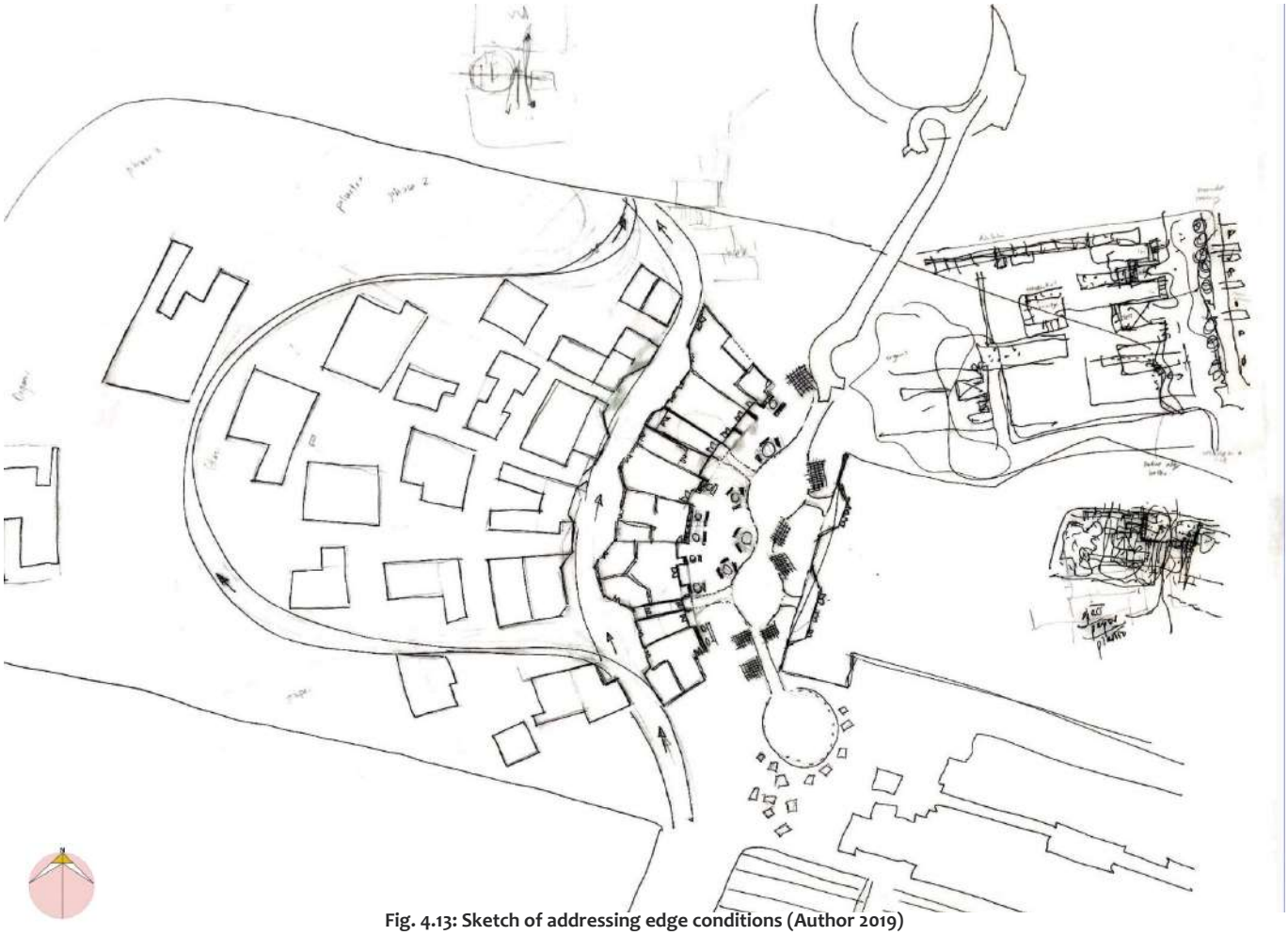


Fig. 4.13: Sketch of addressing edge conditions (Author 2019)

A slightly altered form, which is more functional in its nature, creates a predominant pedestrian area in the centre which easily draws pedestrians from the northern are towards the southern Denneboom station.

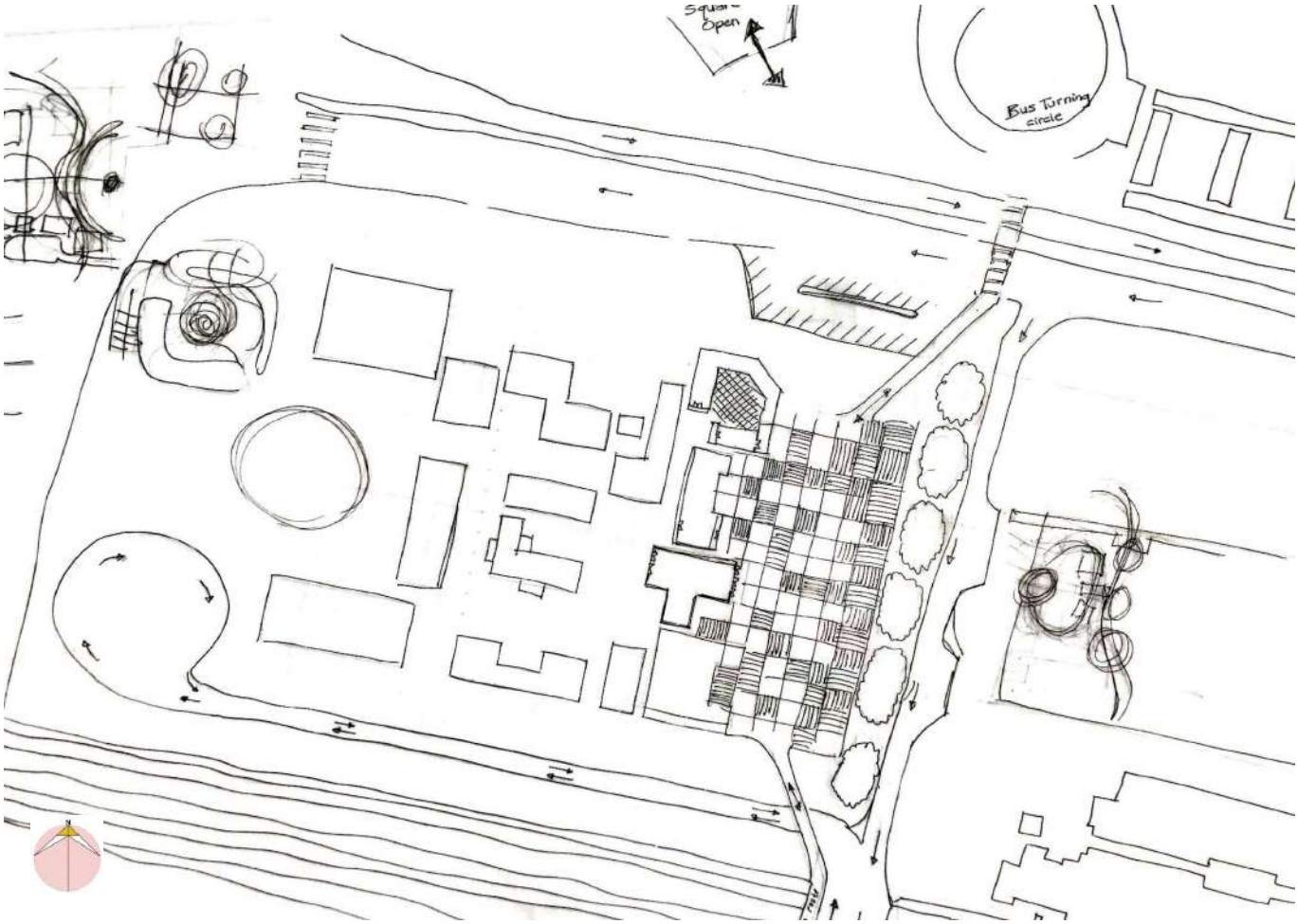


Fig. 4.14: Sketch of addressing edge conditions in its altered form (Author 2019)

5.1 MODEL DEVELOPMENT

The form is designed in order to create small niches along the north-south walkway, where pedestrians are able to stop and purchase groceries and basic necessities that are usually sold in informal trade settings. This new form addresses the northern street condition and pulls pedestrians through the site as they will be attracted to certain shops or products being sold.

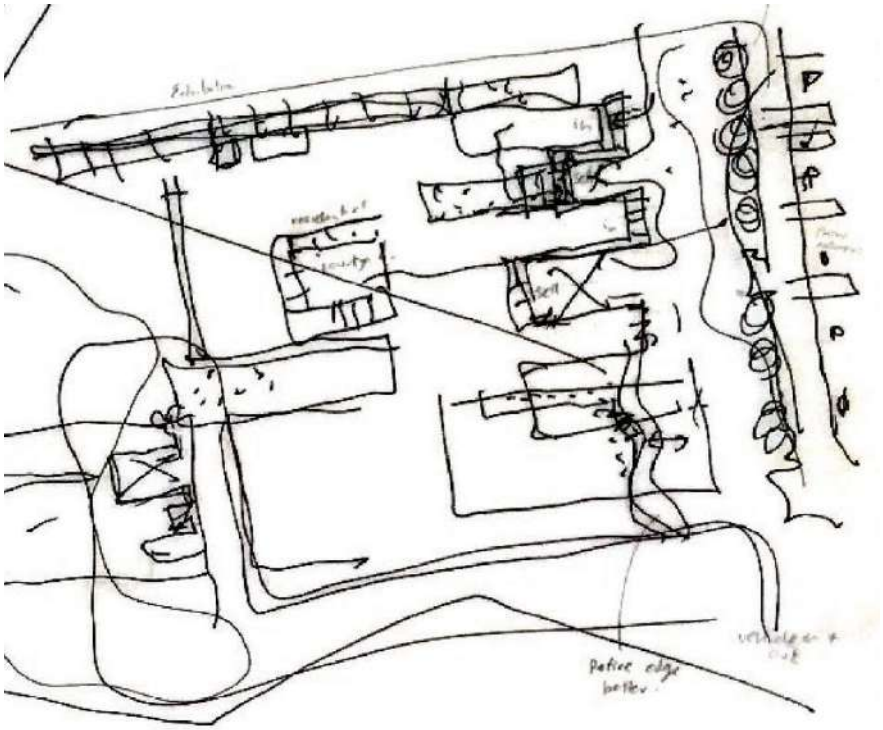
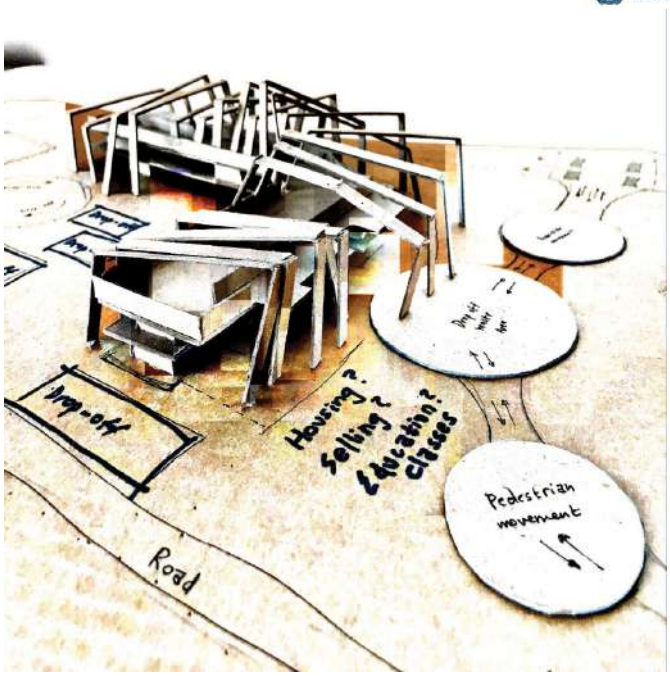
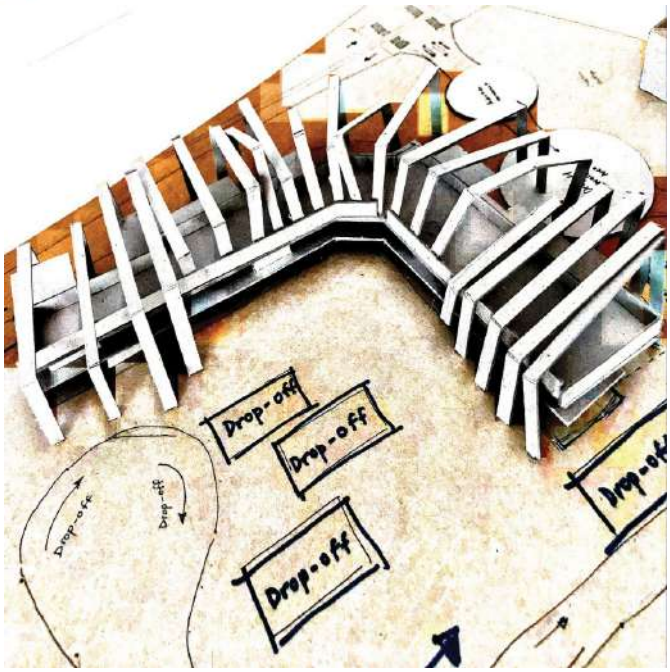
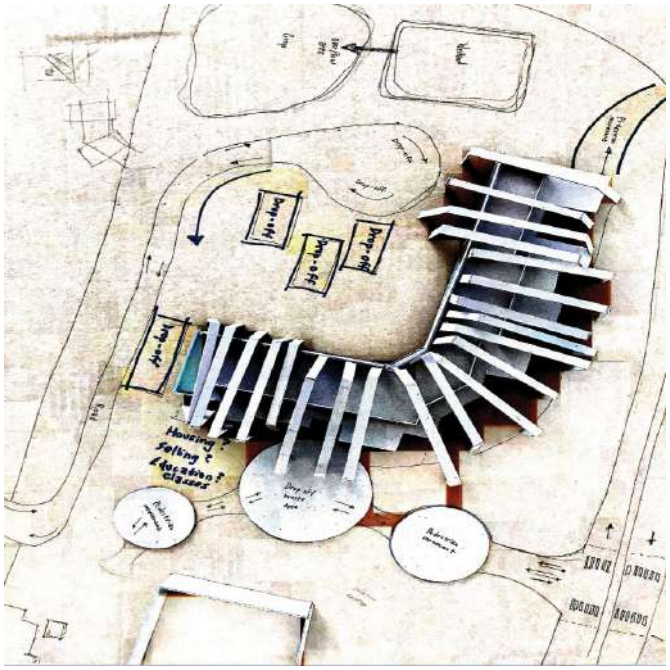
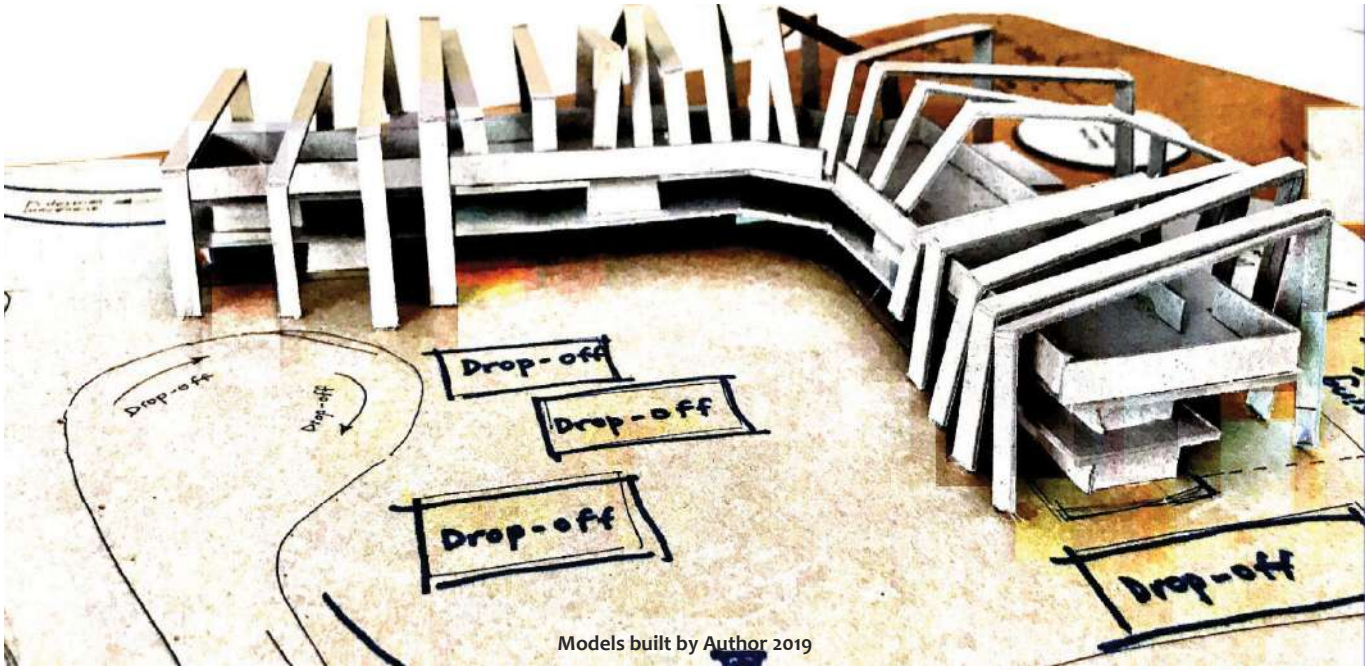


Fig. 4.13: Sketch of addressing north and east edge conditions (Author 2019)









Models built by Author 2019

5.1 MODEL DEVELOPMENT

The breaking up of solid forms was the initial urban vision concept which allows for courtyard recreational areas as well as more green niches that are situated between masses.

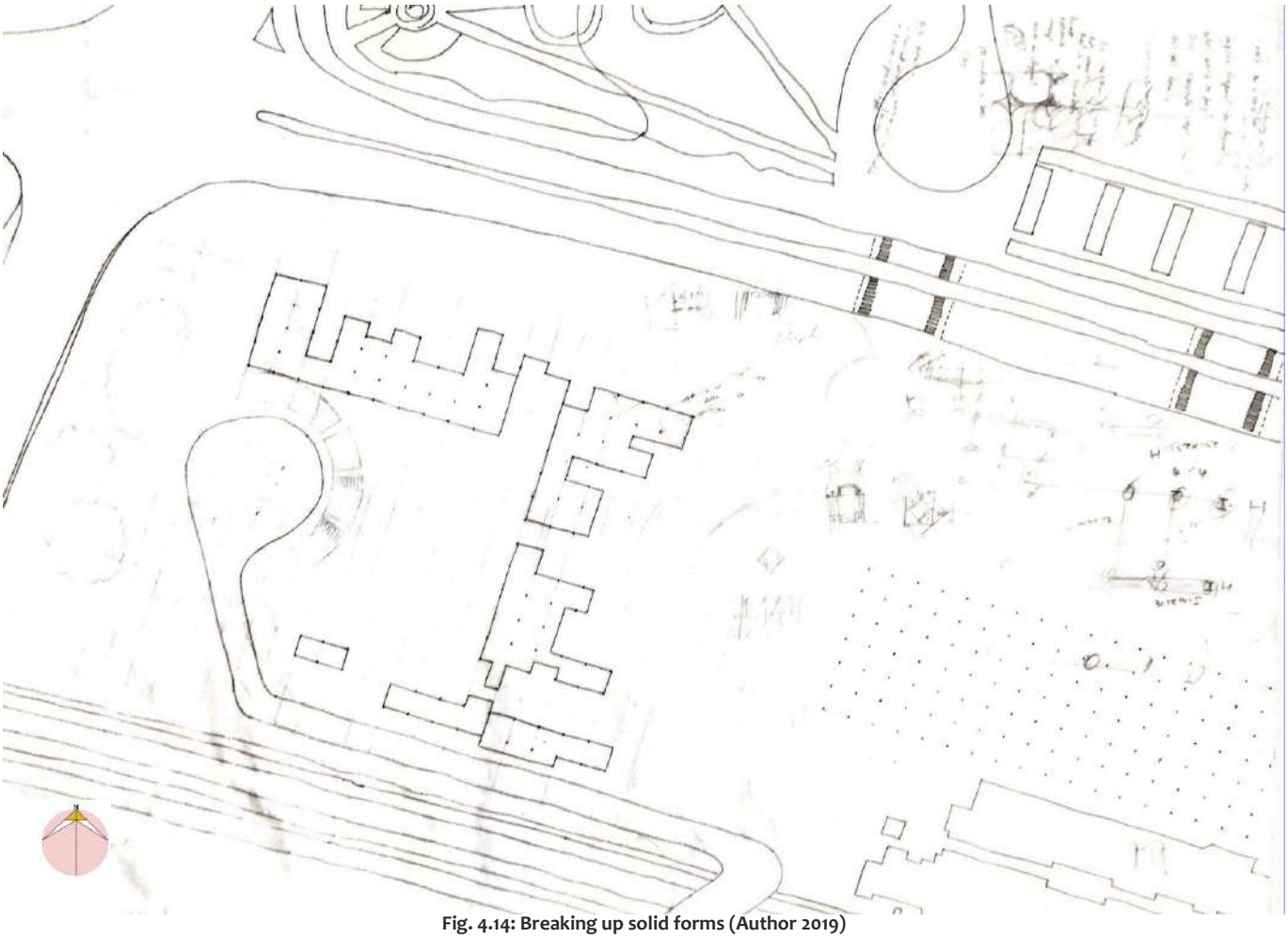


Fig. 4.14: Breaking up solid forms (Author 2019)

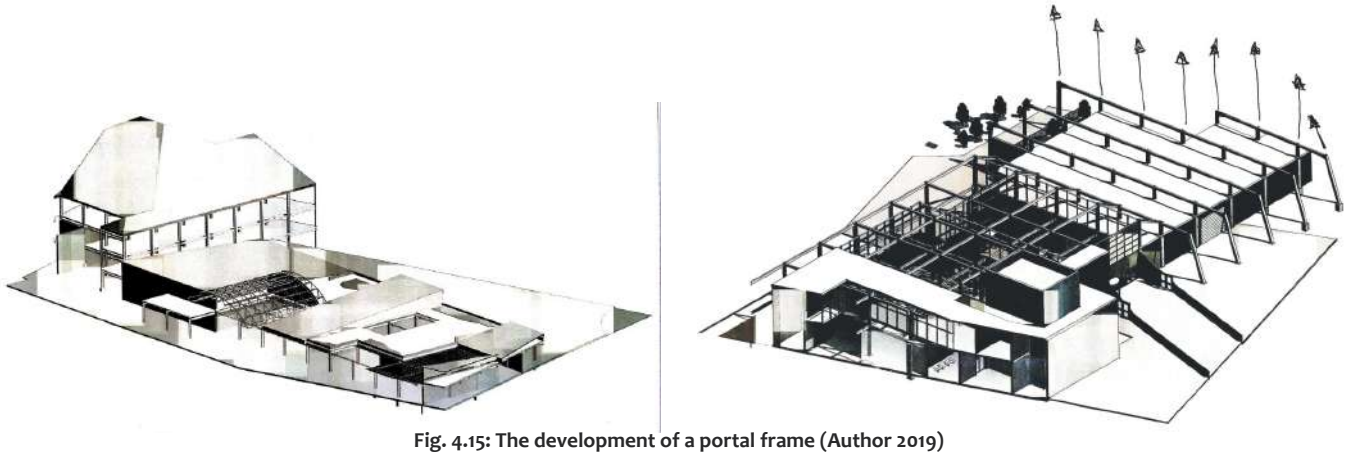
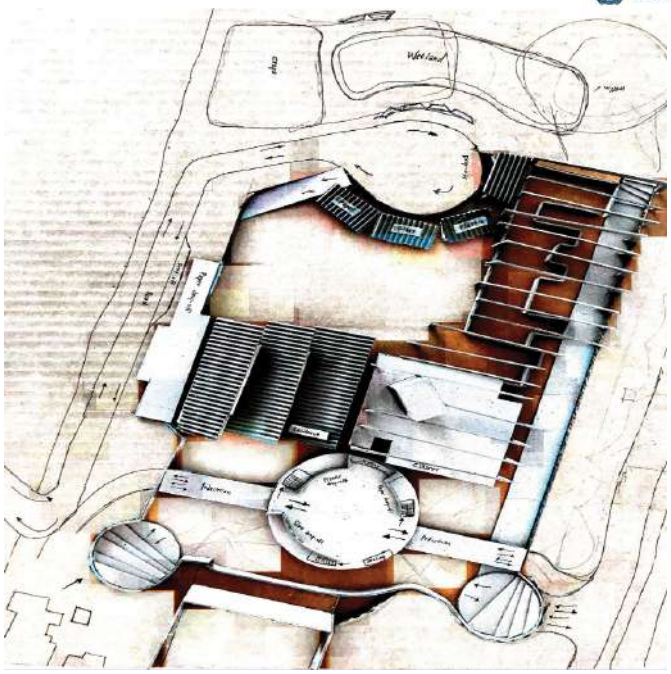
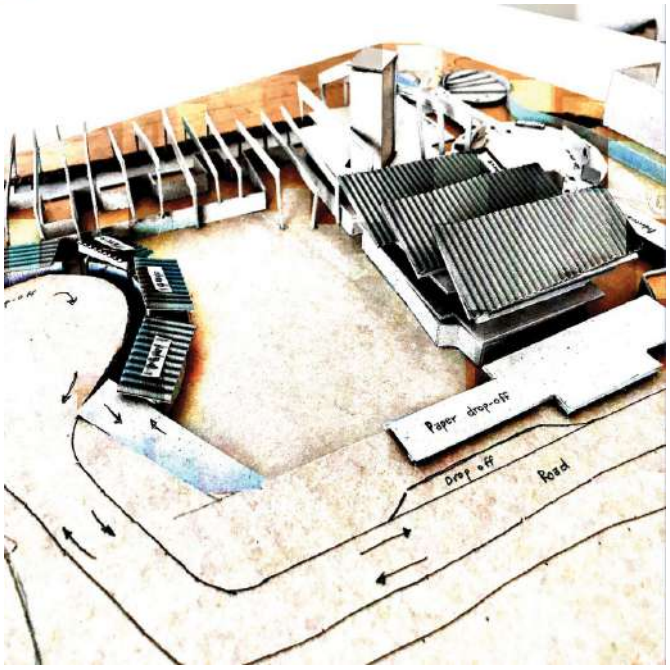
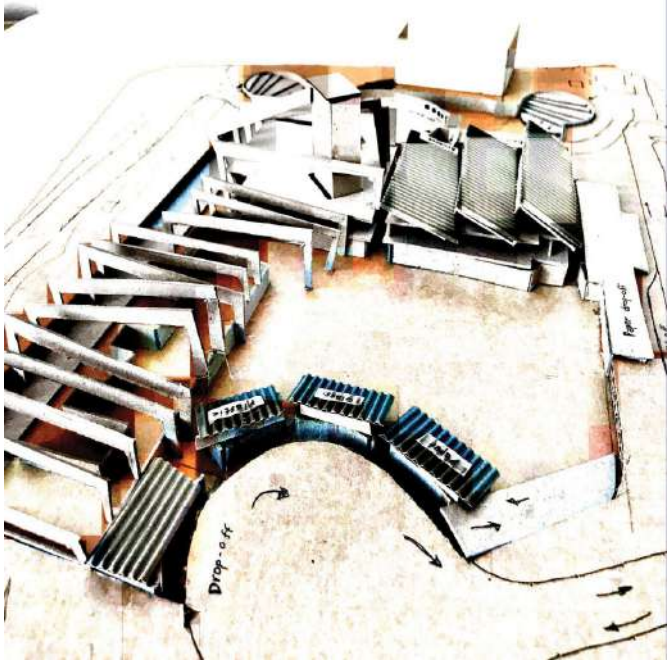
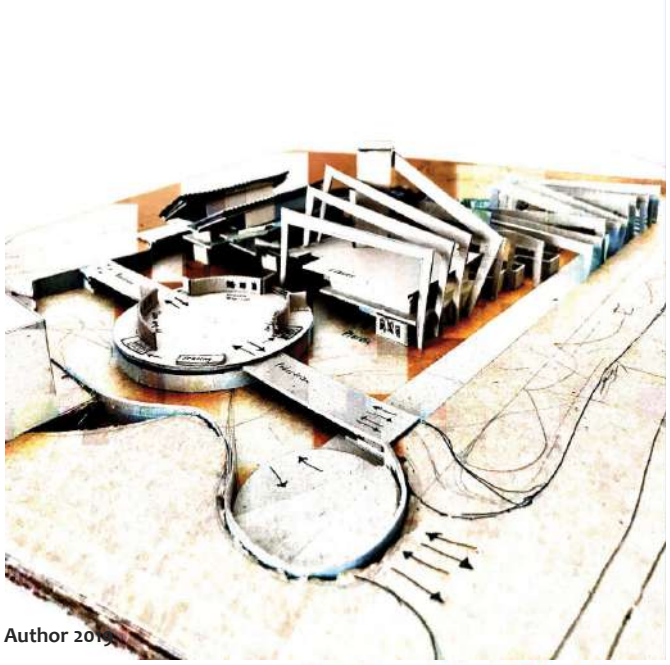


Fig. 4.15: The development of a portal frame (Author 2019)



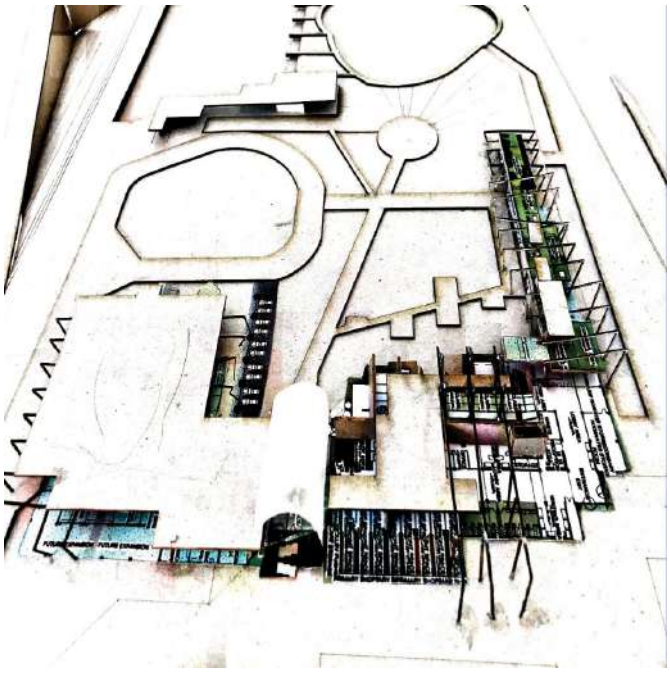


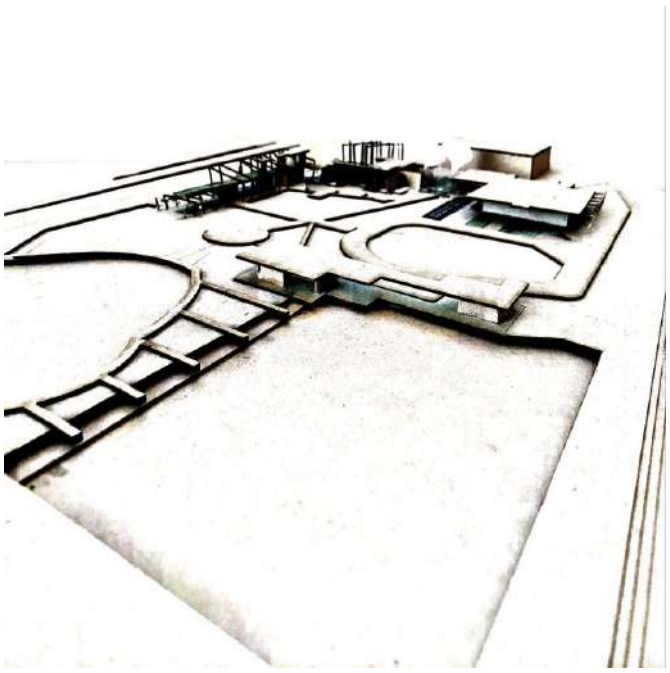


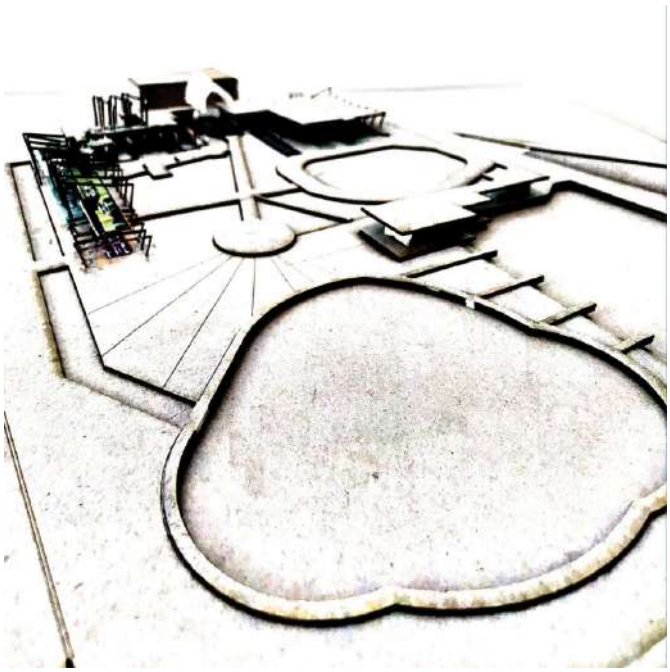


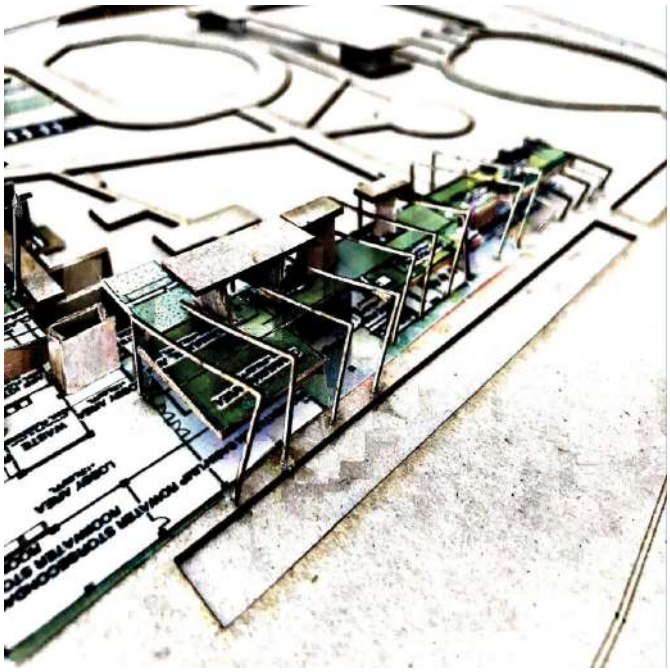
Models built by Author 2019

5.1 MODEL DEVELOPMENT



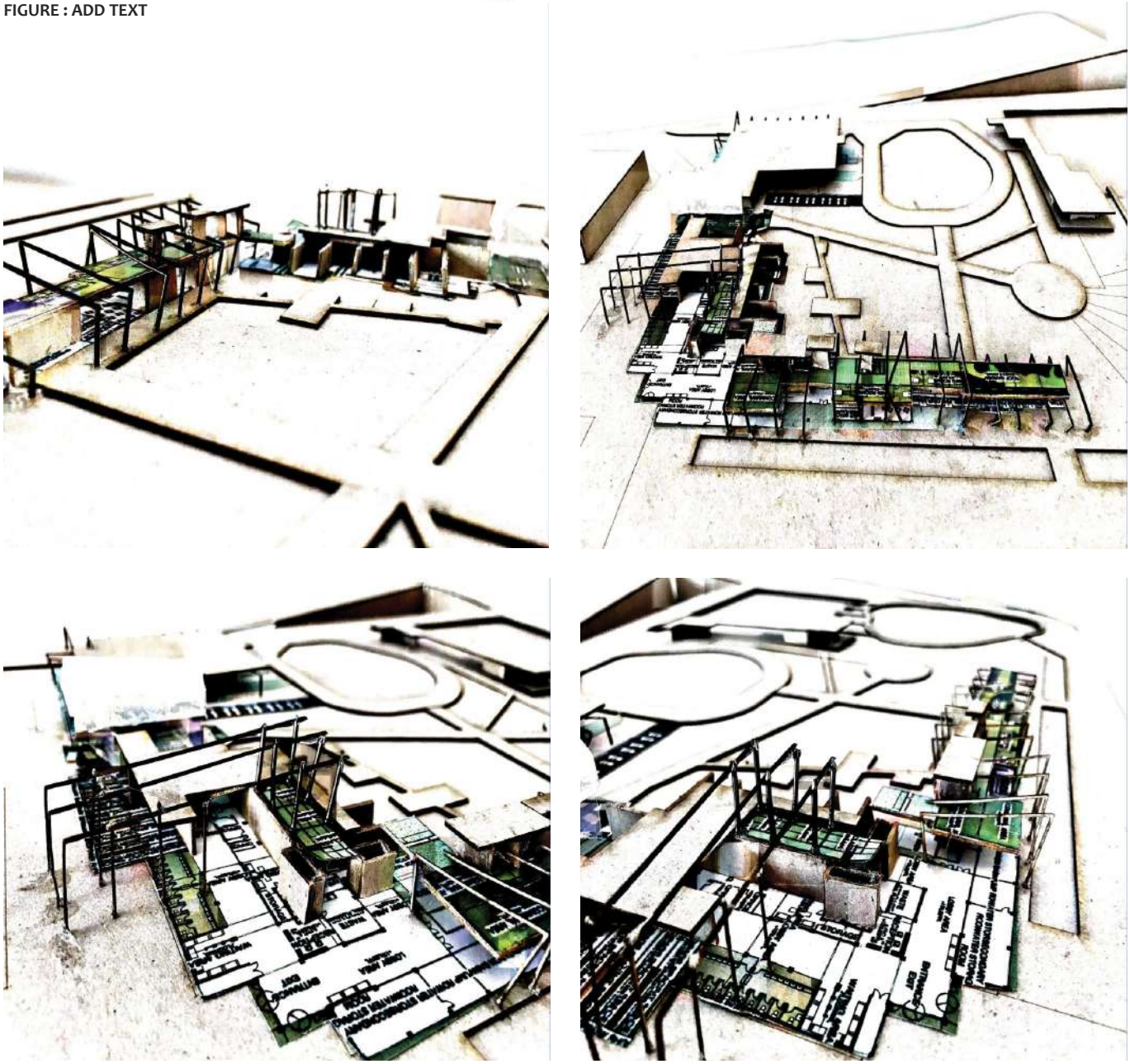




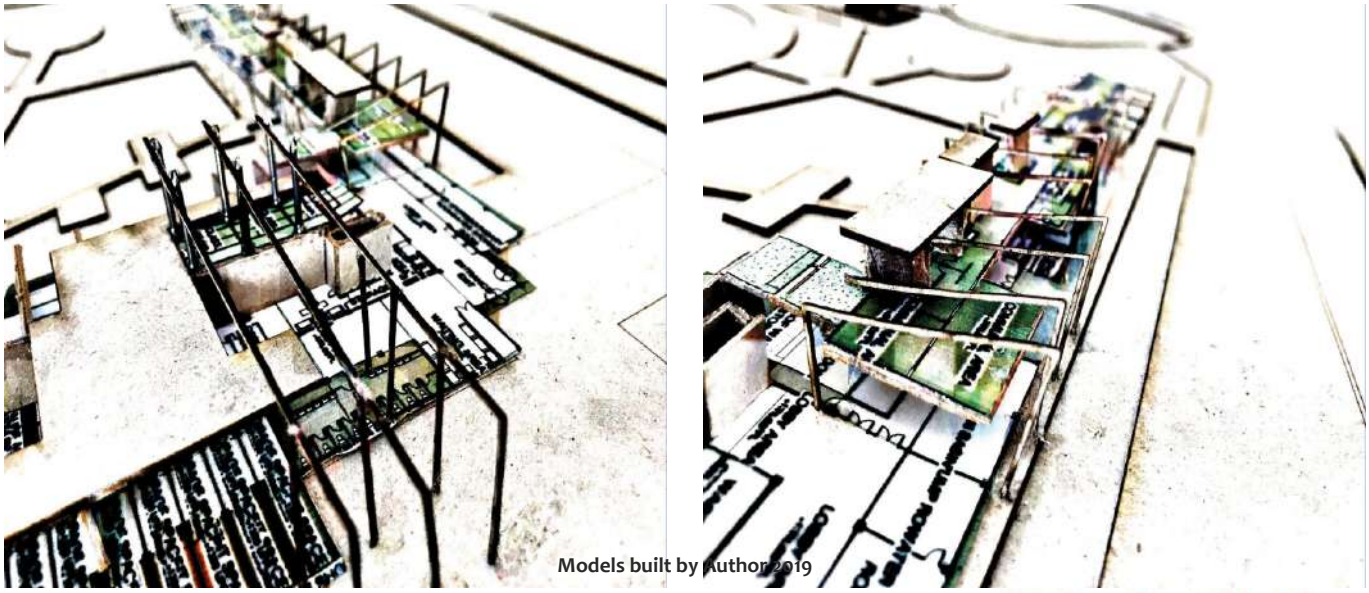


Models built by Author 2019

FIGURE : ADD TEXT



The breaking up of solid forms was the initial urban vision concept which allows for courtyard recreational areas as well as more green niches that are situated be The span of the portal frames ranged to up to 12m span and therefore a steel coloumn will be added at every 6m intervals in order to allow for manual assemble. This will enable future expansion to be easier. ween masses.



Models built by Author 2019

5.2 THE PORTAL FRAME

The reason to choose a portal frame is due to the cost-effective and extremely efficient manner of enclosing a functional space. Due to their flexible nature and ability to carry modest loads, a steel portal frame does not demonstrate harmful behaviour to the overall performance of the envelope (Koschmidder & Brown 2012).

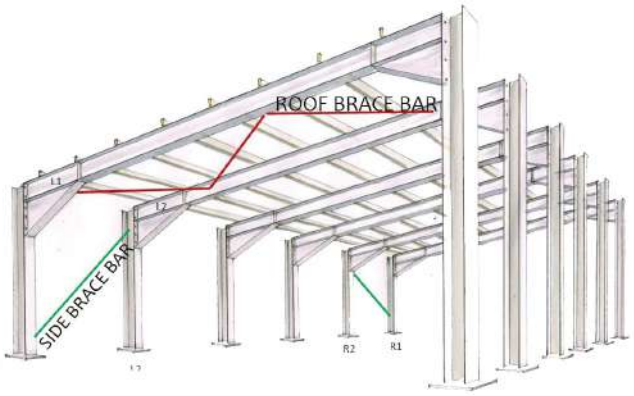


Fig. 4.16: Loads of a portal frame (Koschmidder & Brown 2012) (Adapted by Author 2019)

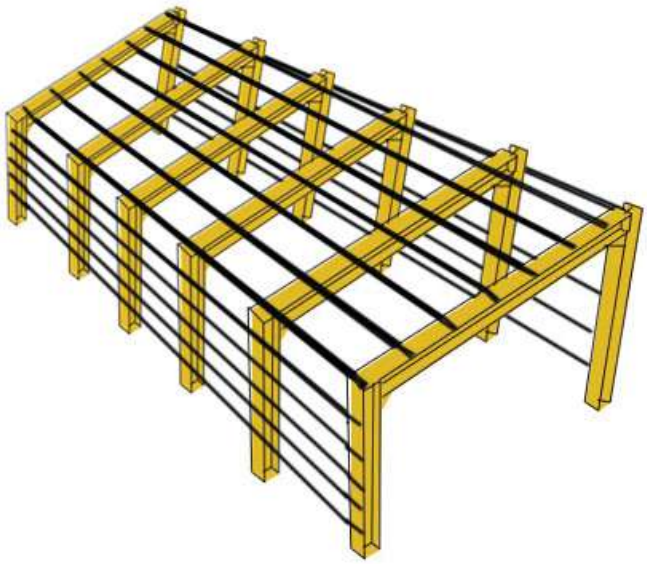


Fig. 4.17: The portal frame (Koschmidder & Brown 2012) (Adapted by Author 2019)

A mono-pithed portal frame is one of many types of portal frames which is usually used in the case where it is situated in close proximity to other buildings. According to Koschmidder and Brown (2012), a portal frame is compiled out of transverse primary frames which consist of rafters and columns. This primary frame is then longitudinally braced for maximum support. The secondary frame consists of purlins for the roof and side rails for the walls. This secondary frame is essential for preventing the primary frame from buckling or shifting out of plane (Koschmidder & Brown 2012).

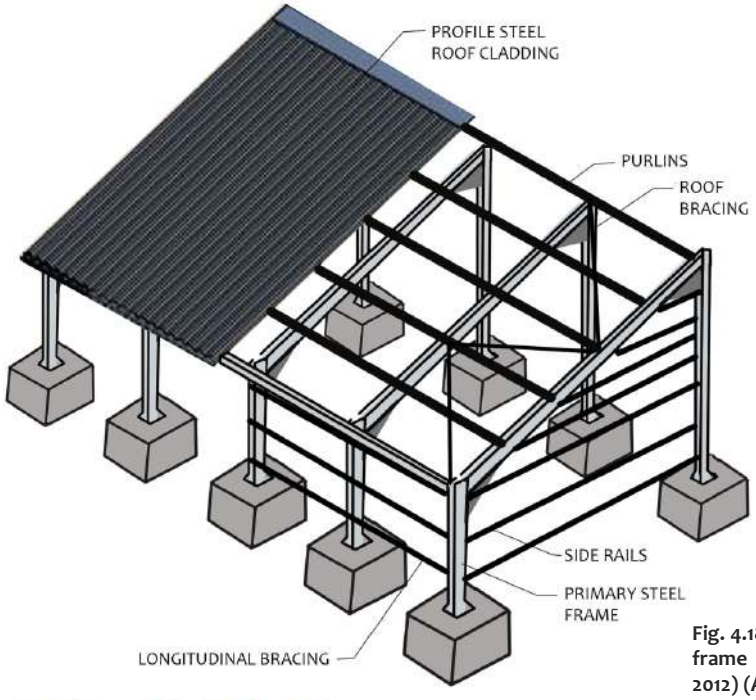
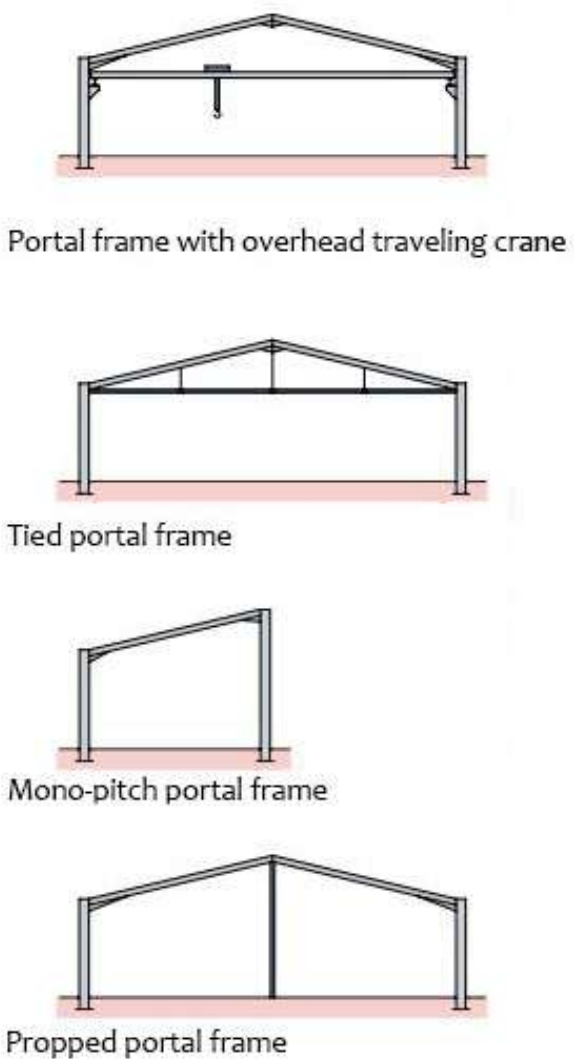


Fig. 4.18: The mono-pitched portal frame (Koschmidder & Brown 2012) (Adapted by Author 2019)

Fig. 4.19: Other types of portal frame (Koschmidder & Brown 2012) (Adapted by Author 2019)



Illustrated are other types of portal frames which are typical details which do not reflect all of the possibilities of portal frames.

The portal frame with overhead travelling crane can carry a crane of at least 20 tonnes which requires brackets that are attached to the column in order to support the rails of the crane (Koschmidder & Brown 2012).

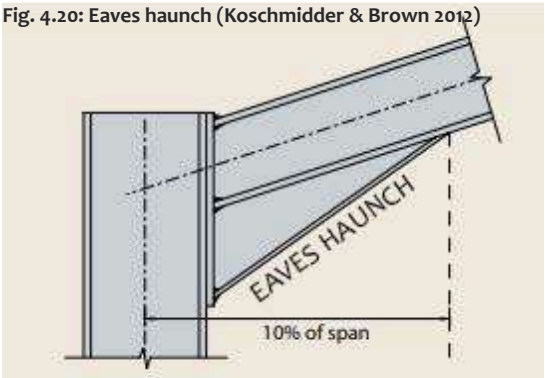
The tied portal frame limits deflection especially in a crane supporting structure (Koschmidder & Brown 2012).

A mono-pitched portal frame is used in the case where it is situated in close proximity to surrounding structures or buildings (Koschmidder & Brown 2012).

A propped portal frame is used in the aim to reduce the size of the rafter as well as the horizontal force at the base of the column (Koschmidder & Brown 2012).

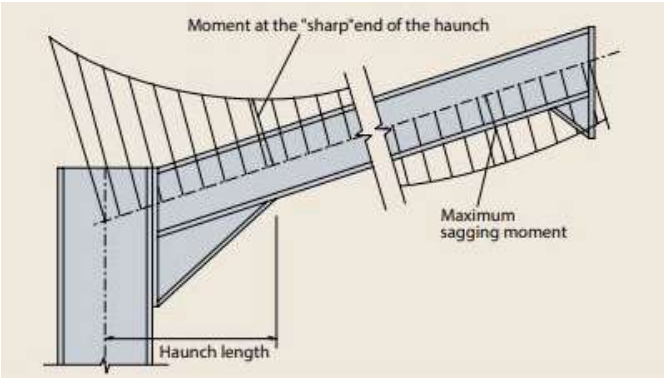
The haunch is used at the eave to reduce deflections as well as to increase stiffness. They reduce the needed depth of the rafter as well as increases the members' bending resistance. The eaves hanch is typically cut from the rafter and is welded to the underside of it (Koschmidder & Brown 2012).

Fig. 4.20: Eaves haunch (Koschmidder & Brown 2012)



According to Koschmidder and Brown (2012), the size of the haunch is required to be 10% of the portal span and typically is defined from the tapers section of the portal span to the centre-line of the column as illustrated below.

Fig. 4.21: Span limitations (Koschmidder & Brown 2012)



5.3 TECHNOLOGICAL PRECEDENTS

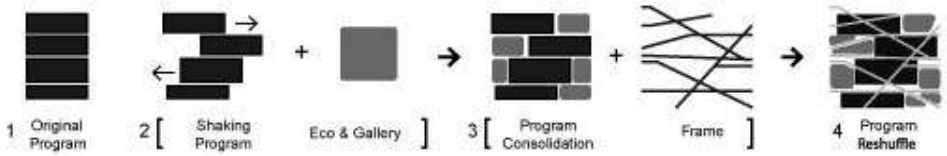
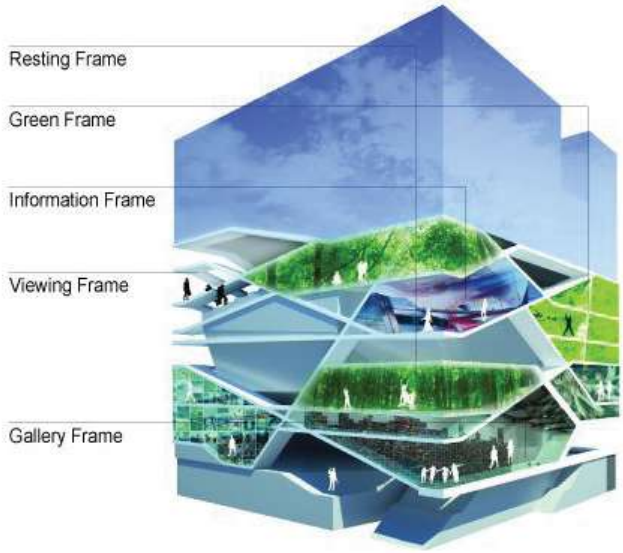


Fig. 4.22: Diagram &Photographs by Unsangdong architects.

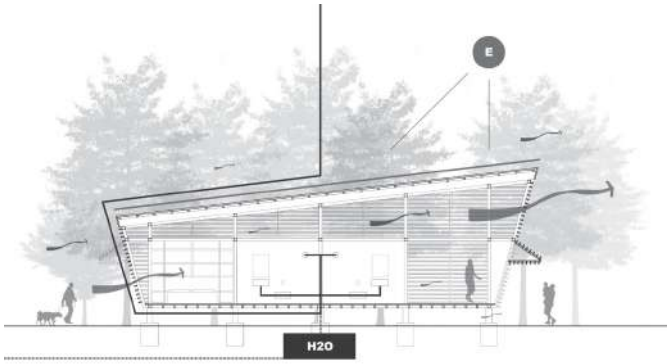


CULTURE FOREST / UNSANGDONG ARCHITECTS

The project titled 'Culture Forest' by architects Unsangdong Architects is a Culture and art centre located in SeongDong-gu, Republic of Korea. The structure is compiled of a steel framed reinforced concrete.

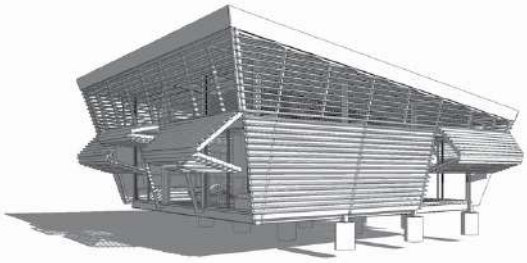
According to Jordana (2010), the building encompasses the harmony of a forest within certain spaces in the building, the design manages to provide a storytelling experience. This eco-friendly architecture aims to unify the exterior and the interior together in the form of green spaces and a skin that generated energy through solar powered panels.

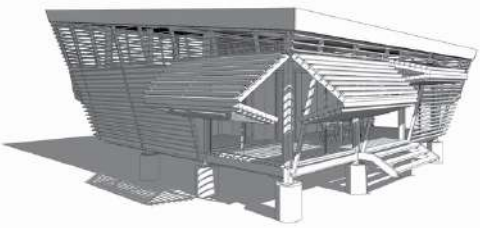
Fig. 4.23: Diagram &Photographs by (Ott 2019)



NO FOOTPRINT HOUSE / A-01

The 'No Footprint House/ A-01' located in Costa Rics designed by A-01 Oliver Schütte is perfectly placed within its surroundings as it deals with passive climate control through solar shading and natural ventilation. The intelligence of this building is beyond measure as it is compact in nature while being extremely efficient in terms of maintence and assembly (Ott 2019).





The structure is compiled of an inclined exterior façade which limits the amount of impact precipitation and sunlight has, thus limiting water splashing on the surface as well as overheating. The vertical structural columns carry of internal load therefore allowing the façade panels to be adaptable in order to regulate air flow through the building as well as to regulate views as desired (Ott 2019).

MATERIALITY

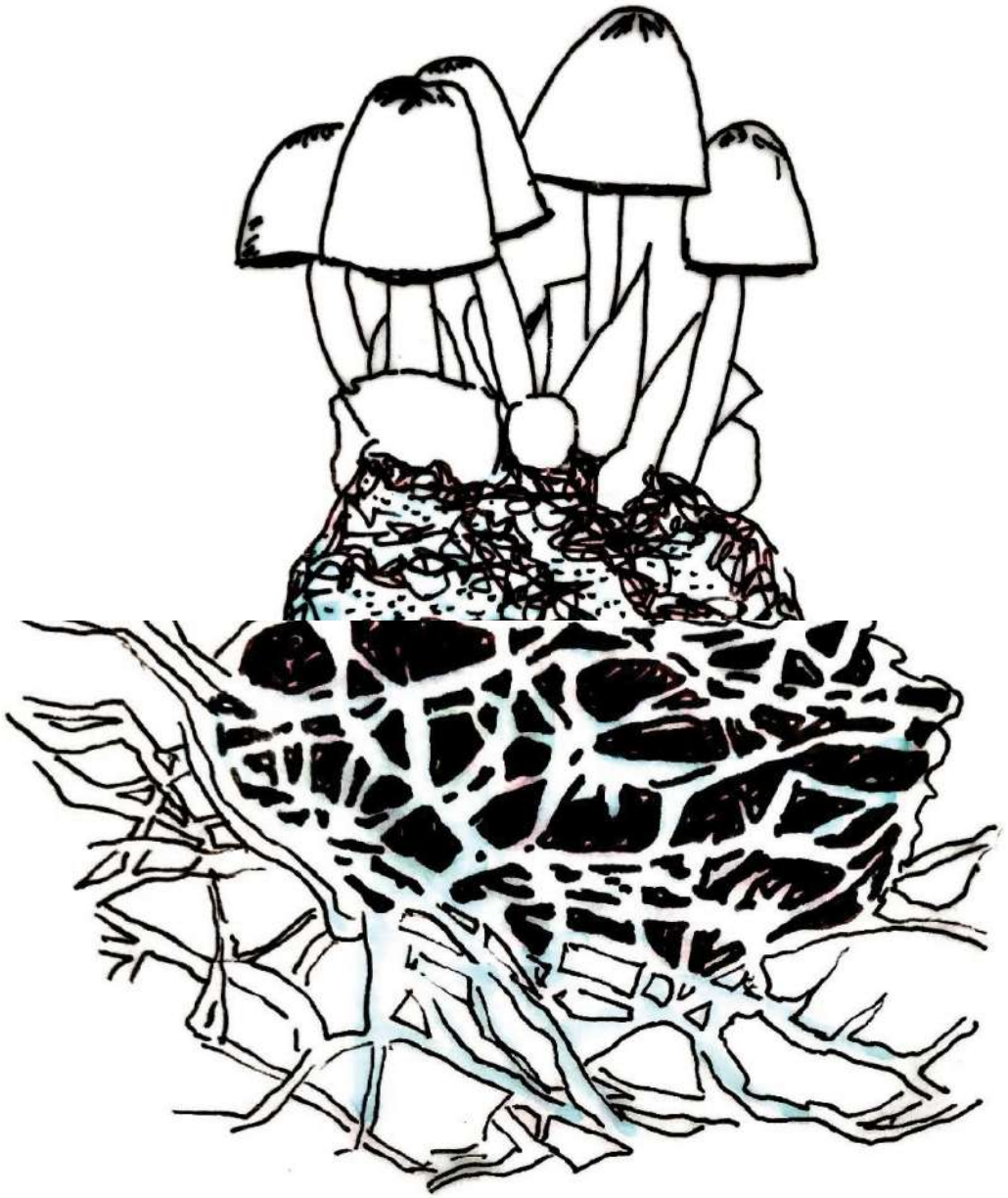


Fig. 6.1: Sketch drawn by Author 2019

6.1 PRIMARY FEATURES

SITE

Due to the site being an open space, the allowance for new materials are limitless. The site is levelled earth and has being unmaintained whereby grass and weeds are growing in certain areas.

Fig. 6.2.1: Photograph by Author 2019

ACTIVITY

Located near the Denneboom station is where informal traders have set up their stalls, thus attracting pedestrian traffic through the site.

Fig. 6.2.2: Photograph by Author 2019

NEEDS

There is a need for open spaces that can adapt to future needs. An adaptive space which is protected from the natural elements such as rain, wind and drastic temperatures.

Fig. 6.2.3: Photograph by Author 2019

STRUCTURE

The structure consists of a primary, secondary and tertiary construction. For the primary structure, steel H-columns and steel I-beams are employed throughout, while in the manufacturing areas allowance is made for the use of steel–concrete composite columns in order to protect the steel from harsh chemicals used in these areas.

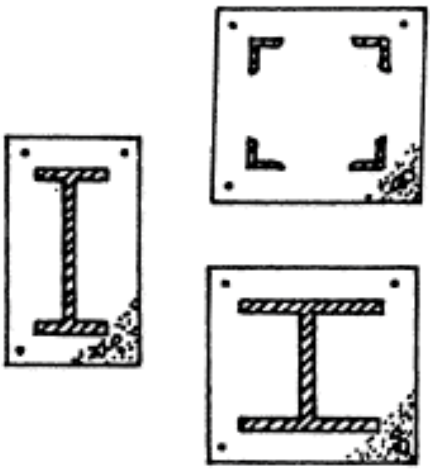


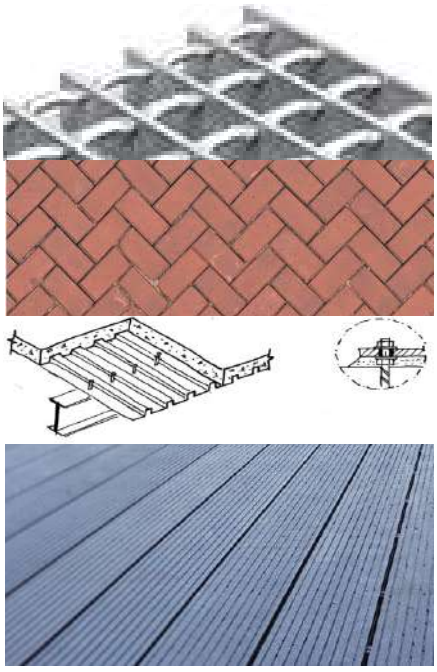
FIG 6.3: Encased columns (Shanmugam & Lakshmi 2001)

6.2 SECONDARY MATERIALS

Pre-manufactures materials are used as infill materials within the primary steel structure.

FLOORS – GROUND

The overall floor treatment in public areas consist of of polished concrete as they are very quick to use and is a quick installation. The floor areas where heavy machinery is used will be power floated concrete as it is slip resistant and economical. The difference between polished concrete and power floated concrete is that power floated concrete is not compacted and hardened and is completed at a faster rate. Polished concrete has a longer lifespan and is easier to clean (Becosan.com 2019). In terms of outdoor areas mentis grating is used with clay brick pavers and ceramic tiles.



FLOORS – FIRST

According to Simpson (2014) a principal engineer in structural design mentions that the correct terms for metal floor is referred to as a composite floor and not a 'Q-Deck'. The term Q-deck is a generic description that contractors have begun using.

Composite deck system is used from the first floor upwards. Due to its non-slip, non-toxic, impact resistant and environmentally friendly nature, it is suitable for the interior and exterior application. Vertical ribs are bonded with concrete to for the composite flooring system (Simpson, 2014).

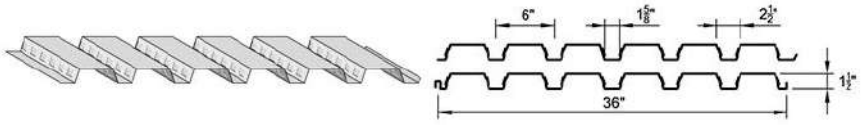


FIG 6.4: The composite deck system (Simpson, 2014).

WALLS

Single leaf clay bricks are used as infill in areas that require less insulation. Cavity clay brick walls are used where higher insulation is required. Concrete blocks are used in high insulation areas where steel-concrete composite columns are used.

ROOF

The majority of the roofing is 0.8mm chromadek colour bond kliplock 700 system while near the accommodation and pause areas a concrete roof slab is used with lafarge light weight concrete screed to fall of min 1:5.

FIG 6.5: The composite deck system (Simpson, 2014).

6.3 TERTIARY MATERIALS

6.3.1 PAPER

THE BACKGROUND TO WASTE TYPES
This study is focused on the upcycling of waste products such as paper, glass and plastic.

PAPER

In the paper industry, waste has the potential to bring about environmental and economic benefits, since material waste can be used in place of raw materials. In the manufacturing of construction materials worldwide, significant attention is focused on industrial by-product materials. The study conducted by Raut, Ralegaonkar and Mandavgane (2013) investigated recycled paper-mill residue (RPMR) for making bricks that can be used in construction. It was discovered that RPMR, although it has a fibrous and porous structure, meets the compressive strength requirements of bricks and has the ability to withstand temperatures of 280 degrees Celsius (Raut, Ralegaonkar & Mandavgane 2013).

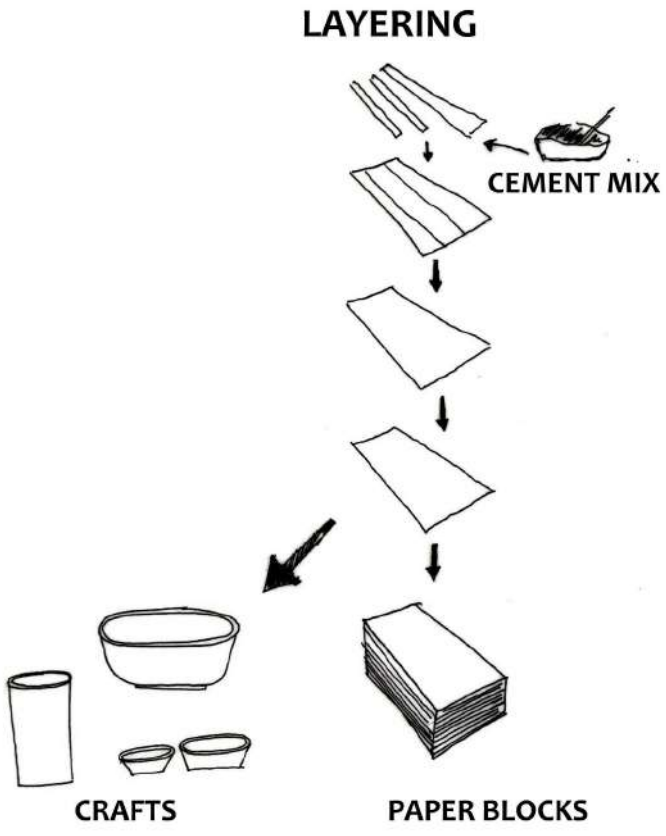


Fig. 6.6: The layering process of paper bricks (Author 2019)

FIG 6.7 & 6.8: Furniture made from paper (Fonder 2016)

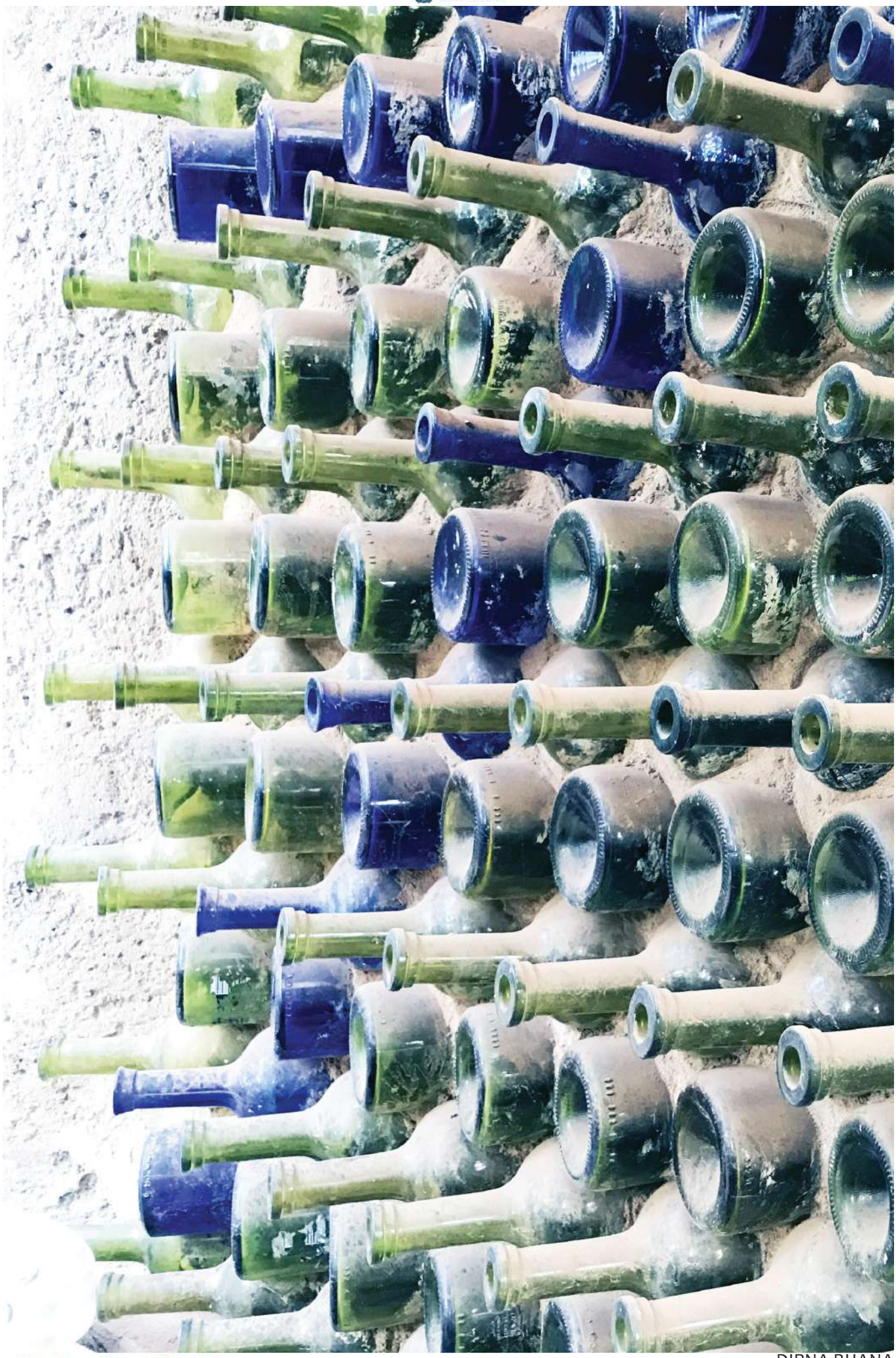


FIG 6.9: Existing wall built by Abre Crafford (Photograph by Author 2019)

6.3.2 GLASS

FIG 6.10: Bottle collection by Abre Crafford (Photograph by Author 2019)

FIG 6.11: Existing floor built by Abre Crafford (Photograph by Author 2019)

GLASS

The most common form of glass recycling is the closed-loop recycling method which entails the collecting, sorting, cleaning and beneficiating of waste glass, remanufacturing it into glass bottles, and transporting these bottles to a desired destination (Dhir, Limbachiya & Dyer 2001). This process can become exorbitantly expensive, as each step is necessary in the recycling process.

FIG 6.11: Making of glass and concrete pavers (Made by Author 2019)

During the recycling of glass, certain requirements must be met in order to sustainably benefit from the recycling process. Glass recycling can be extremely labour intensive, since it is necessary to sort and clean debris from the waste glass as well as to separate it into different categories (Fulton 2008). In spite of this fact there is opportunity for job creation in the context of Mamelodi. Fulton (2008) has experimented with the recycling of glass waste in pavement aggregate, and has discovered that one main issue that could be detrimental to the finished product is that if the glass is not cleaned thoroughly. Fulton (2008) then states that it is highly beneficial to recycle glass waste, as 'virgin rock' is conserved while the lifespan of landfill sites is extended.

With the excessive amounts of different types of glass in rivers, streams and landfills, the concrete industry has slowly incorporated ways in which glass could be crushed into aggregate and used in concrete mixes (Ismail & Al-Hashmi 2009). Tests were conducted by Ismail and Al-Hashmi (2009) in which 80 kg of crushed glass waste partially replaced sand and was mixed into 900 kg of a concrete mix. Tests revealed that the tensile and compressive strength of the concrete mix was higher than the control mix at 28 days of curing. It was also proven that the crushed-glass waste mix reduced the expansion rate of the concrete by 66% in comparison to the control mix (Ismail & Al-Hashmi 2009).

Located south of the selected site is a company called Pronto RMX Silverton, which is a supplier of ready-mix concrete, screeds and mortars. It is associated with testing laboratories and therefore every batch that it manufactures is tested daily (Prontormc 2017). There is opportunity for this proposed facility to clean, sort and crush the glass waste and supply it to the ready-mix companies around the Mamelodi area. This process would expend less energy and cost less than remanufacturing glass bottles, and would therefore make a difference towards the increasing energy demands required for remanufacturing.

PAVING STONE

Paving stone which is currently becoming commercialised comprises up to 100% of glass aggregate. It is possible to create a unique type of paver with diverse textures and colours which can not necessarily be obtained with natural aggregate. Tests were conducted on reinforcing pavers with short fibres, and it was shown that the properties of the pavers, such as the fracture toughness and energy absorption capacity, were improved. The outcome of using crushed glass waste in pavers proved to be highly beneficial to the environment, as less energy is used compared to remanufacturing the product into useable bottles (Dhir, Limbachiya & Dyer 2001).

FIG 6.12: Making of crushed glass and concrete blocks (Made by Author 2019)

6.3.3PLASTIC

FIGURE :
PHOTOGRAPHS COURTESY OF Unsangdong Architects.

FIG 6.13: Adapted from Seaman (2012), different plastic types (Author 2019)

PLASTIC

Polymer production today is ongoing, as it is low priced and mass produced, but after use it is disposed of and forgotten about. Upcycling or recycling can take place through chemical, thermal, mechanical and even biological processes. Chemical recycling, to an extent, converts some plastic into hydrocarbon fractions (Zhuo & Levendis 2014) which can be used as feedstock. Thermal recycling utilises the high energy content of plastic through processes called waste-to-energy or incineration. Mechanical recycling is mainly focused on PET thermoplastics and converts them into secondary raw materials with no change in the chemical structure. Biological recycling occurs on a micro level through the use of organisms such as fungi, enzymes and bacteria (Zhuo & Levendis 2014). The focus of this dissertation is placed on the biological recycling process using mycelium fungi.

FIG 6.14 : Photograph by Abre Crafford (2019)

FIG 6.15 : Eco brick wall .Photograph by Anon (2019)

FIG 6.16 : Plastic melted building block .Photograph by Anon (2019)

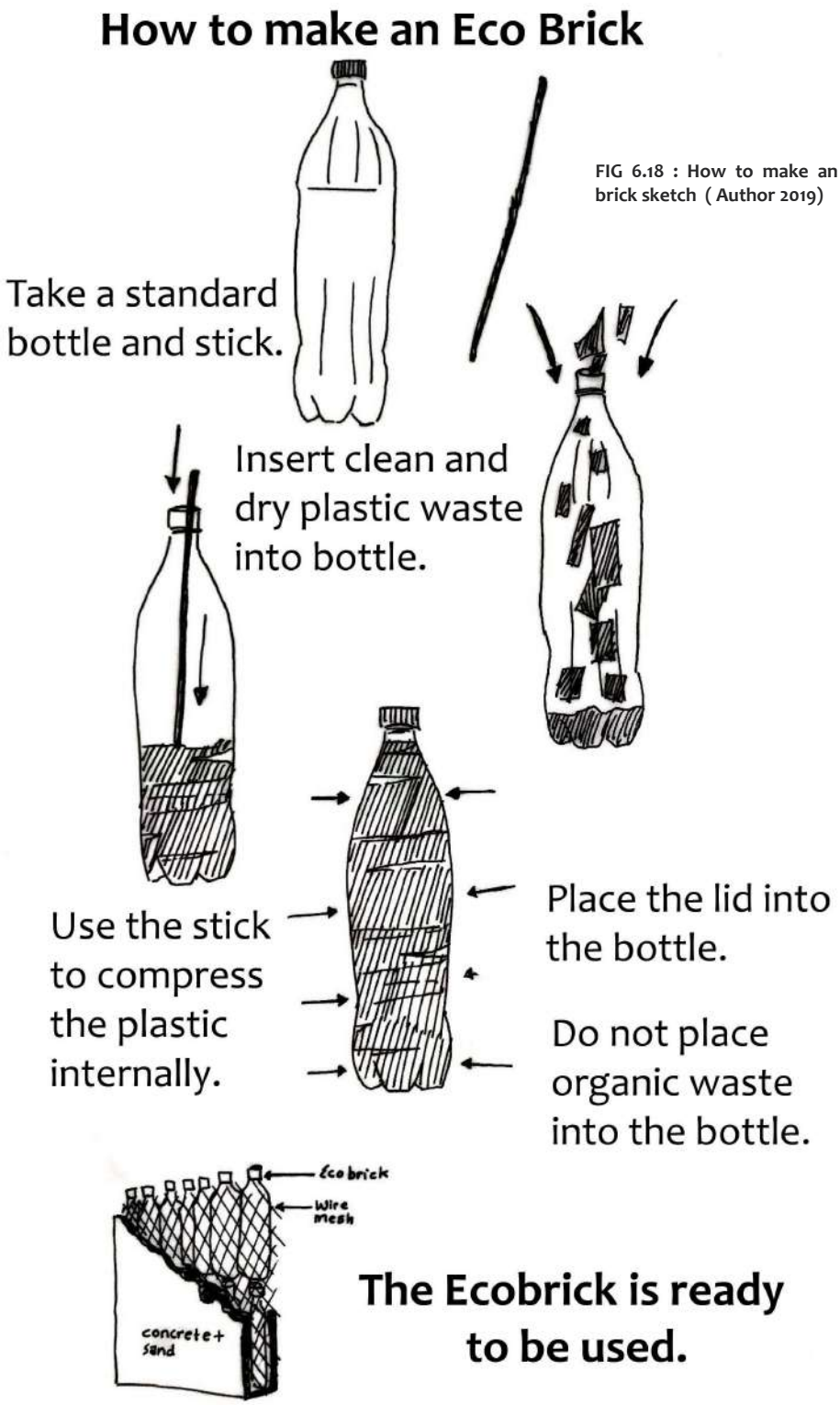
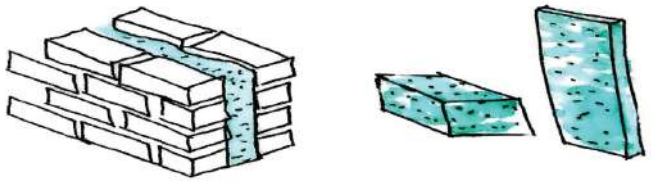


FIG 6.18 : How to make an eco-brick sketch (Author 2019)

FIG 6.17 : Eco-brick (Made by Author 2019)

FIG 6.19& 20 : Eco brick wall and brick .Photograph by Anon (2019)

6.4 MYCELIUM



Mycelium components such as insulation and internal bricks

FIG 6.21 : Mycelium insulation and bricks (Author 2019)

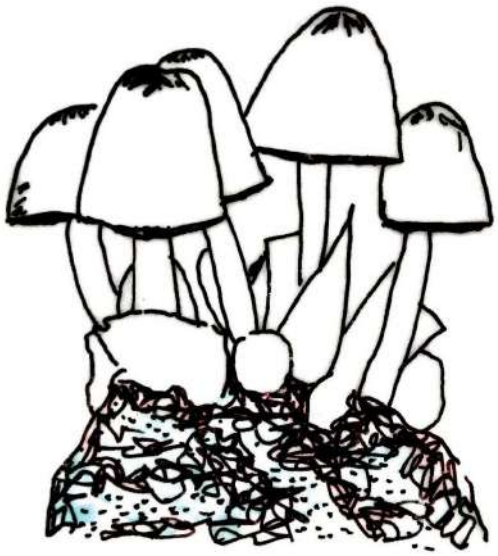
MYCELIUM

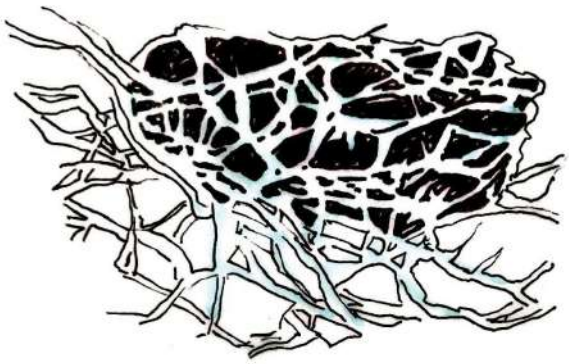
Over the last few years, numerous discussions have been conducted on the global concern for overflowing landfills and excess amounts of plastic waste. Based on this awareness and environmental concern, attention has been placed on degradable polymers (Shah, Hasan, Hameed & Ahmed 2008:246-265). Today, findings indicate that biodegradation is possible through modern technology, and is necessary for water-soluble polymers which usually end up in oceans, rivers and dams and, in addition, can be neither incinerated nor recycled.

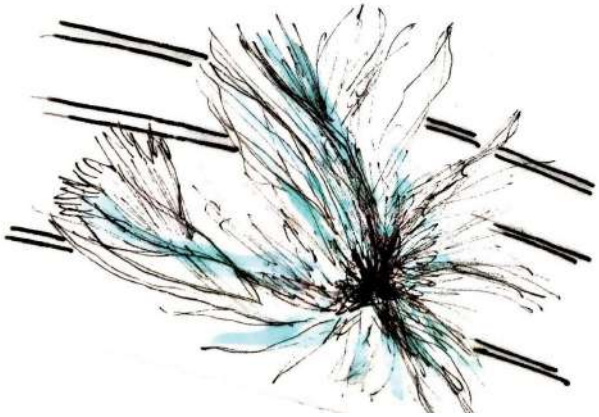
According to Shah et al. (2008:246-265), there needs to be a clearer understanding of the microorganisms, plastic material, and the biochemical process involved in order to perform successful biodegradation.

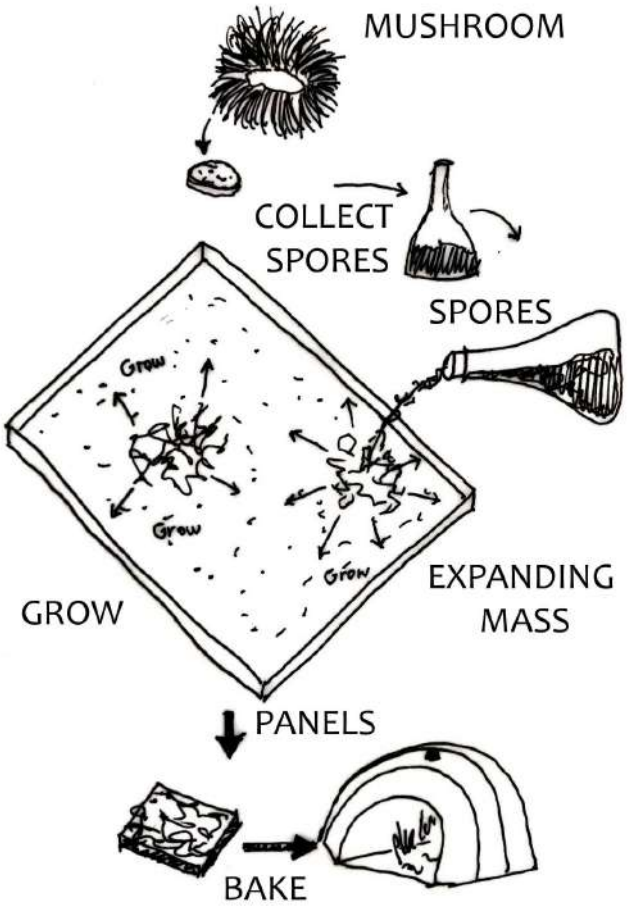
A material currently emerging is mushroom-mycelium which, according to scientists from Kew Gardens in London, is a fungus that has the ability to break down waste, including plastic waste (Aouf 2018). It has been proven that different types of fungus such as Trametes versicolor and Pleurotus ostreatus possess the ability to remove dyes, explosives and even pesticides from soil. In addition to these benefits, mushroom-mycelium can be used as a replacement for building materials as it is fire-resistant, water resistant, has a high insulation rate and is particularly durable (Aouf 2018). The benefits of fungal-mycelium are that it is proven to be 100% biodegradable (Critical Concrete 2018), which will benefit the environment immensely as mushroom-mycelium products are grown and not manufactured.

In his book Mycelium running: how mushrooms can help save the world (2005), Paul Stamets discusses how fungi are the neurological web of nature as they always maintain a consistent molecular connection to their surroundings. The mycelium web has the ability to expand across thousands of miles and even has a close relation to animals on a cellular level. The mycelium fungus has evolved and survived over millions of years and, similar to the digestive system of animals, it has used its network cell chains to secrete acids into its immediate environment in order to break down food (Stamets 2005).

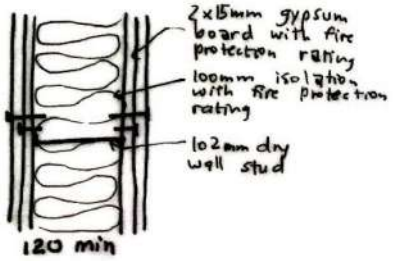








Polystyrene is toxic when it burns



Grow mycellium = NON TOXIC
Fire protection
Isolation

Replace polystyrene with mycellium

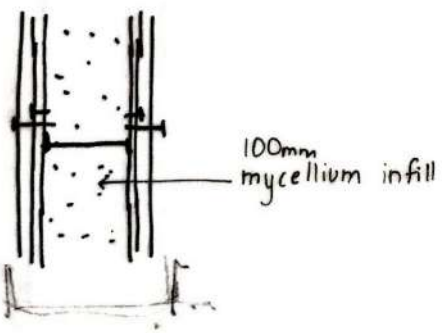
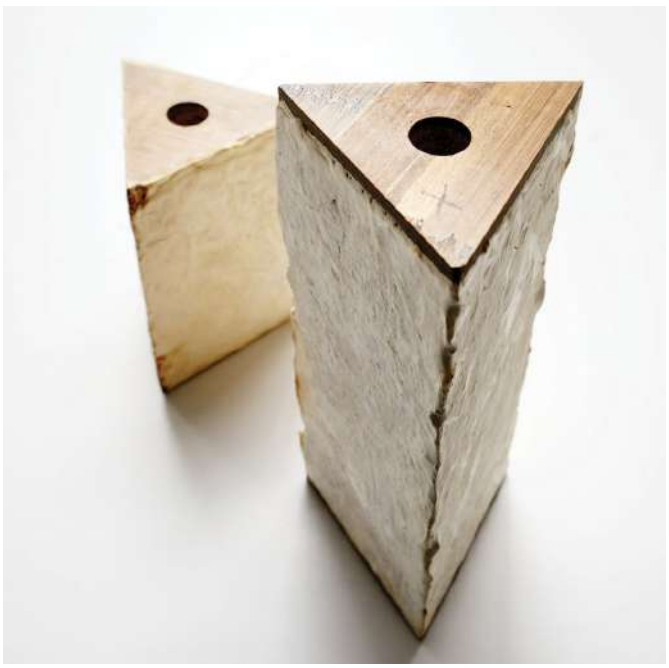


FIG 6.22 : How to make mycelium insulation or brick (Author 2019)

6.3 MATERIAL PRECEDENT



A self-supporting structure that has been grown by engineer Philippe Block and architect Dirk Hebel has proven the potential that mushroom mycelim has in the architecture and design industry (Aouf, 2018).

FIG 6.23, 6.24, 6.25, 6.26 : How to make mycelium self-supporting structure (Aouf, 2018).

DIPNA BHANA

According to Hebel, there is great potential for mushroom mycelium to be used as structural elements for double storey buildings. Based on a 3D modelling program, templates of possible moulds were sent to a company called Mycotech in Indonesia that specialises in mushroom farming. Ultimatley anyone who has access to a CNC machine can grow their own building structure based on a downloadable online design (Frearson 2019).

FIG 6.27 & 6.28 : Competed mycelium self-supporting structure (Aouf, 2018).

FIG. 6.29: Mycelium chair (Samson, 2019)

FIG. 6.30: Mycelium lamp (Samson, 2019)

FIG. 6.31: Mycelium lamps and chair (Samson, 2019)

TECHNIFICATION

7.1 TECTONIC CONCEPT

The aim with this project is to facilitate a waste management centre that gives back to the community as part of a closed loop system. The intake of waste is centred on plastic, paper, glass and organic waste. Illustrated here are the processes required to recycle these materials, thus demonstrating that some areas where the making occurs require high levels of insulation, while other areas, such as the selling and public areas, require lower levels.

The technical concept is expressed by the steel framing system which allows for versatility when it comes to infill. This tectonic form serves as the primary frame in which infill materials can easily be manipulated and replaced independently through time, thus allowing for the community centre to be adapted to current and future needs.

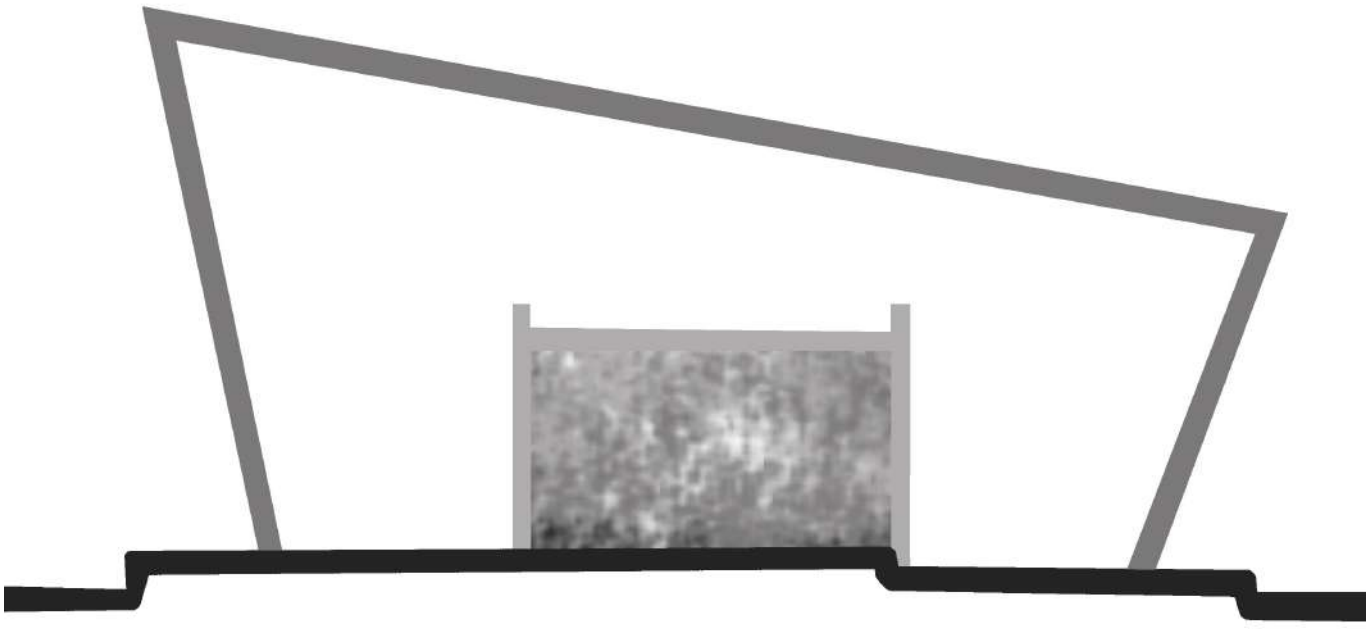


Fig. 7.1: Tectonic concept (Author 2019)

Fig. 7.2, 7.3, 7.4: Diagram of tectonic concept (Author 2019)

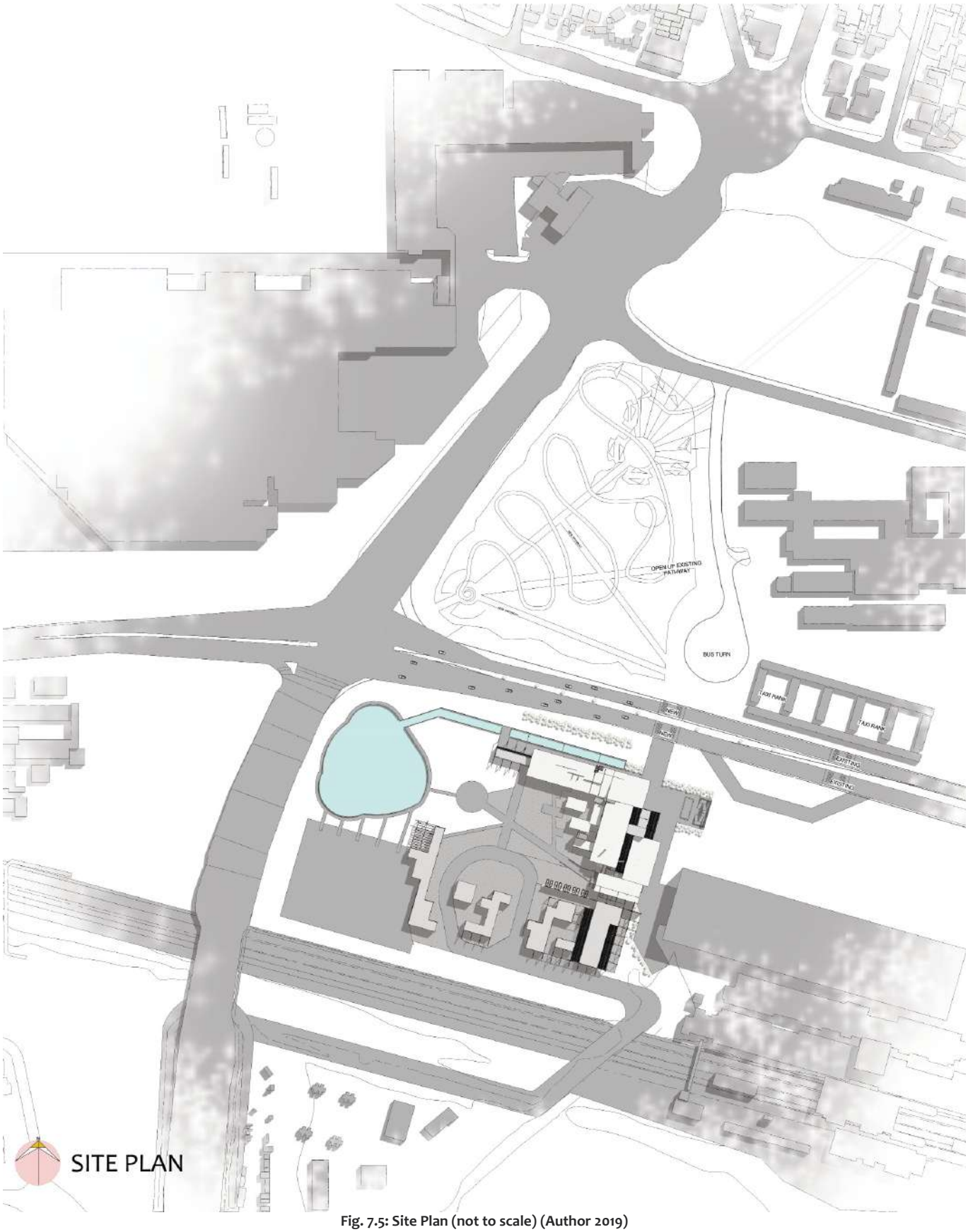
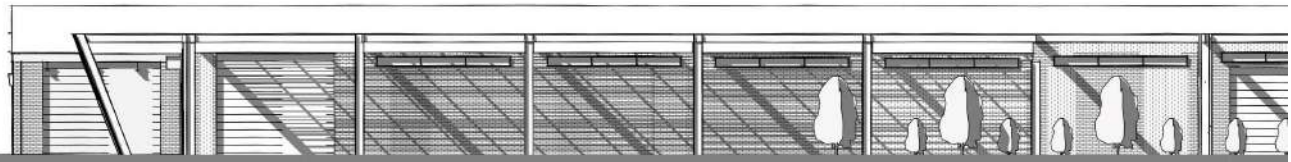
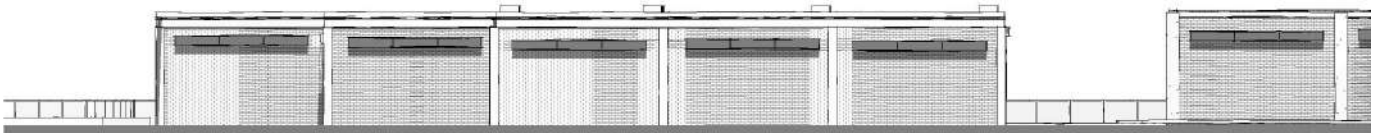


Fig. 7.5: Site Plan (not to scale) (Author 2019)



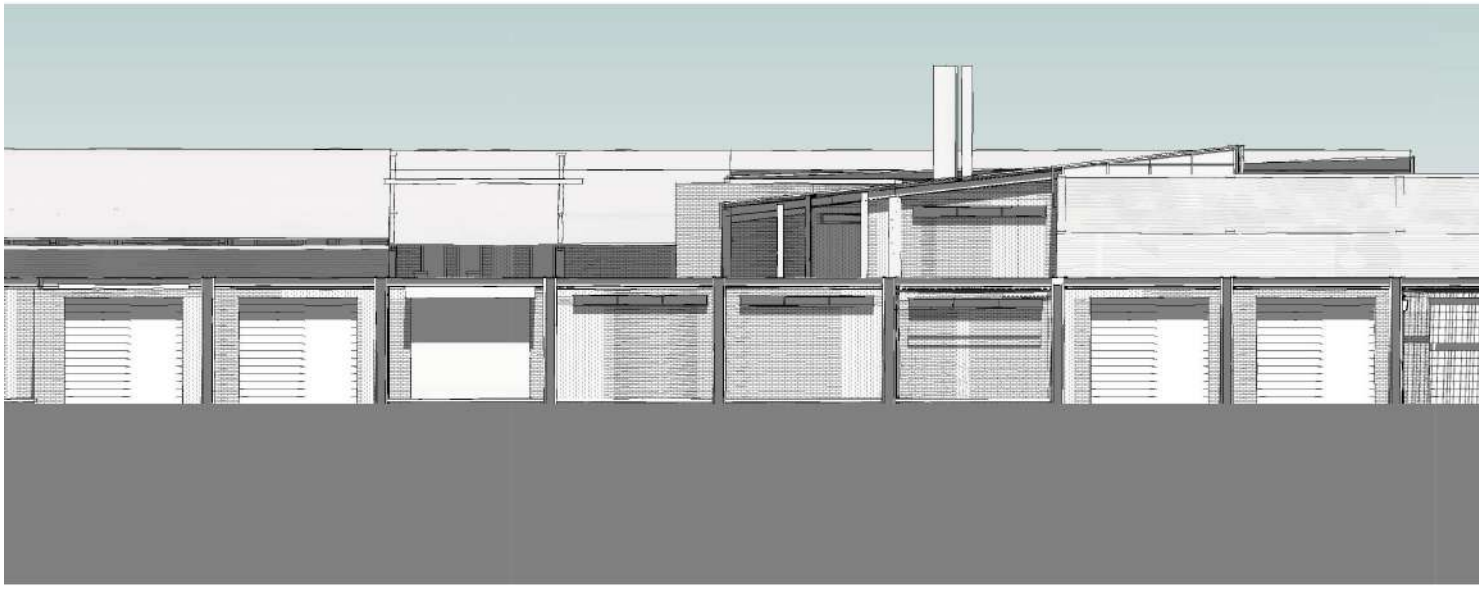
EAST ELEVATION
SCALE 1:200

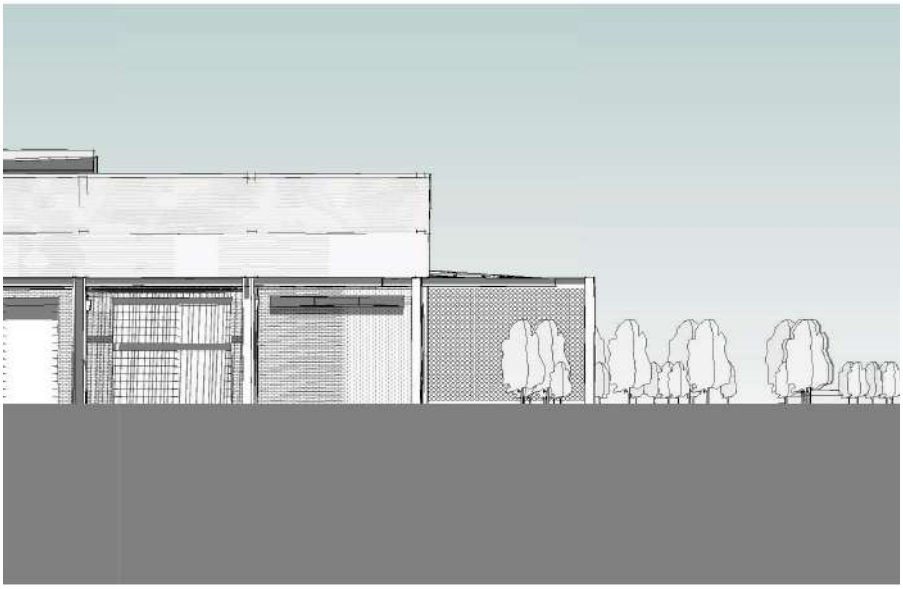


SOUTH ELEVATION
SCALE 1:200

WEST ELEVATION
SCALE 1:200

Fig. 7.6: Elevations (not to scale) (Author 2019)





7.2 STRUCTURE

The structure consists of a primary, secondary and tertiary construction. For the primary structure, steel H-columns and steel I-beams are employed throughout, while in the manufacturing areas allowance is made for concrete around the steel columns in order to protect the steel from harsh chemicals used in these areas. Each material is determined by certain processes taking place in the space. The steel structure consists of bolted connections in order to allow for future adjustment and expansion. Steel was chosen for its speed of erection, as well as to allow for future horizontal expansion. The grid has a 6 m x 6 m span due to the standardized steel components used.

The secondary structure consists of standard bricks and precast concrete blocks.

The tertiary structure is manufactured from upcycled glass, bottles and plastic. Cast in situ concrete flooring, permanent shuttering, and double-layered standard-sized paper & cement bricks, vermiculite mix, cement slurry, fibre used over plastic bottles, and standard-sized cement blocks with vermiculite and glass.

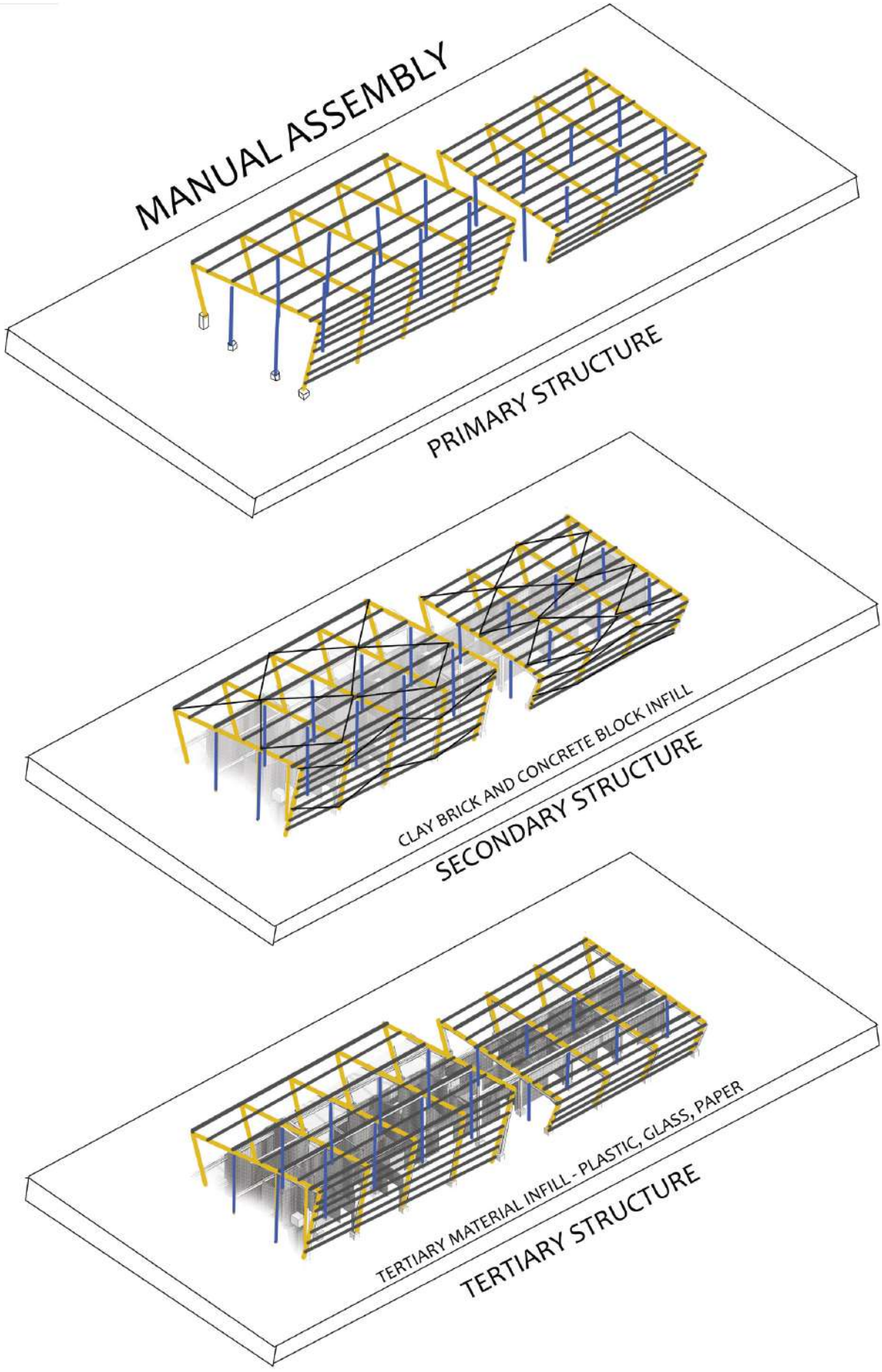
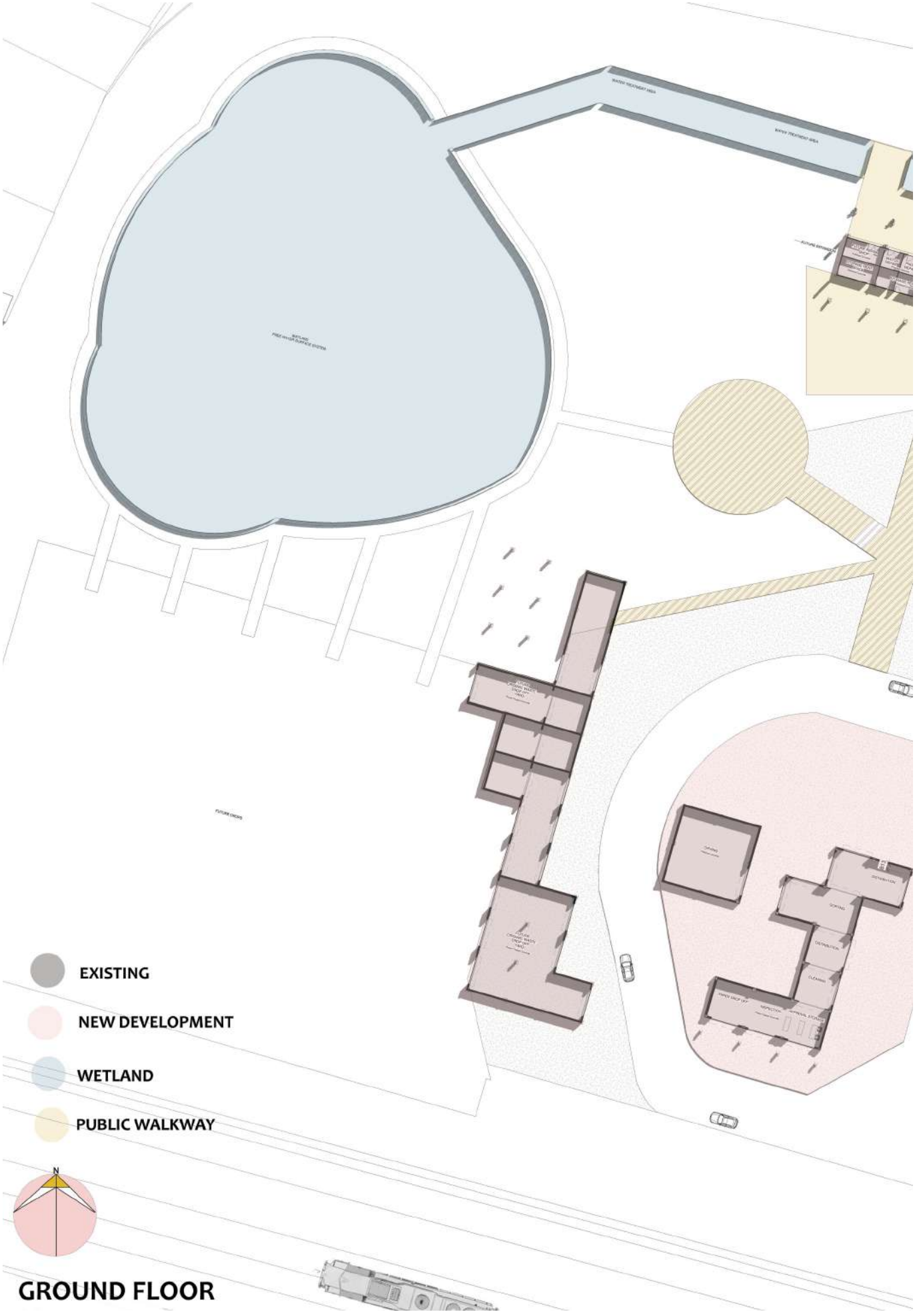
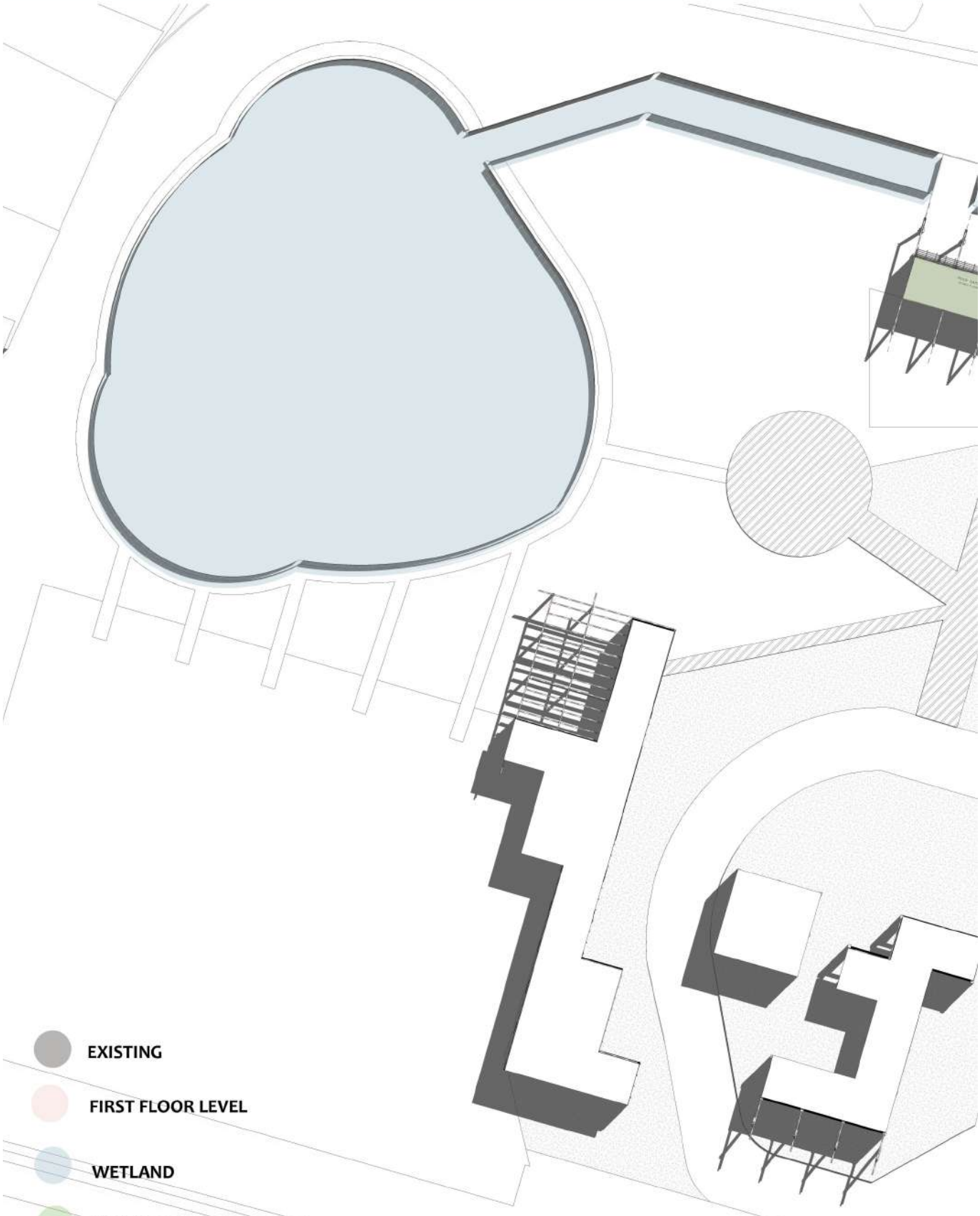


Fig. 7.7: Structure diagram demonstrating the primary, secondary and tertiary structure (Author 2019)



GROUND FLOOR

Fig. 7.8: Ground floor (not to scale) (Author 2019)



FIRST FLOOR

Fig. 7.9: First floor (not to scale) (Author 2019)

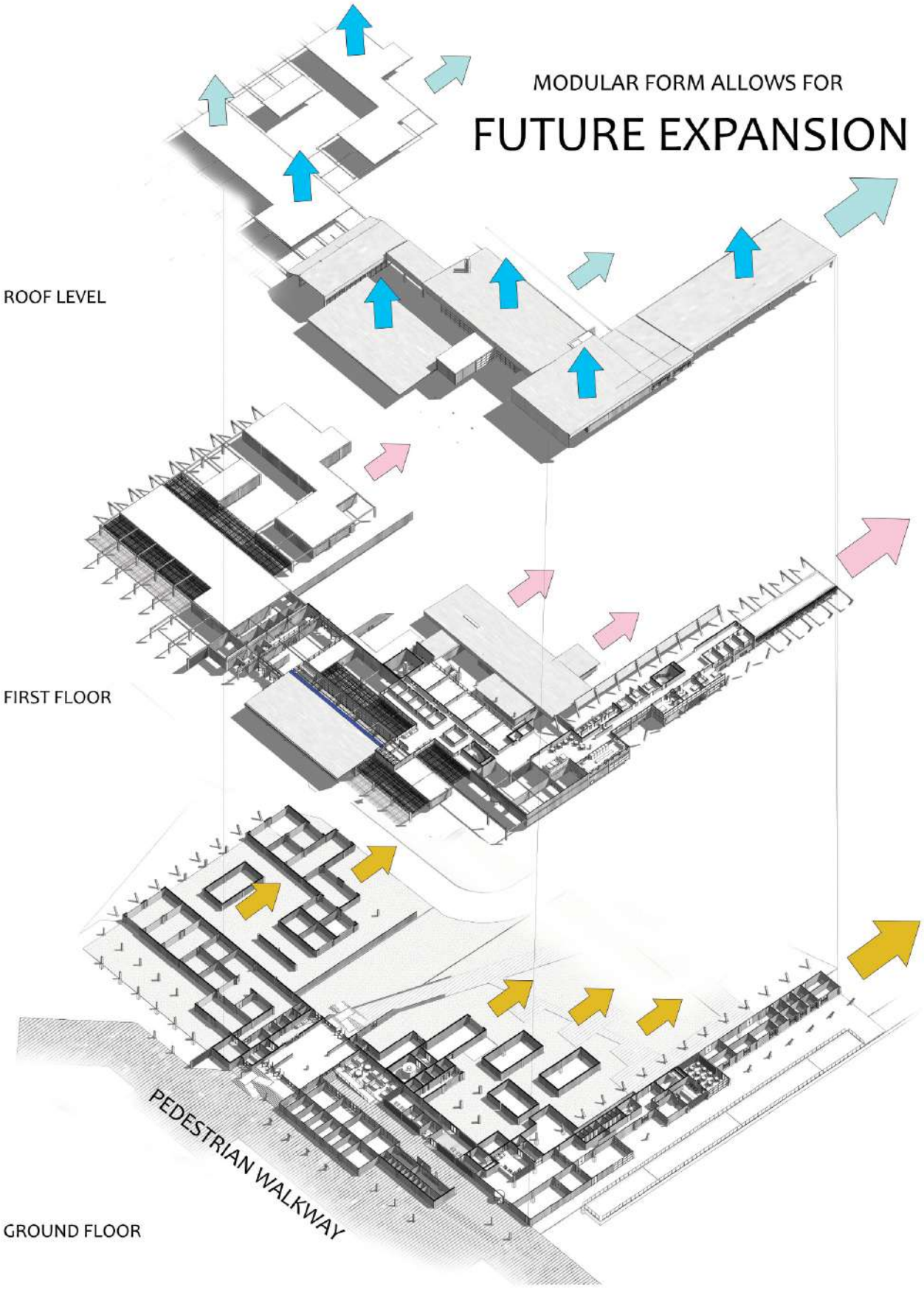
GROUND FLOOR PLAN
A new vehicular road is proposed which would allow for vehicles to enter the site and drop off waste products at the manufacturing sector. The drop-off points are individually indicated through means of way-finding. With each division clearly indicated and colour coded, it would be easy to identify the plastic, paper, glass and organic drop-off zones.
The waste moves through the southern side of the building as it undergoes different processes, after which it is sent to the various laboratories for specialised manufacturing, such as paper-block making, plastic mycelium growing, and the manufacture of transparent concrete using crushed glass.

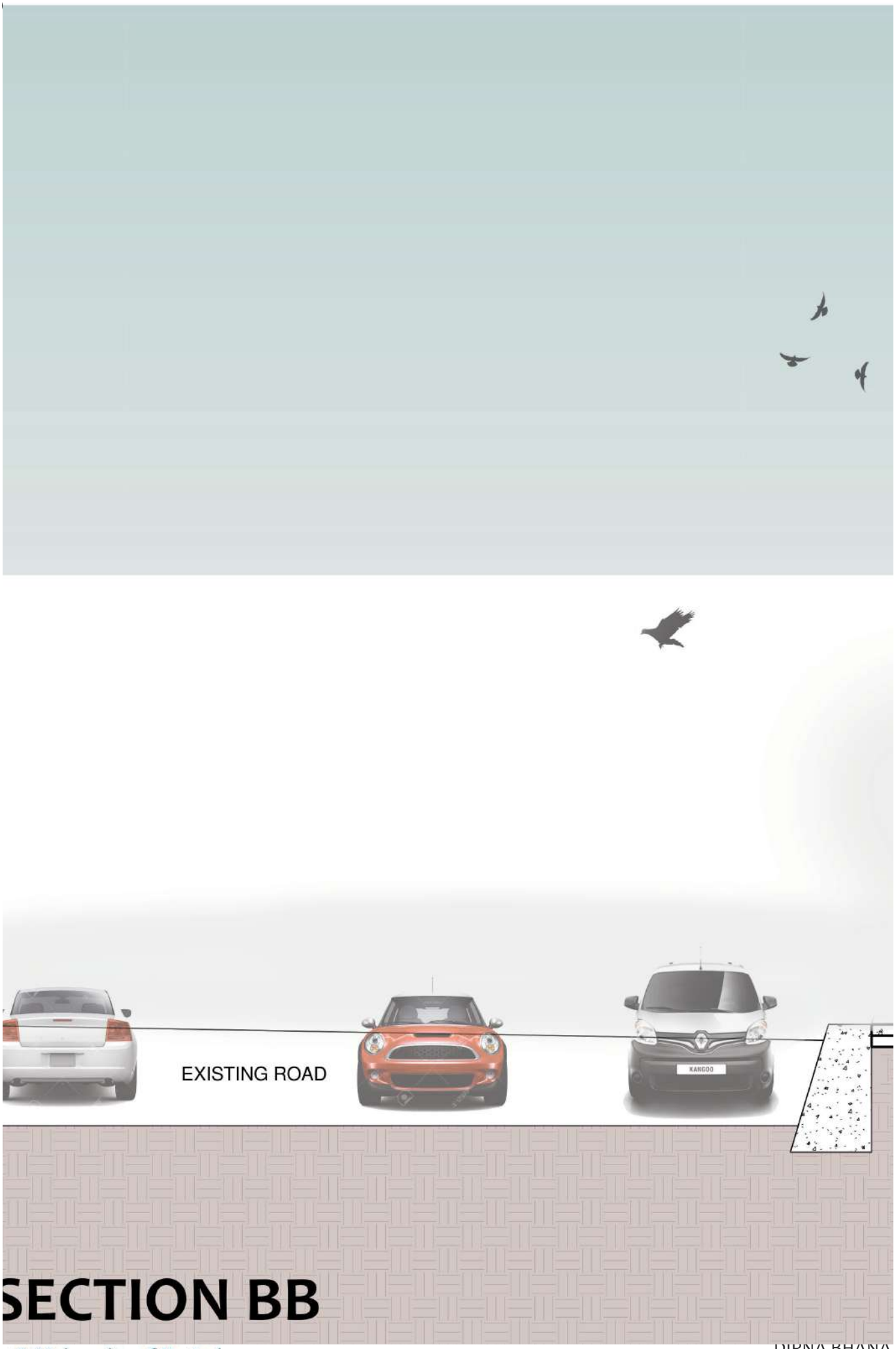
The outer edges of the ground floor accommodate fast-moving pedestrian traffic that flows though the centre of the building where secondary shops are found, such as nail salons, hairdressers and shoemakers . The central part of the building serves as a thoroughfare which directs pedestrians towards the Denneboom Station and the new shopping mall . Primary shops or rental spaces make up the eastern façade. These primary shops sell fruit, vegetables and crafts. Due to the fact that a great deal of informal trading occurs on the street edges in Mamelodi, the community centre contains layers of informality, as spaces within the building can be adapted through time.

GROUND FLOOR PLAN
A new vehicular road is proposed which would allow for vehicles to enter the site and drop off waste products at the manufacturing sector. The drop-off points are individually indicated through means of way-finding. With

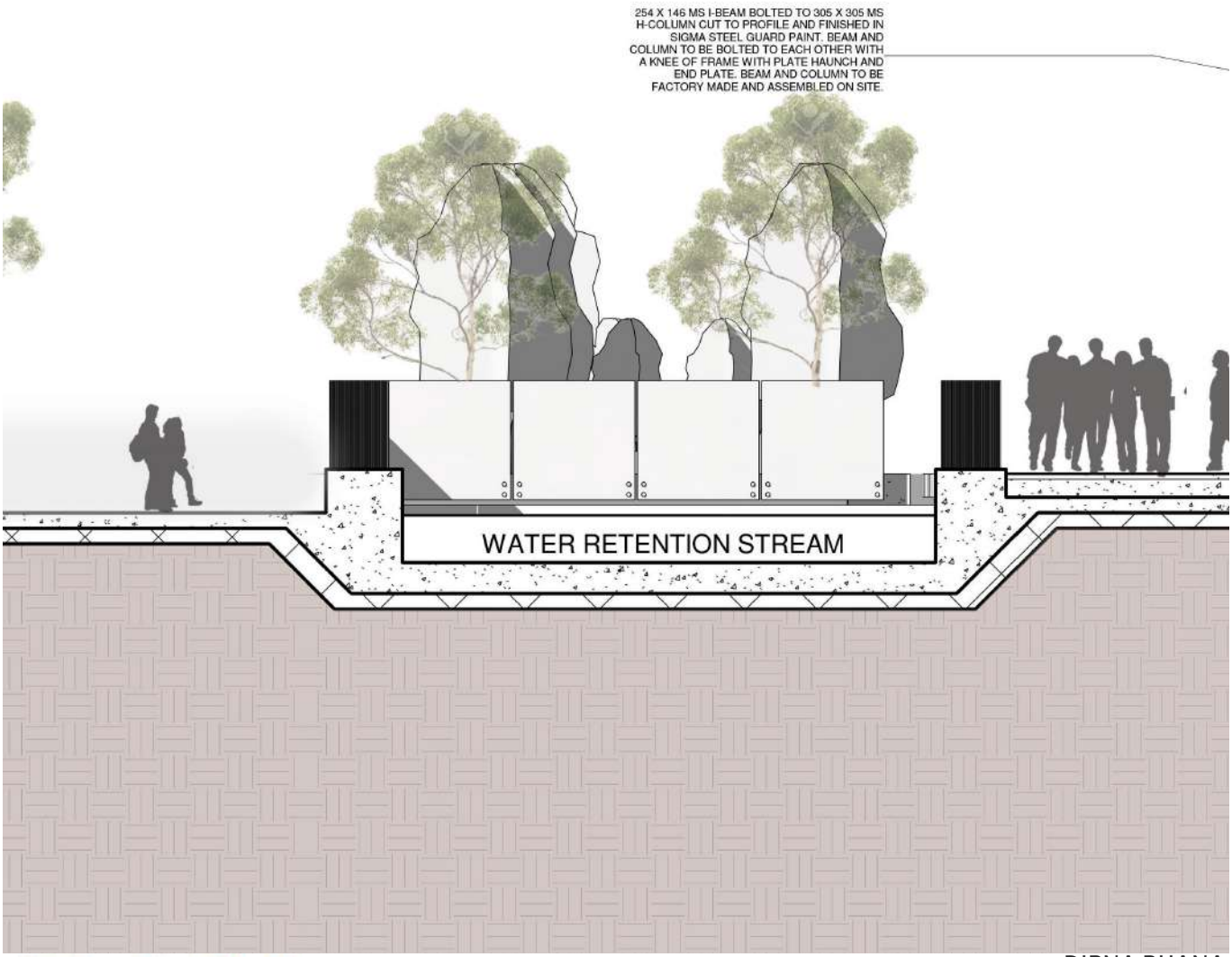
MODULAR FORM ALLOWS FOR

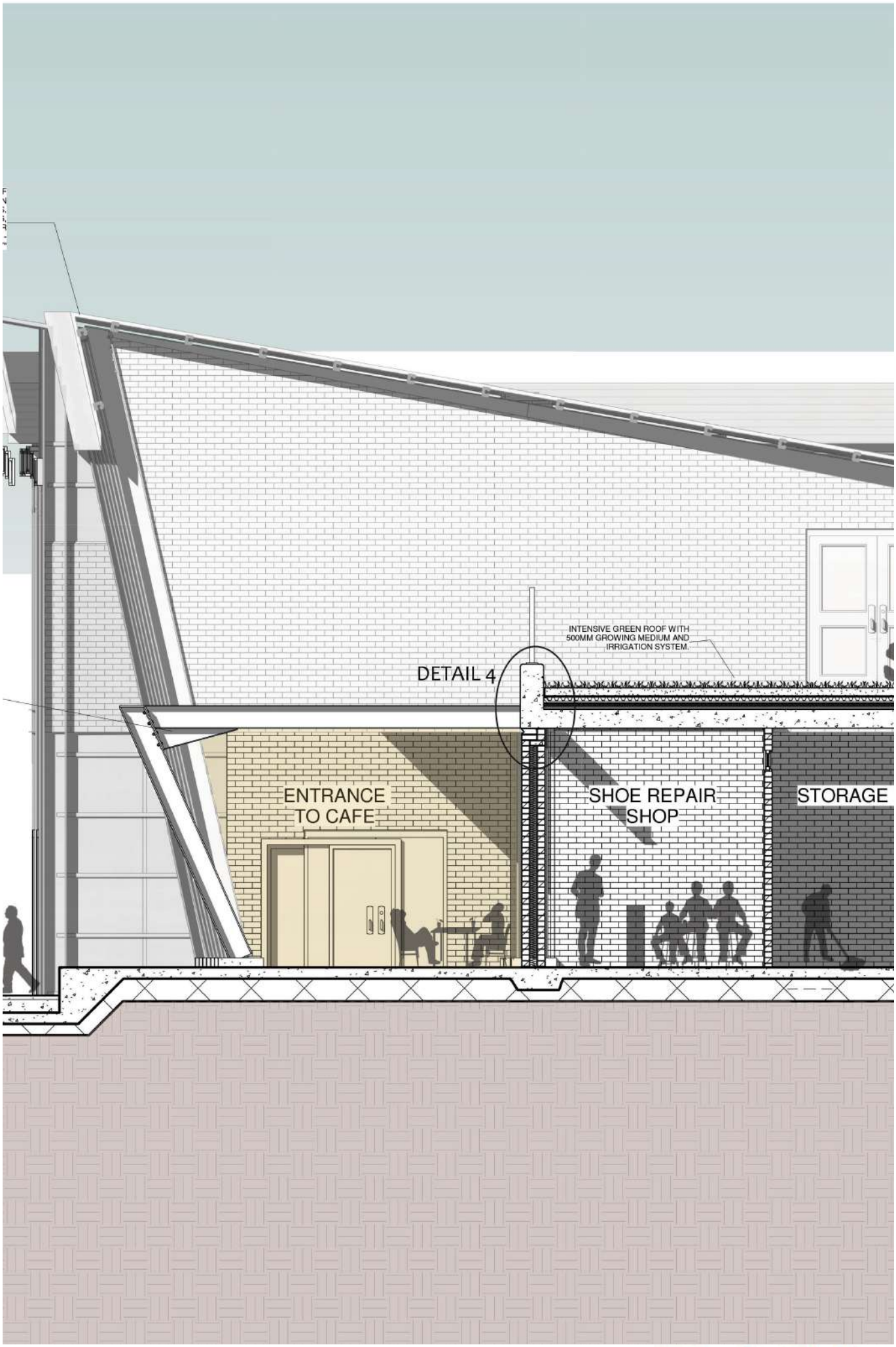
FUTURE EXPANSION

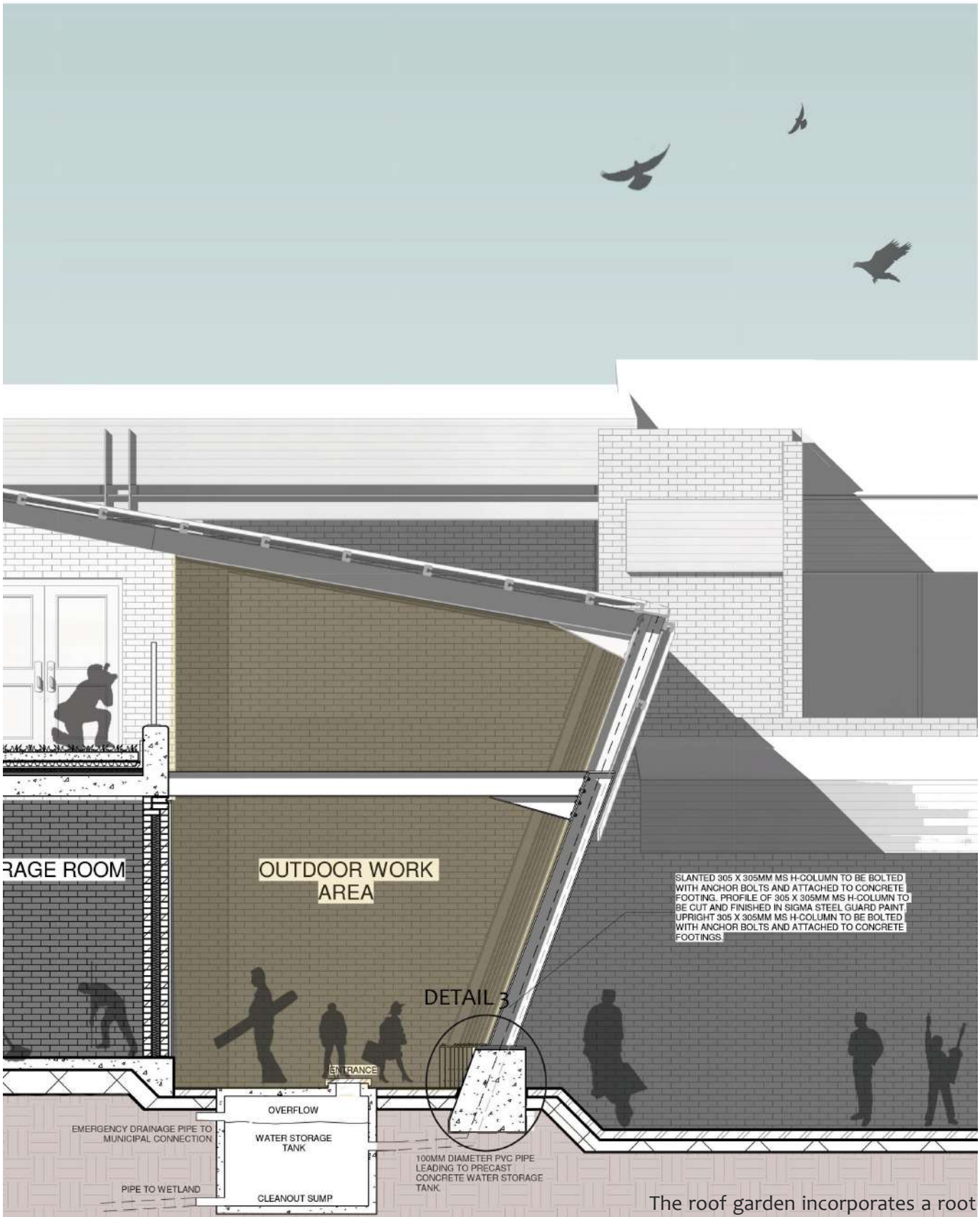




SECTION BB







The roof garden incorporates a root barrier as well as a drainage layer for efficient aeration. The drainage layer is highly durable for use in storm-water management systems. It is designed in such a manner as to enable excess storm water to drain away, while still maintaining the integrity of the waterproofing system as well as the lifespan of the roof (Schmidt & Pinheiro 2013:299).

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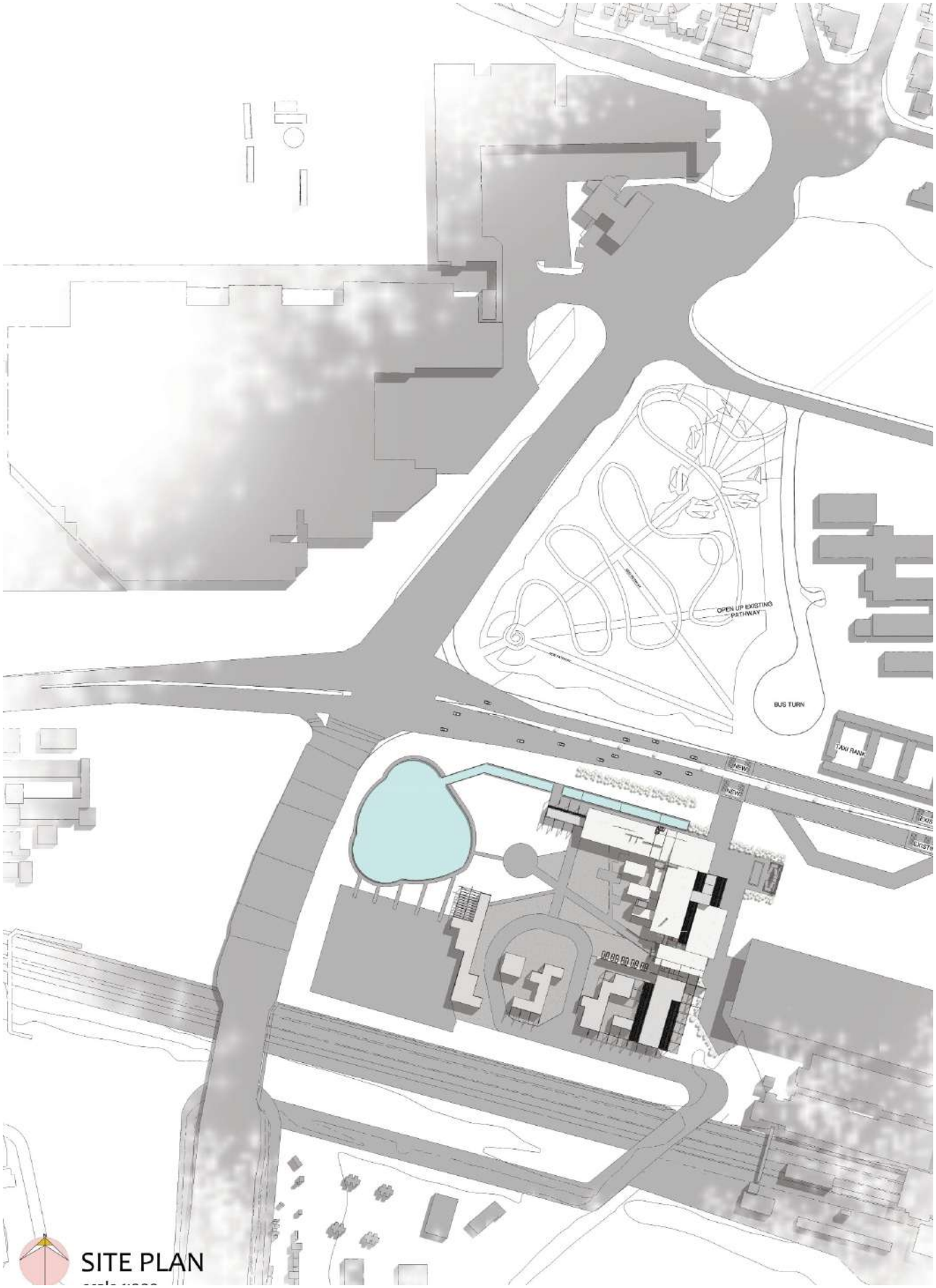

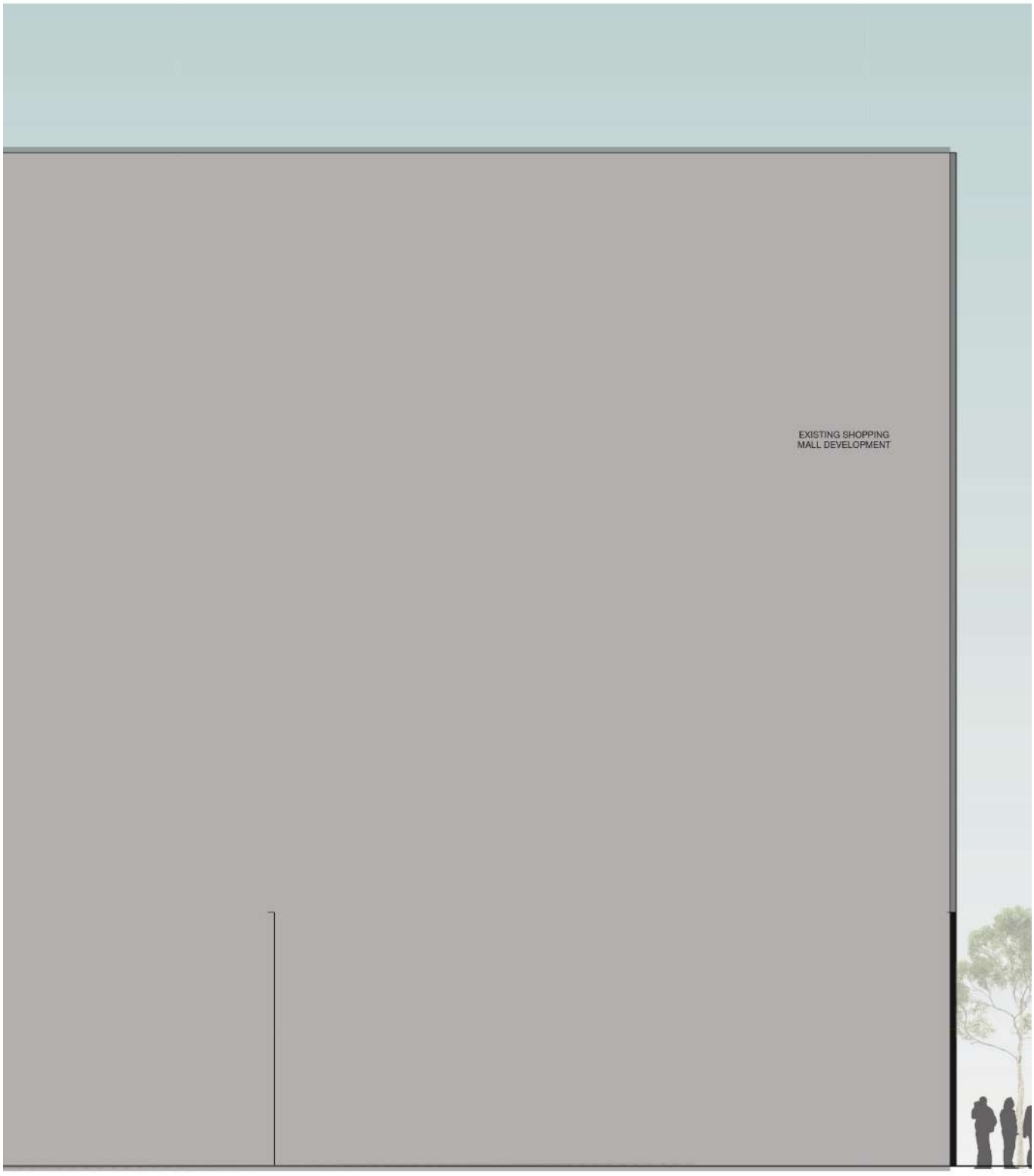

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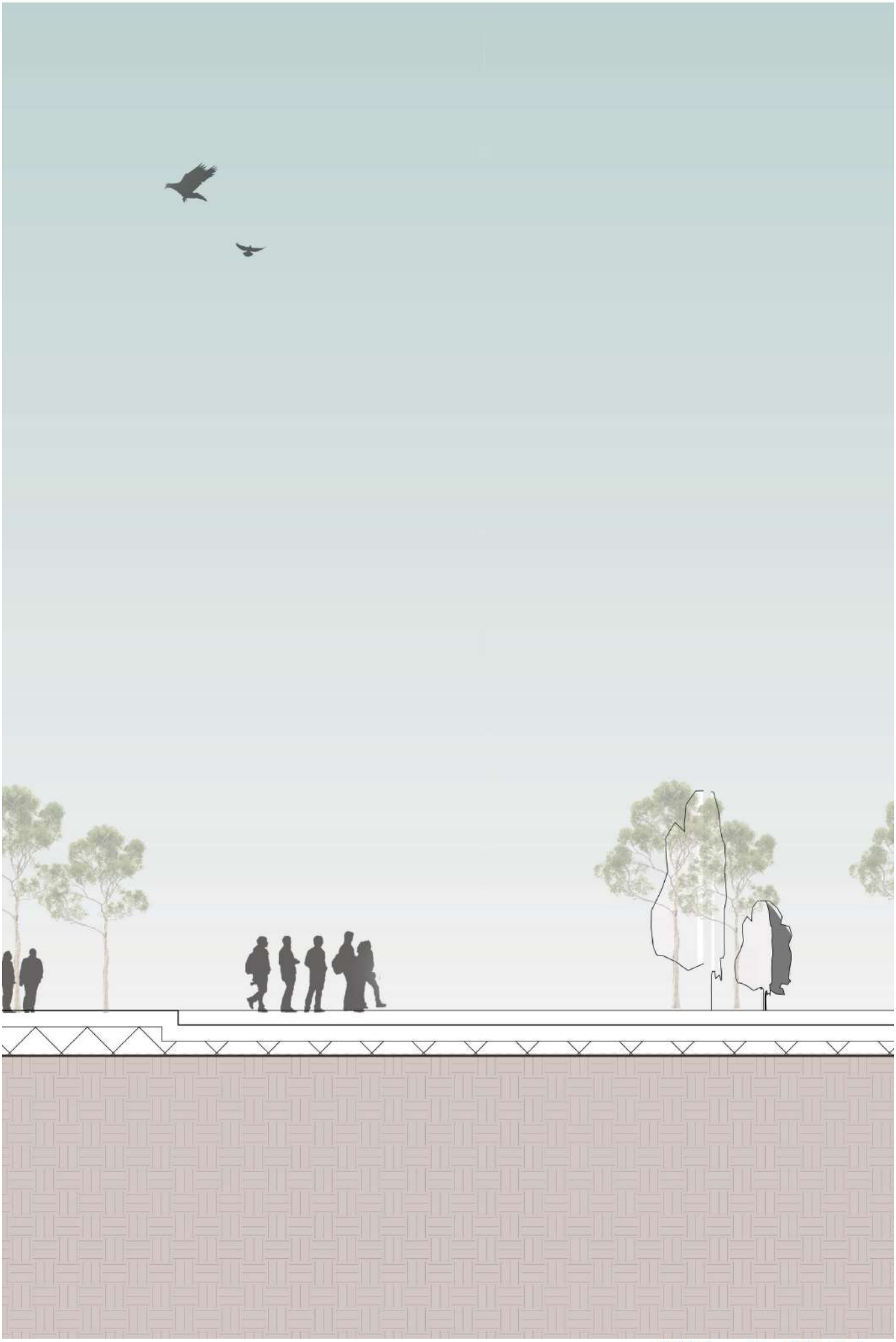
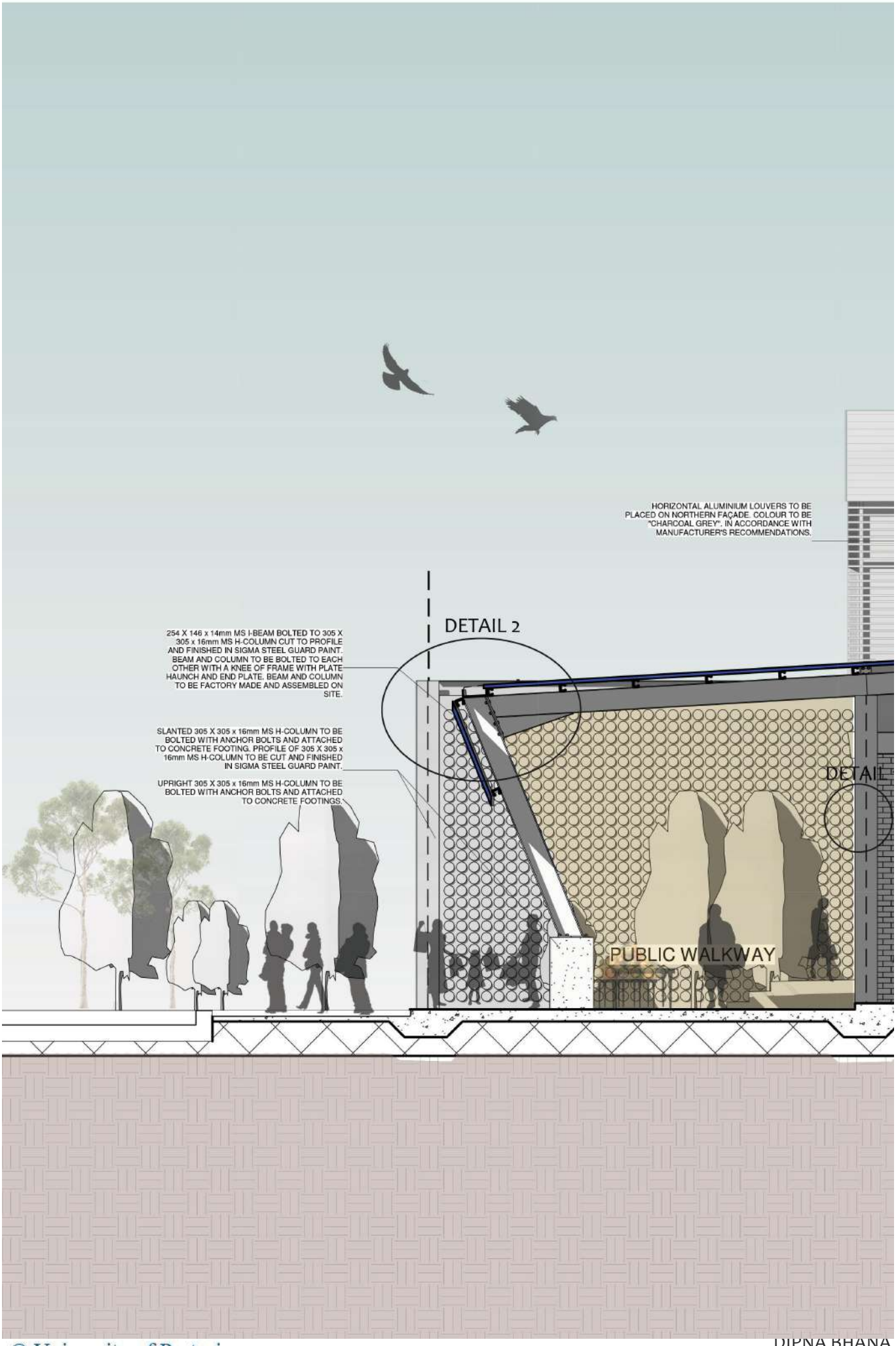
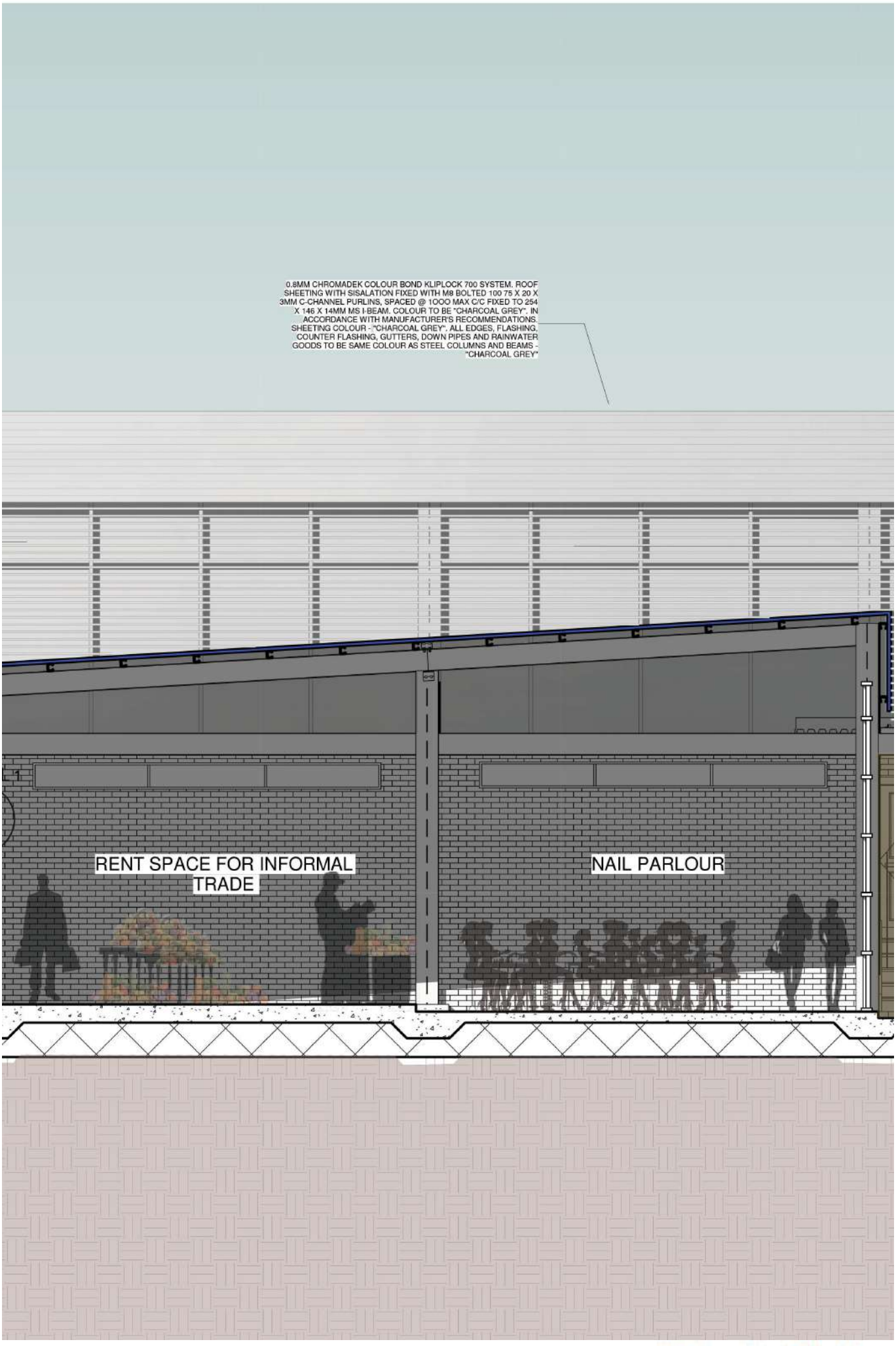
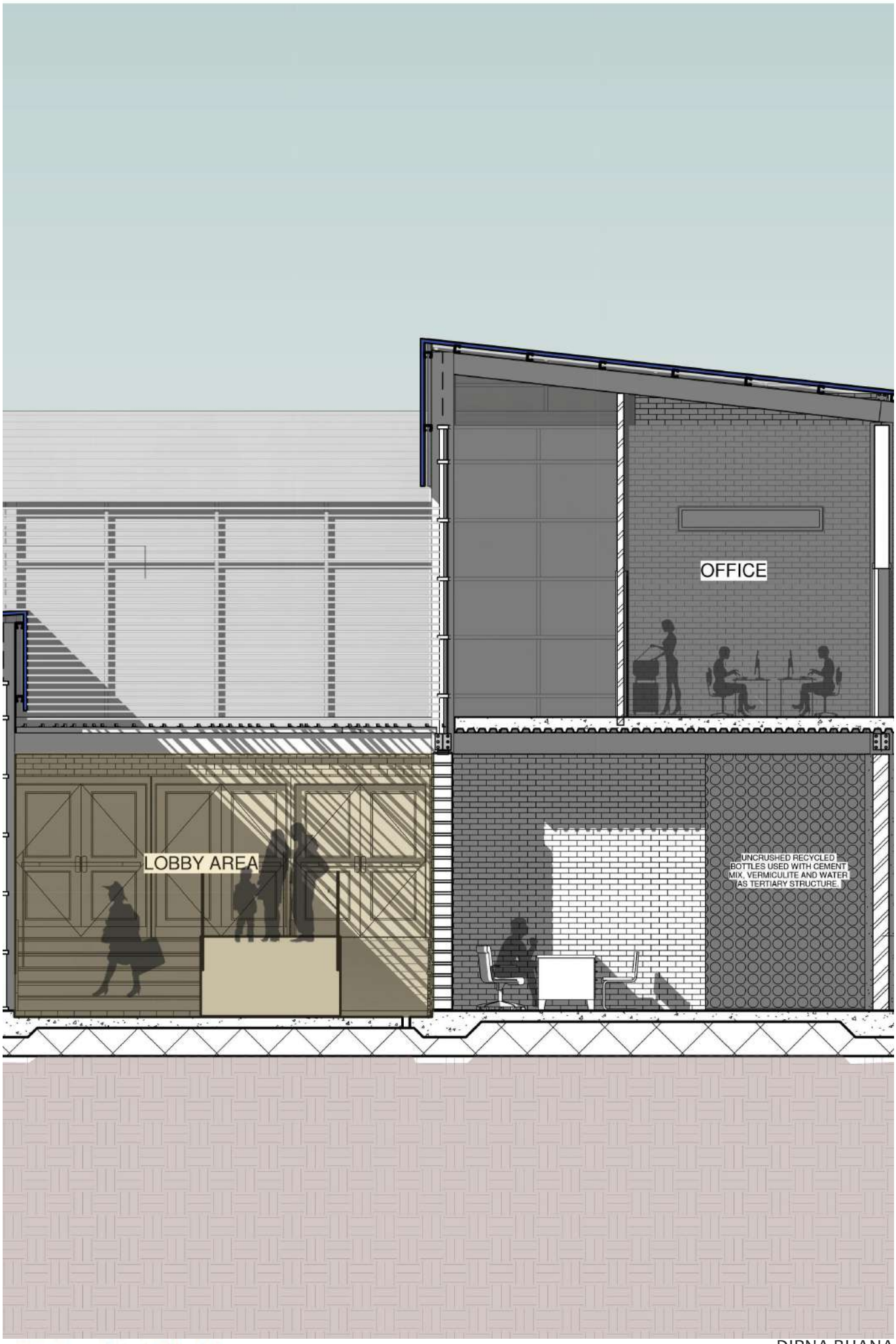
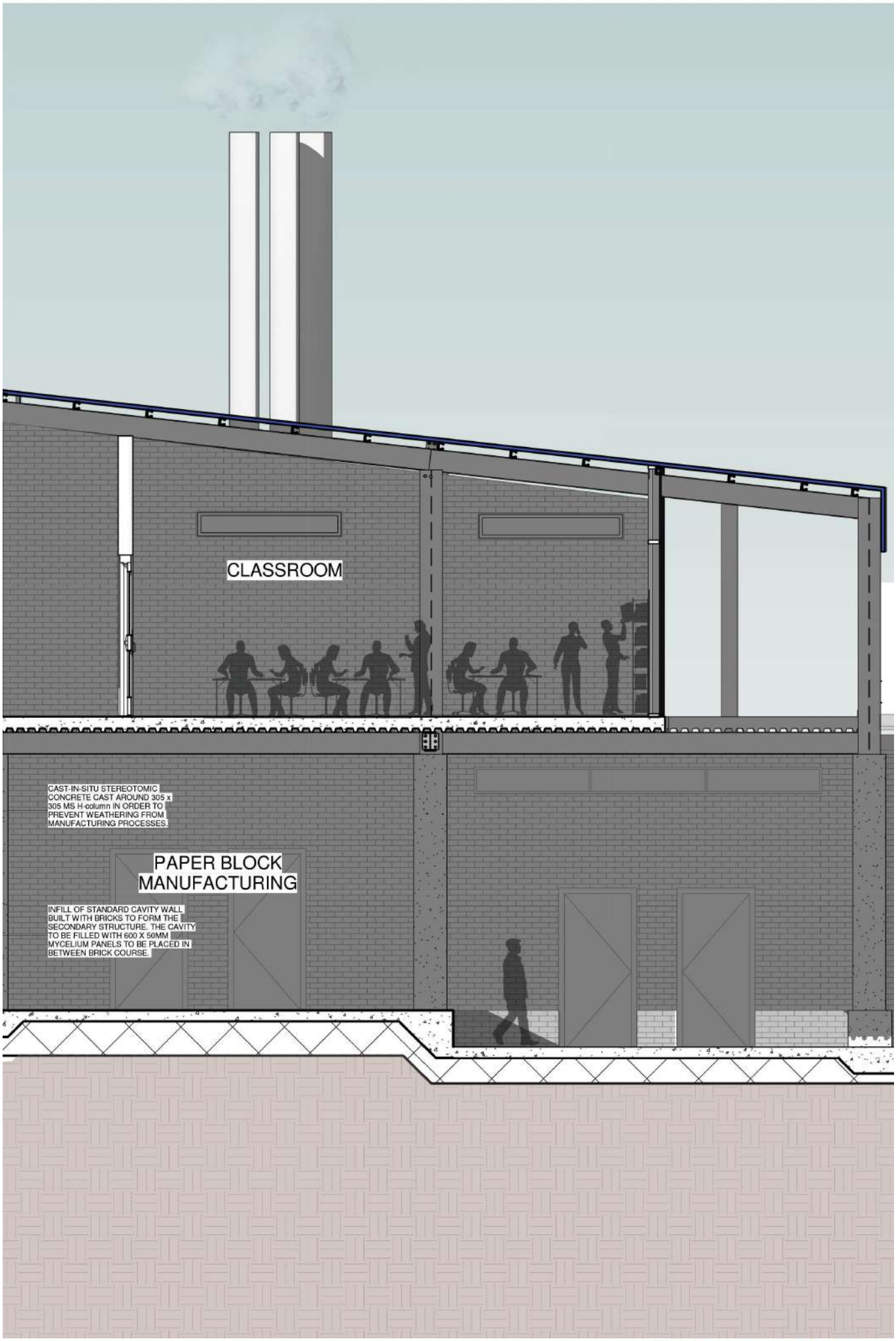
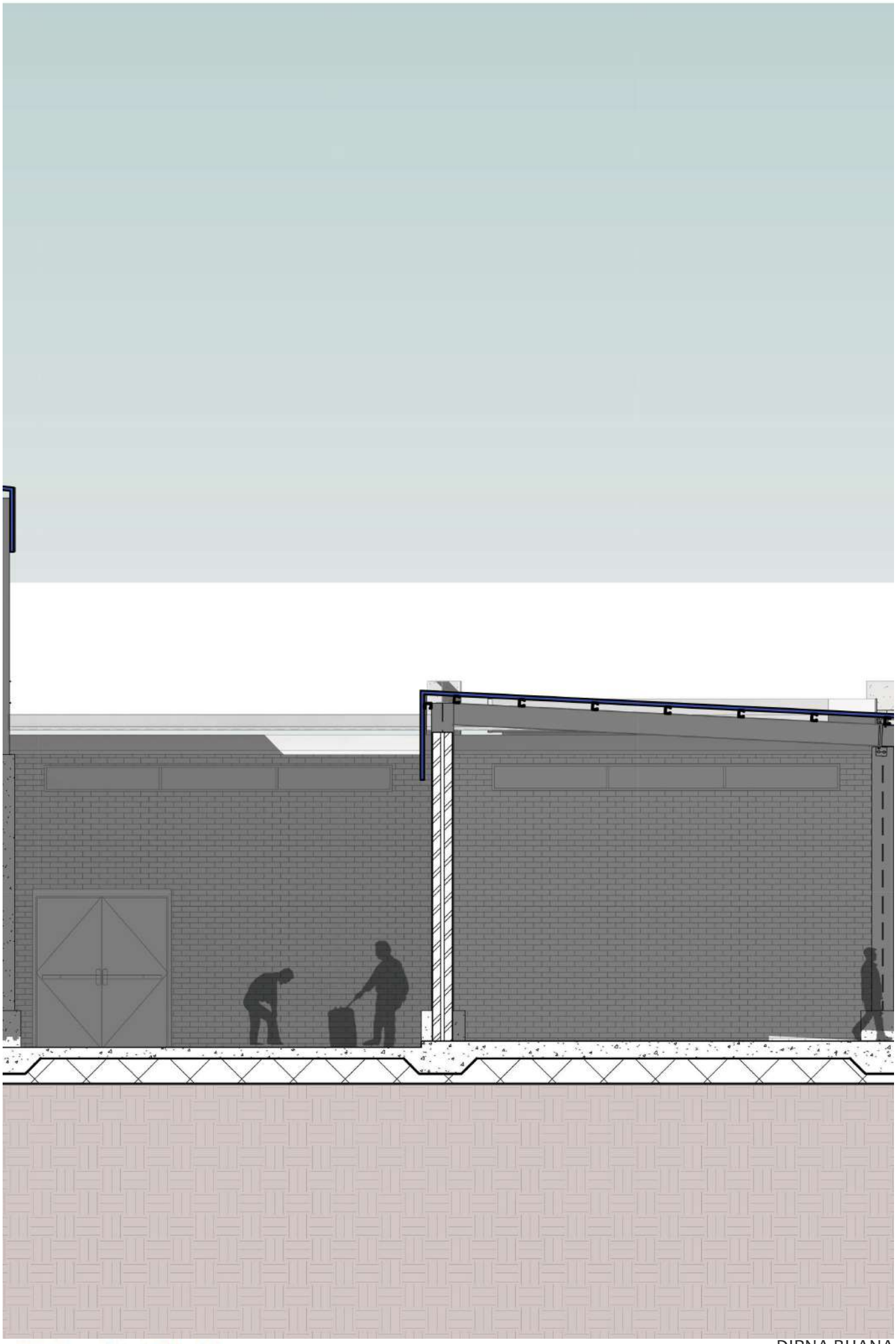












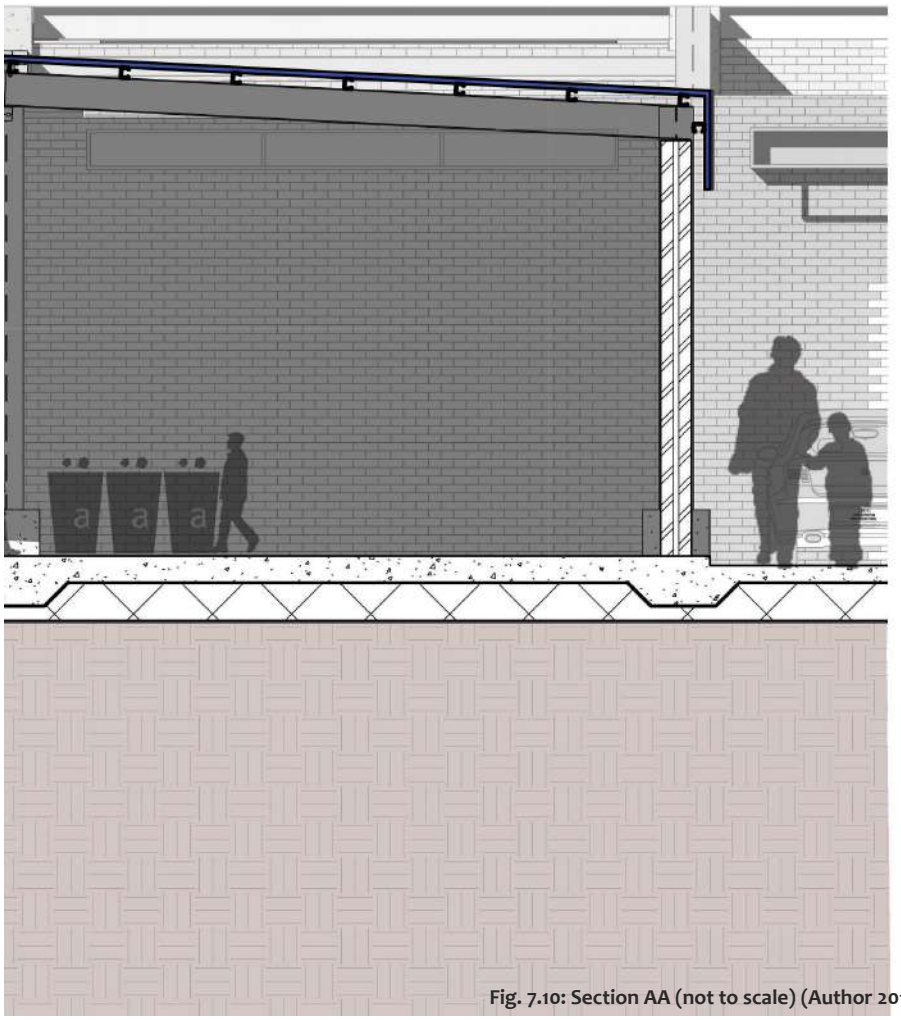
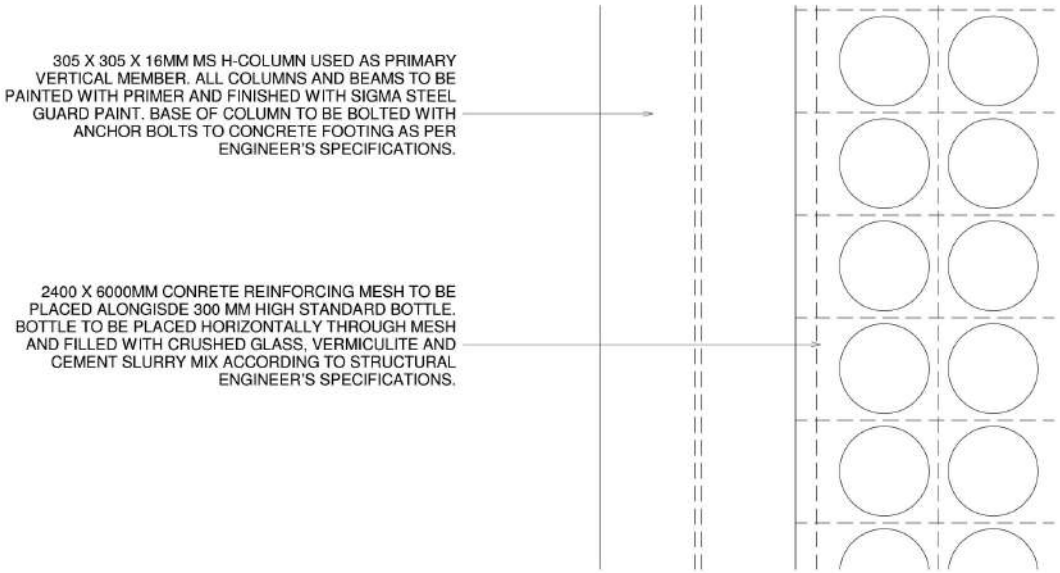
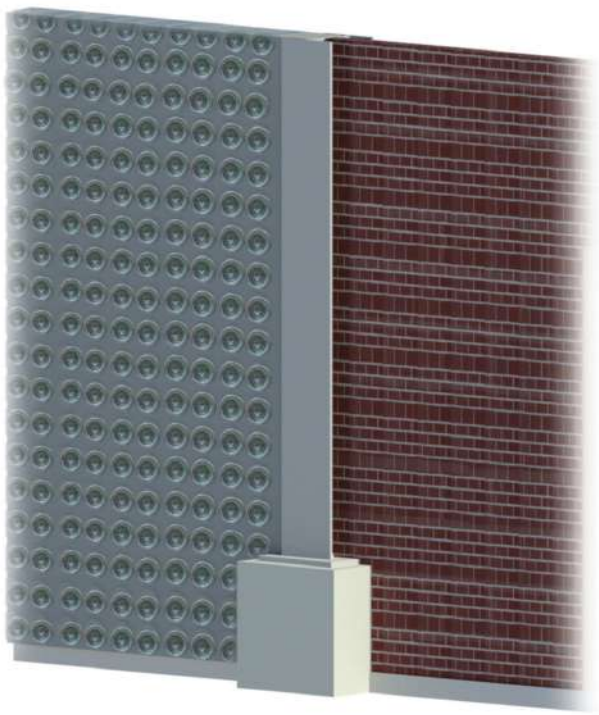
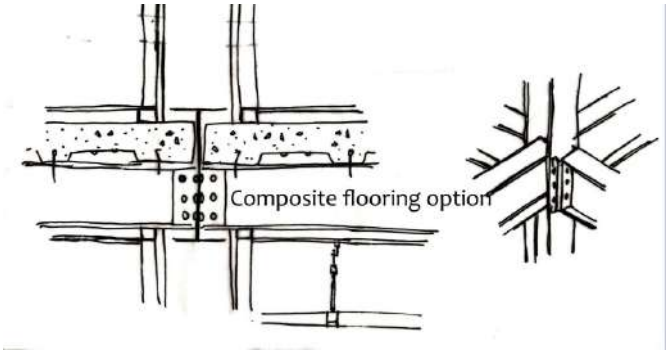
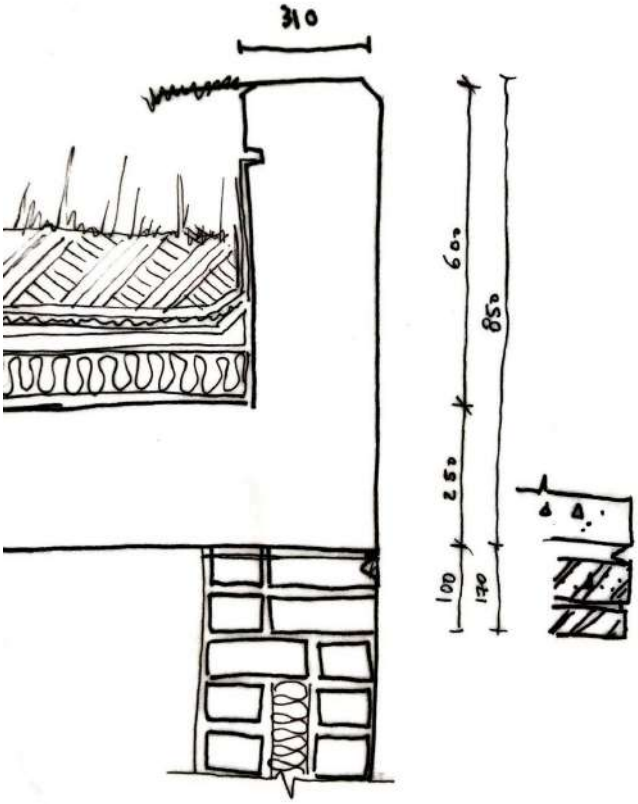


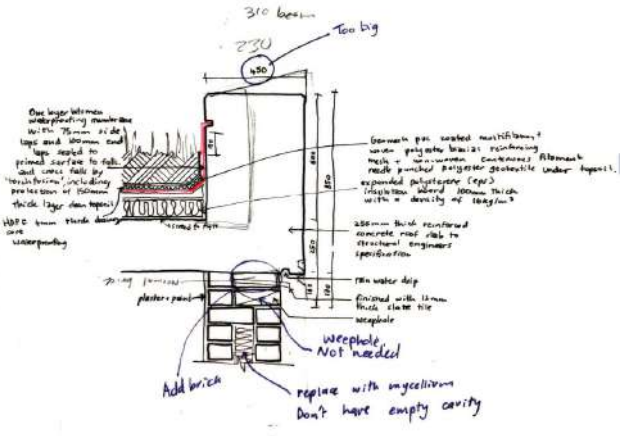
Fig. 7.10: Section AA (not to scale) (Author 2019)

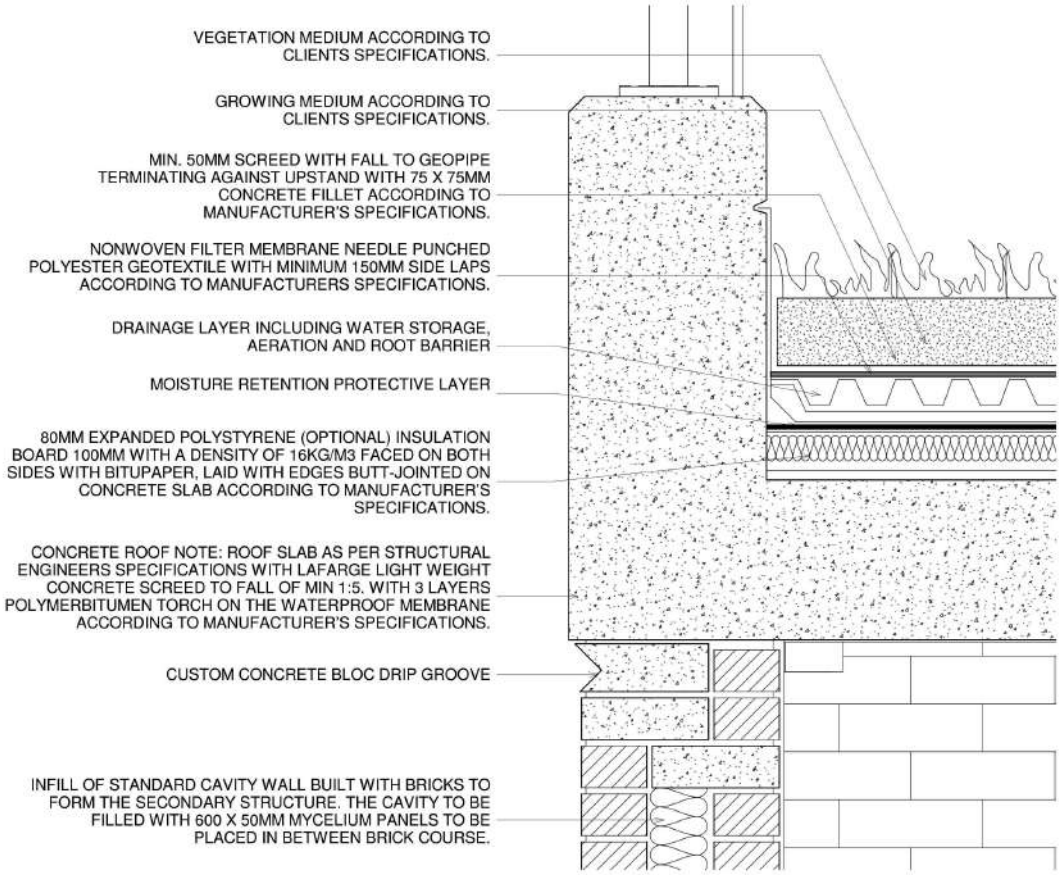


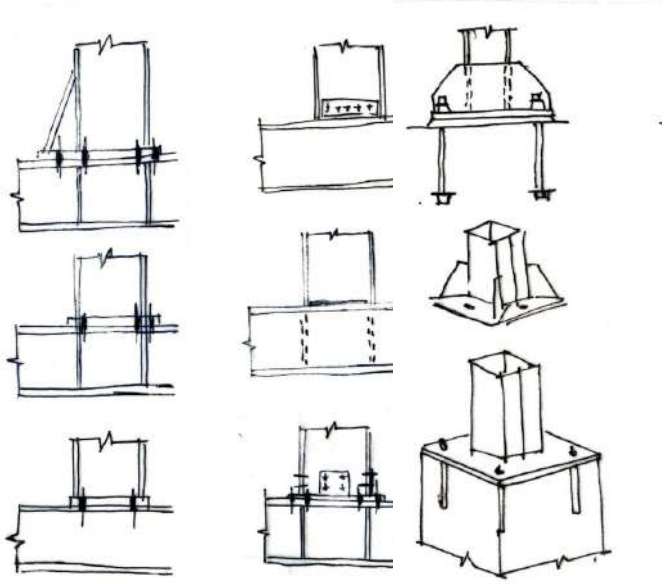












200MM MYCELIUM GROWN AND HEATED IN FURNACE AND PRESSED BETWEEN WITH FIBRE CEMENT AND 0.8MM CHROMADEK COLOUR BOND KLIPLOCK 700 SYSTEM. ROOF SHEETING WITH SISALATION FIXED WITH M8 BOLTED 100 75 X 20 X 3MM C-CHANNEL PURLINS, SPACED @ 1000 MAX C/C FIXED TO 254 X 146 X 14MM MS I-BEAM. COLOUR TO BE "CHARCOAL GREY". IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. SHEETING COLOUR - "CHARCOAL GREY". ALL EDGES, FLASHING, COUNTER FLASHING, GUTTERS, DOWN PIPES AND RAINWATER GOODS TO BE SAME COLOUR AS STEEL COLUMNS AND BEAMS - "CHARCOAL GREY"

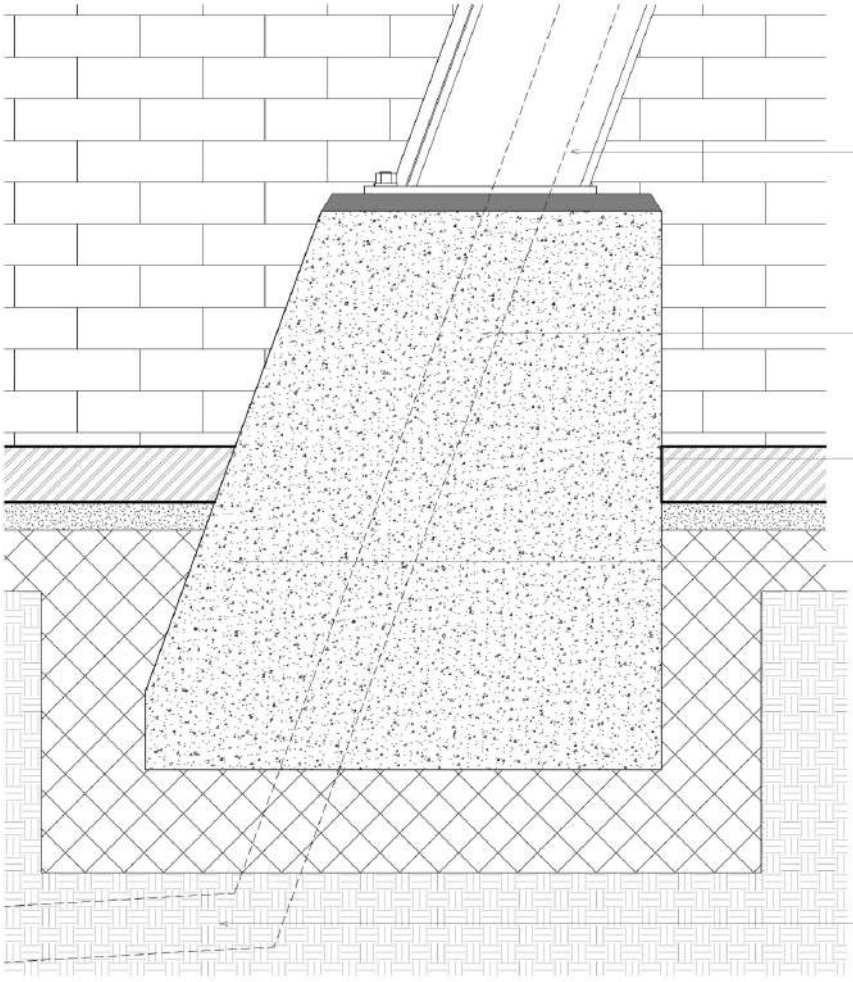
350 MM PURPOSE MADE GALVANISED STEEL GUTTER TO BE COVERED WITH MESH GUTTER LEAF GUARD TO BE PRE MANUFACTURED AND INSTALLED ON SITE.

SUPPORT PLATE ACCORDING TO ENGINEER'S SPECIFICATIONS.

254 X 146 X 14MM MS I-BEAM BOLTED TO 305 X 305 X 16MM MS H-COLUMN CUT TO PROFILE AND FINISHED IN SIGMA STEEL GUARD PAINT. BEAM AND COLUMN TO BE BOLTED TO EACH OTHER WITH A KNEE OF FRAME WITH PLATE HAUNCH AND END PLATE. BEAM AND COLUMN TO BE FACTORY MADE AND ASSEMBLED ON SITE.

A KNEE OF FRAME WITH SUPPORT PLATE HAUNCH AND END PLATE ACCORDING TO ENGINEER'S SPECIFICATIONS.

305 X 305 X 16MM MS H-COLUMN USED AS PRIMARY VERTICAL MEMBER. ALL COLUMNS AND BEAMS TO BE PAINTED WITH PRIMER AND FINISHED WITH SIGMA STEEL GUARD PAINT. BASE OF COLUMN TO BE BOLTED WITH ANCHOR BOLTS TO CONCRETE FOOTING AS PER ENGINEER'S SPECIFICATIONS.



305 X 305 X 16MM MS H-COLUMN USED AS PRIMARY VERTICAL MEMBER. ALL COLUMNS AND BEAMS TO BE PAINTED WITH PRIMER AND FINISHED WITH SIGMA STEEL GUARD PAINT. BASE OF COLUMN TO BE BOLTED WITH ANCHOR BOLTS WITH BASE PLATE TO CONCRETE FOOTING AS PER ENGINEER'S SPECIFICATIONS.

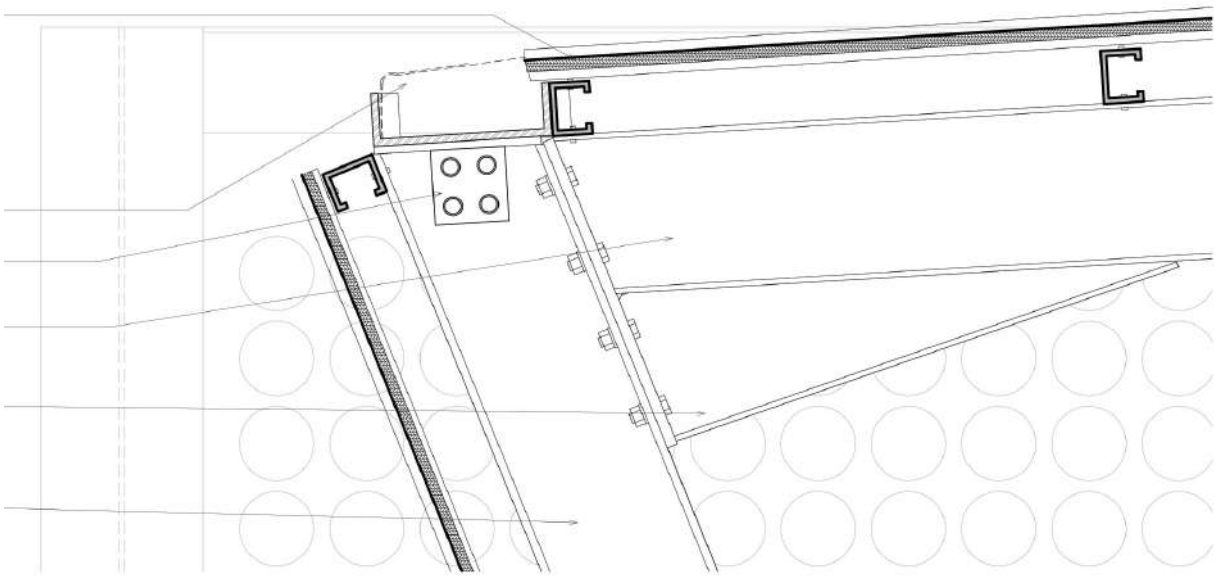
100MM DIAMETER GALVANISED STEEL RAINWATER DOWNPIPE @ 6000C/C INTERVALS

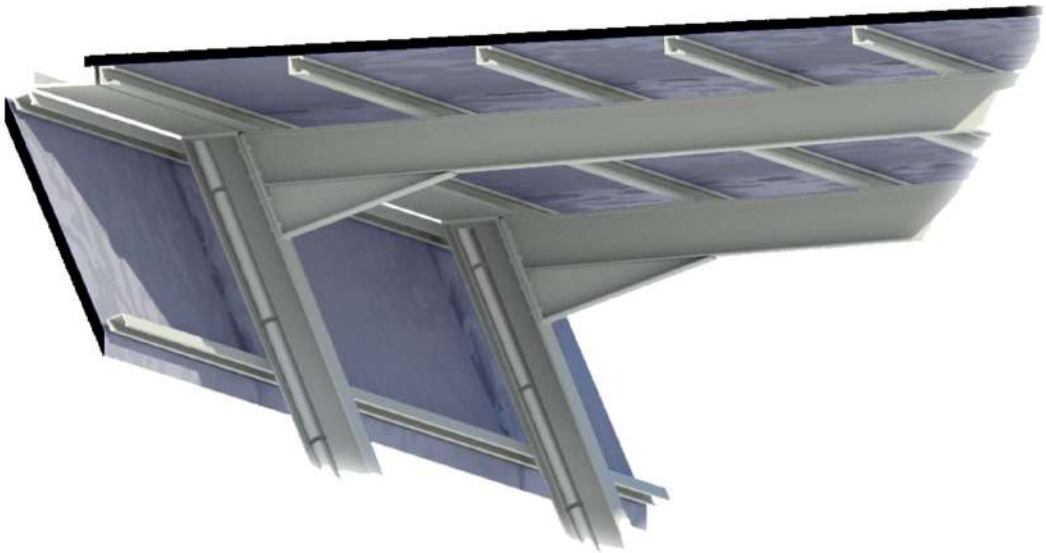
GLASS AGGREGATE CONCRETE PAVERS TO BE ACCORDING TO MANUFACTURERS SPECIFICATIONS

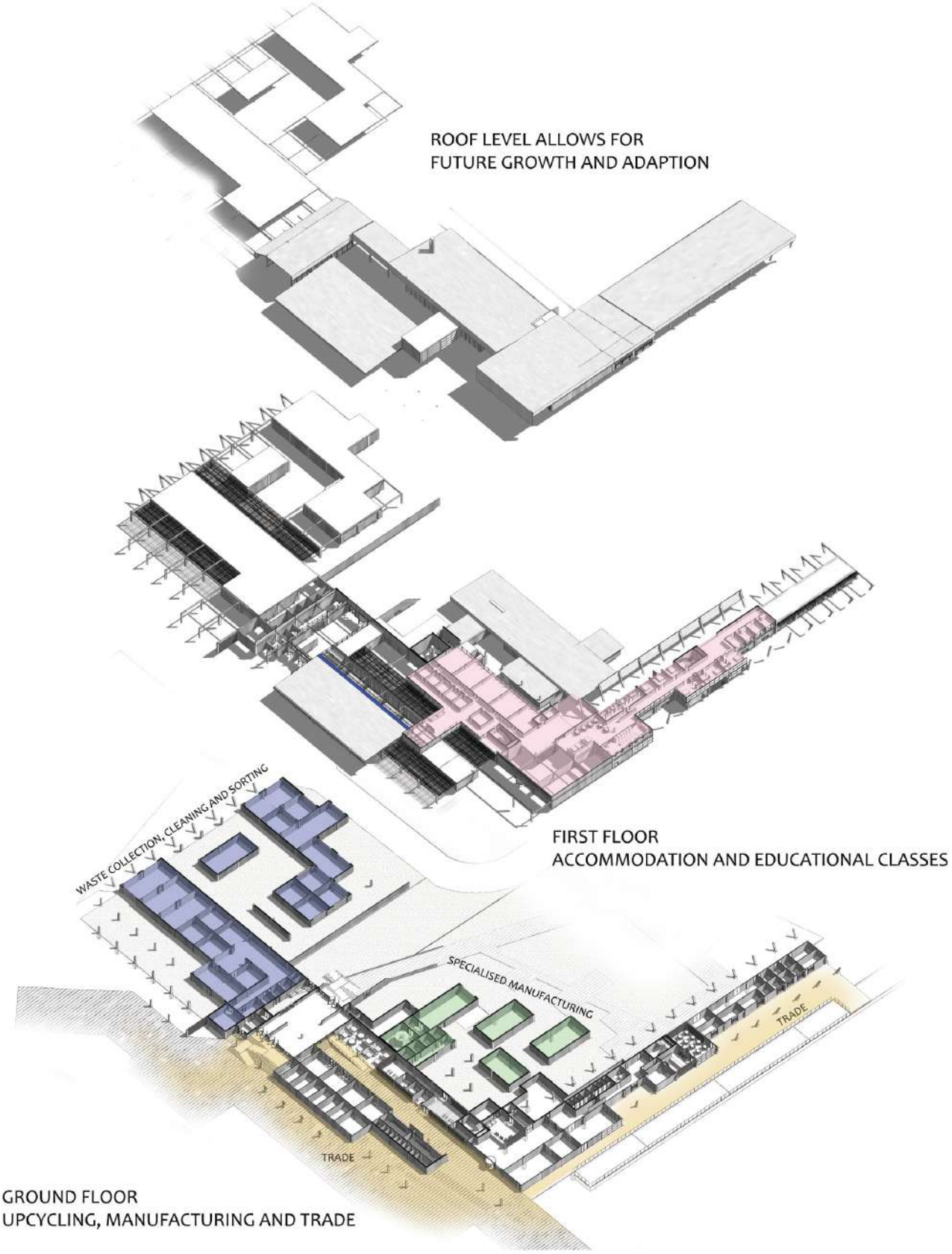
CONCRETE FOOTING SHAPE TO BE DETERMINED BY ANGLE OF H-COLUMN IN ORDER TO MINIMISE SHEAR FORCE AS PER ENGINEER'S SPECIFICATIONS.

DRAINAGE THROUGH FOOTING ALLOWS FOR THE GROUND WATER UNDER SLAB TO DRAIN AWAY.

100MM DIAMETER PVC PIPE LEADING TO PRECAST CONCRETE WATER STORAGE TANKS.







TECHNOLOGY

The building system functions as a closed loop system, as there is an inflow and outflow of Recycling, Making & Education. The high levels of waste produced by the malls and surrounding shops are recycled here. The unused organic material could be turned into compost at a wormery for improving the organic carbon levels of the local soil (Paulin & O'Malley 2008).

Making could also take the form of service provision, such as a mechanical repair centre where machines can be repaired or used for another purpose. In this way an important exchange of knowledge and skills could take place. Furthermore, Making could include the growing of plants or fungi. Beneficial plants such as turmeric and ginger with their medicinal and anti-inflammatory properties could be provided to the public, for example in exchange for five single-use plastic bags.
Through a process of give and take, education will enrich the lives of adults, teenagers and children with knowledge and ideas. Night classes will provide opportunities to the working class as well, teaching accounting, finance and crafts in order to raise the education rate in the area and empower the community.

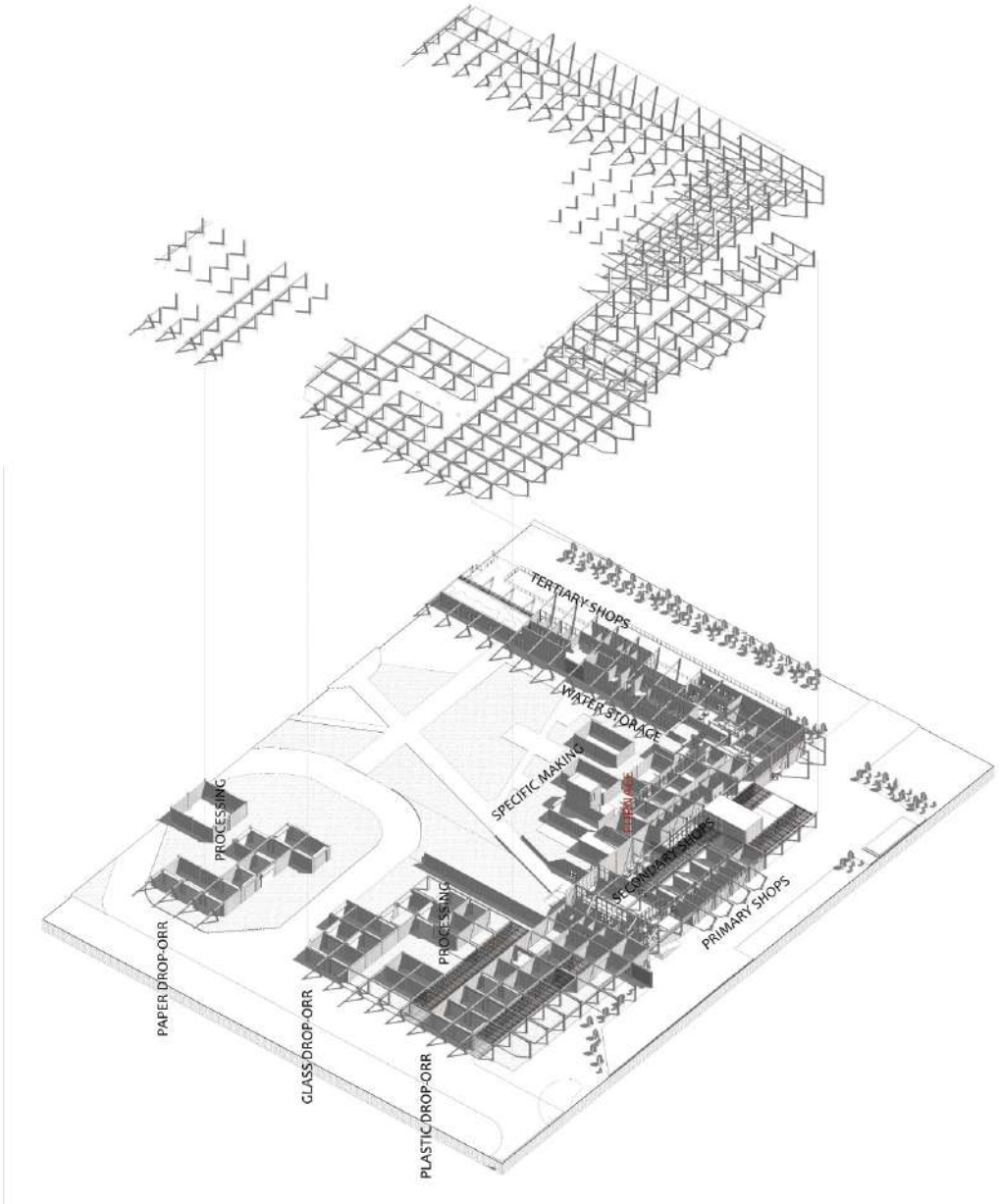


Fig. 7.12: Axonometric system diagram (Author 2019)

SERVICES

Because of the abovementioned systems and the vastness of the area of the site, water is a necessity for the recycling, cleaning and upcycling of waste materials as well as for the growing of crops (Making). Water harvesting will be a driving technological service whereby the main supply of water will be gathered in a storm-water management system. From there, the water will be separated through storm-water quality checks such

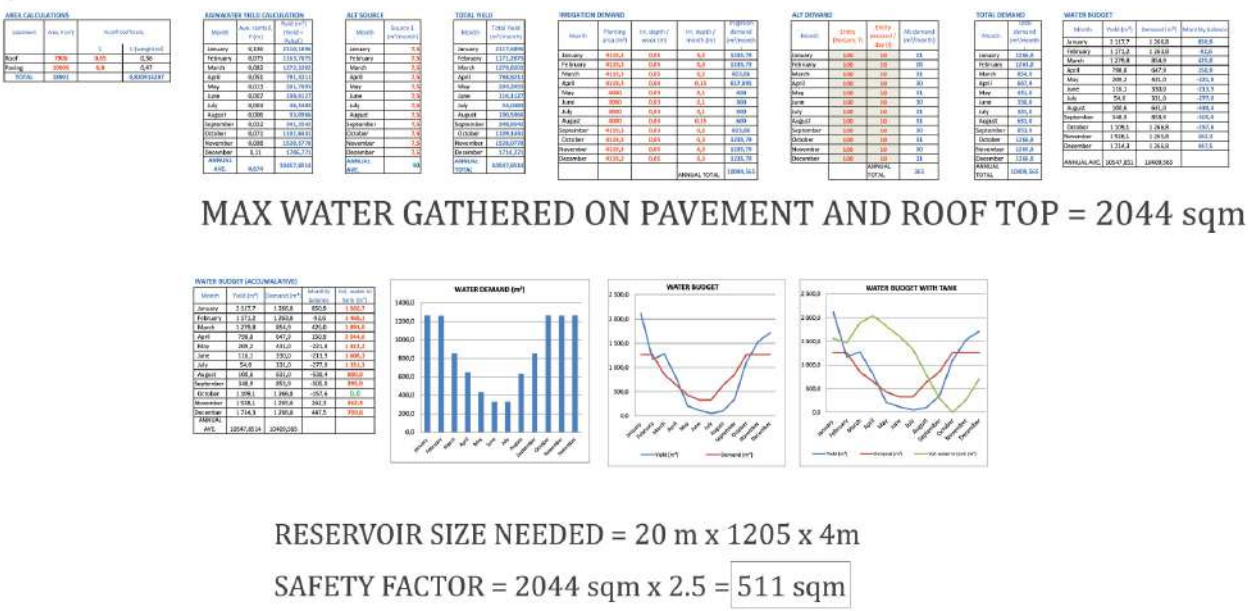


Fig. 7.13: Water harvesting calculation (Author 2019)

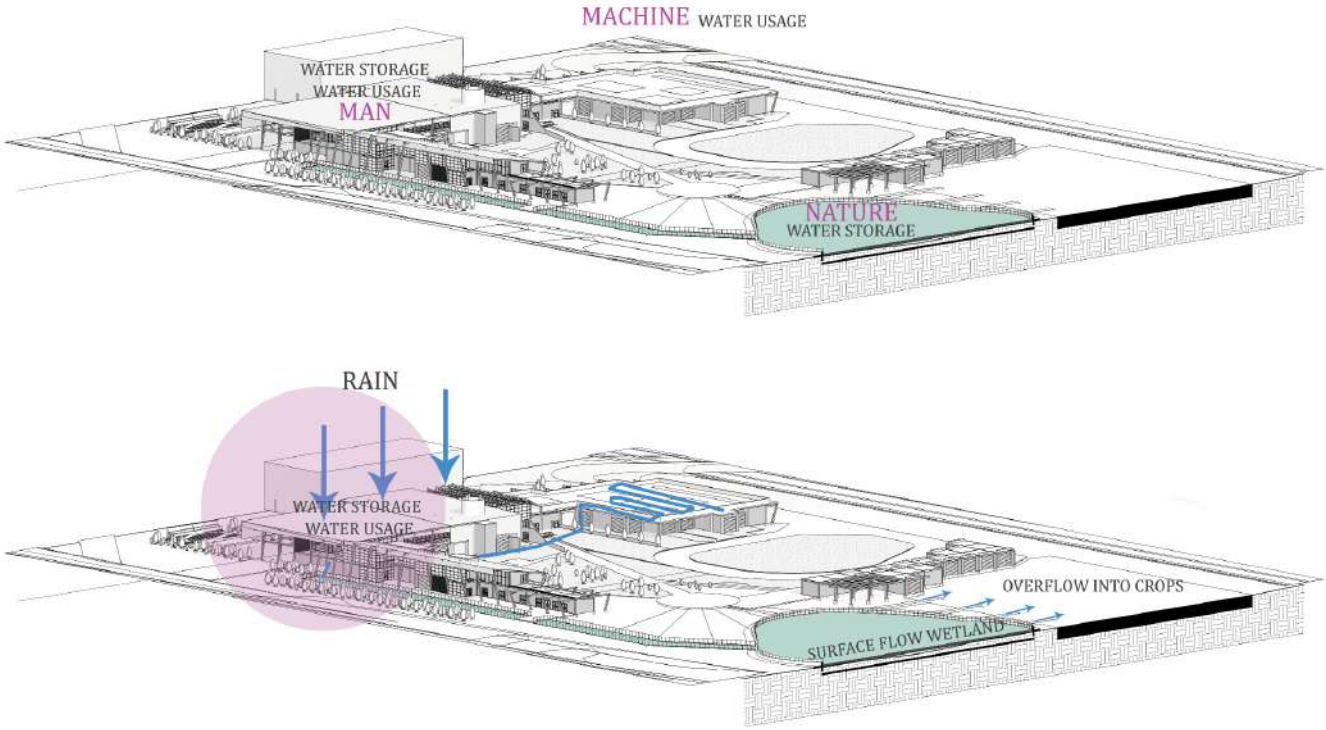


Fig. 7.14: Water harvesting axonometric (Author 2019)

as oil traps, settlement traps, water augmentation tanks and a wetland. Once the quality of the storm water has been checked, the water will be brought into the closed loop system and reused for multiple purposes.

HOT WATER

The furnace as well as solar heaters will be used to heat the water in the community centre to supply hot water to all taps and showers.

According to the SANS 10400-XA Energy Usage in Buildings regulations in South Africa, it is stated that a maximum of 50% of hot water may still be gained from direct immersion heating and therefore, in addition to solar panels being used for heat gain, the geysers for taps and showers will be connected to an electricity outlet on a timer switch.

The taps in all the bathrooms will be placed slightly higher than the cistern tank so that the tap water from all the basins can be used to fill the toilet cisterns.

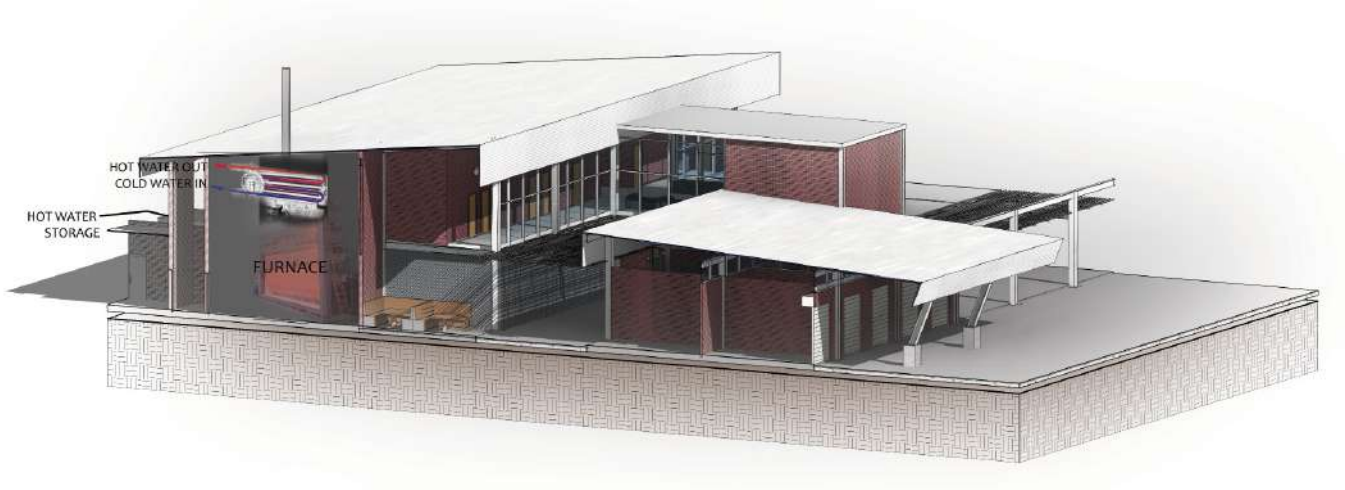


Fig. 7.15: Furnace and water heating sectional perspective (Author 2019)

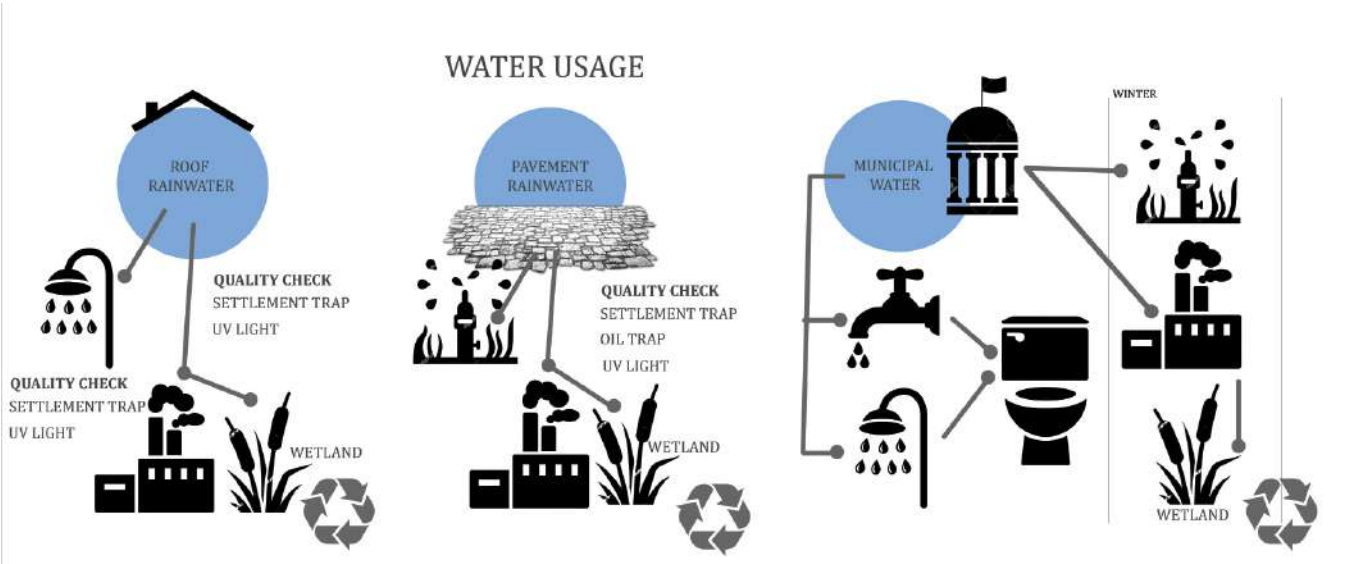


Fig. 7.16: Water usage systems (Author 2019)

SUSTAINABILITY

SUSTAINABLE BUILDING ASSESSMENT TOOL (SBAT–P) V 1

The SBAT analysis demonstrates that the overall score is an even rating with an average score of 4.1 to 4.9. The economic contribution of the proposed project is the highest, while its environmental contribution is the lowest, while still holding a high score. These ratings prove to be beneficial to the environment, economy and social sphere, while still being well integrated with the surrounding area.

GREEN STAR SA RATING

A weighted score of 50 was gained from the Green Star SA – Public & Education Building V1 Rating Tool assessment, with the building therefore proving to be a 4 star rated building .

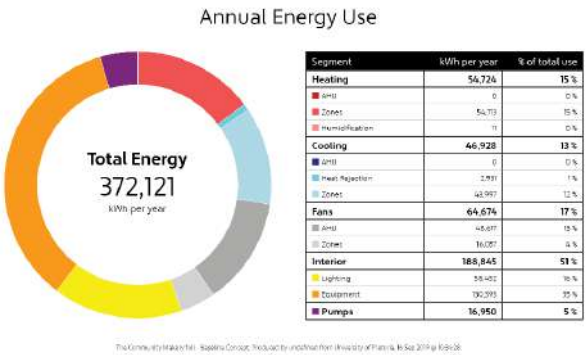


Fig. 7.17: Energy analysis of the community makery (Author 2019)

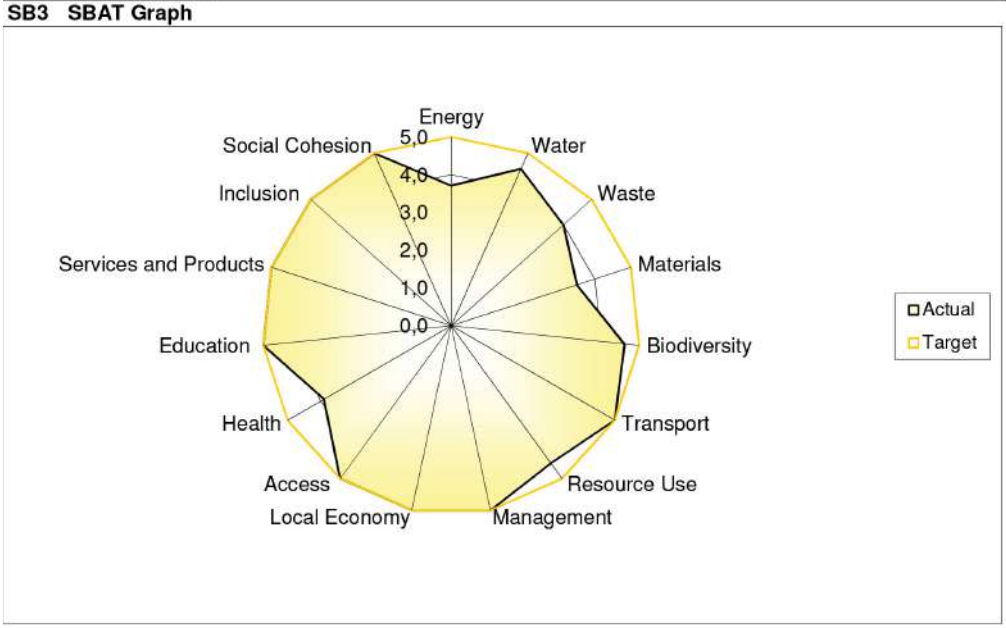
SB1 Project

The community makery

SB2 Address

Mamelodi West

SB3 SBAT Graph



SB4 Environmental, Social and Economic Performance	Score
Environmental	4,1
Economic	4,9
Social	4,8
SBAT Rating	4,6

Fig. 7.18: SBAT analysis after installation (Author 2019)

GREEN STAR RATING

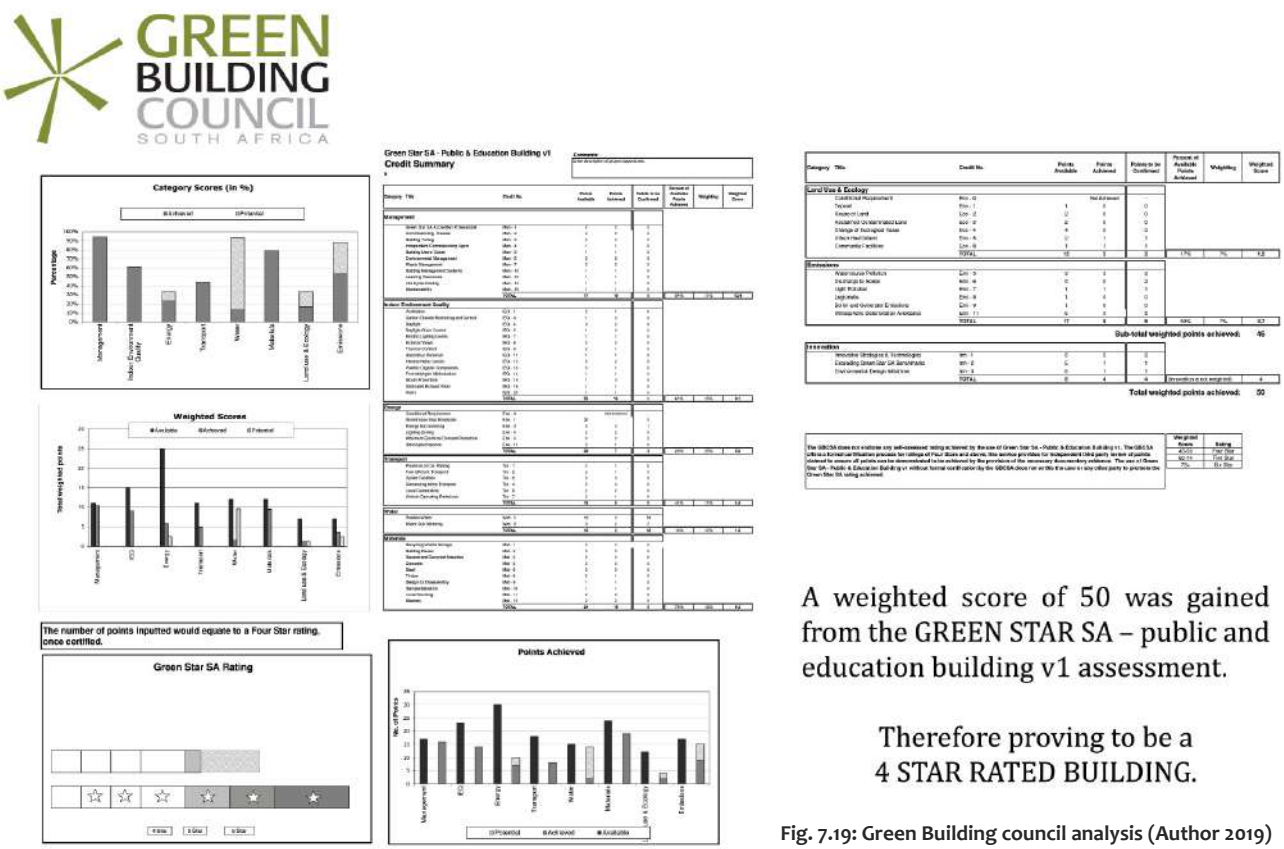


Fig. 7.19: Green Building council analysis (Author 2019)

CONCLUSION

It is essential to understand all the tangible and intangible properties that exist on a particular site before any architecture can be placed there. According to Richard Sennet (1990), it is crucial to engage with the surroundings of the site and be present in the moment. In order to contribute to the successful social life of cities or suburbs, the barriers that segregate neighbourhoods from the city need to be broken down. Since Mamelodi West is clearly demonstrating the notion of suburbanism, as a population shift emerges from the bustling cities towards the suburb, there is positive opportunity for architectural intervention.

The existing urban condition of Mamelodi West, in conjunction with the main areas of focus, namely free green spaces, broken forms, the landmark effect and intensification, have allowed for the following conclusions. Due to the lack of green spaces that exists in Mamelodi West – since it was initially proposed to have a low area percentage of green spaces with a low density of housing, albeit with a high percentage of area per person (McConnachie & Shackleton 2010:244-248), this project aims for an increase in broken forms and a higher level of public green spaces. Through the minimisation of lost and derelict spaces, pedestrians and informal traders will be encouraged to utilise the new public green space as a result.

This project would promote more social infrastructure within the public green spaces through the use of public amenities such as rubbish bins, benches, bicycle lanes, traffic lights and crosswalks. Attention will also be paid to edge conditions. The mix of land uses within the new architectural design would support a higher level of pedestrian activity, according to Rodríguez, Brisson and Estupiñán (2009).

In conclusion, since this site has been selected for the number of facilities found in the area as well as the accessibility of transportation and short walking distances between facilities, the current lost spaces hold the potential to uplift the community and the opportunity to explore the use of living architecture and how its carbon impact can be minimised. This project would serve as a step towards an improved relationship between nature, people and the environment, and will focus on the notion of nature's evolution and how its temporality influences both the built and the natural environment.

Fig. 7.20: Perspective 1 (Author 2019)

Fig. 7.21: Perspective 2 (Author 2019)

FIG: SITE PLAN (AUTHOR 2019)

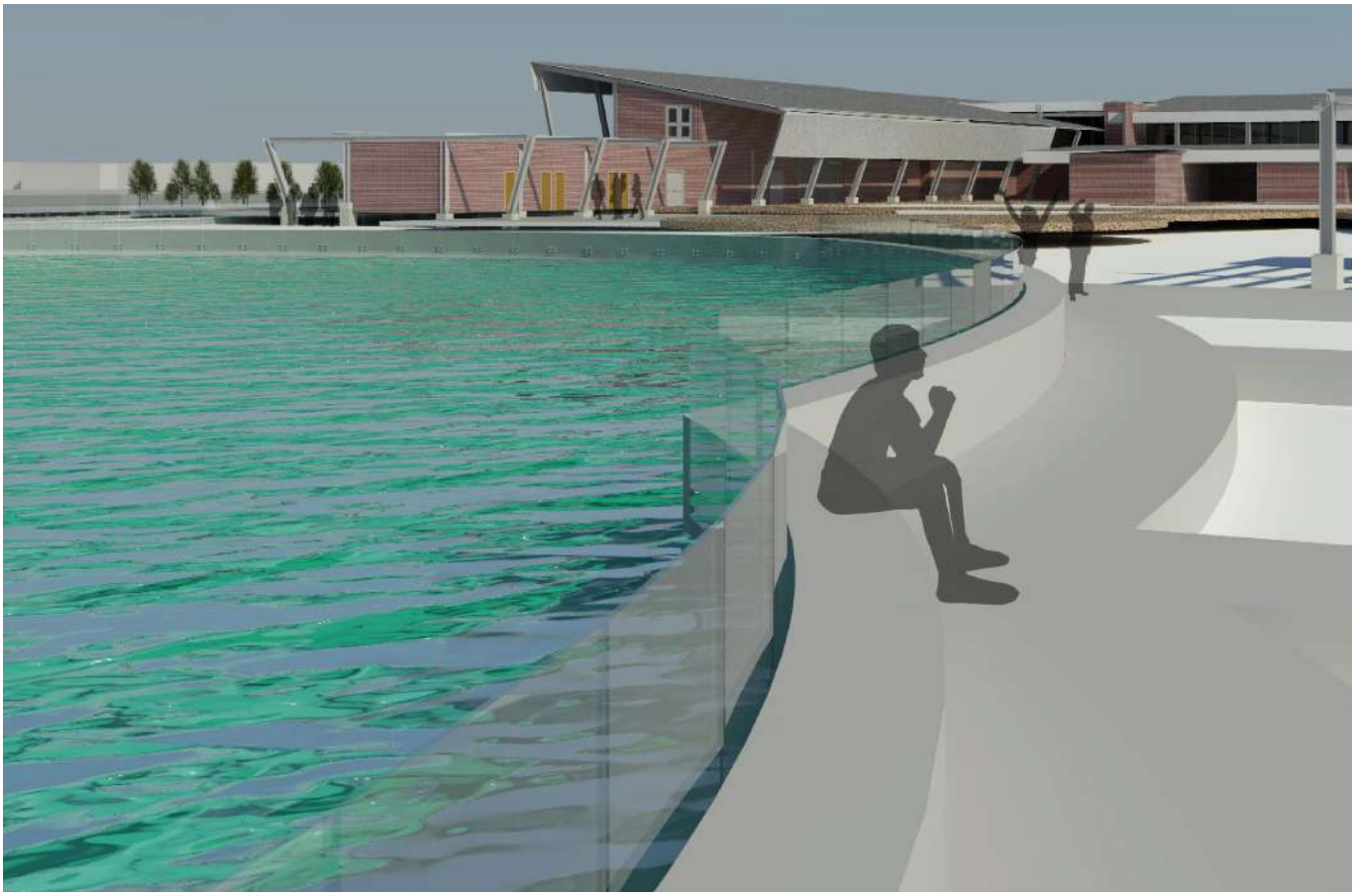
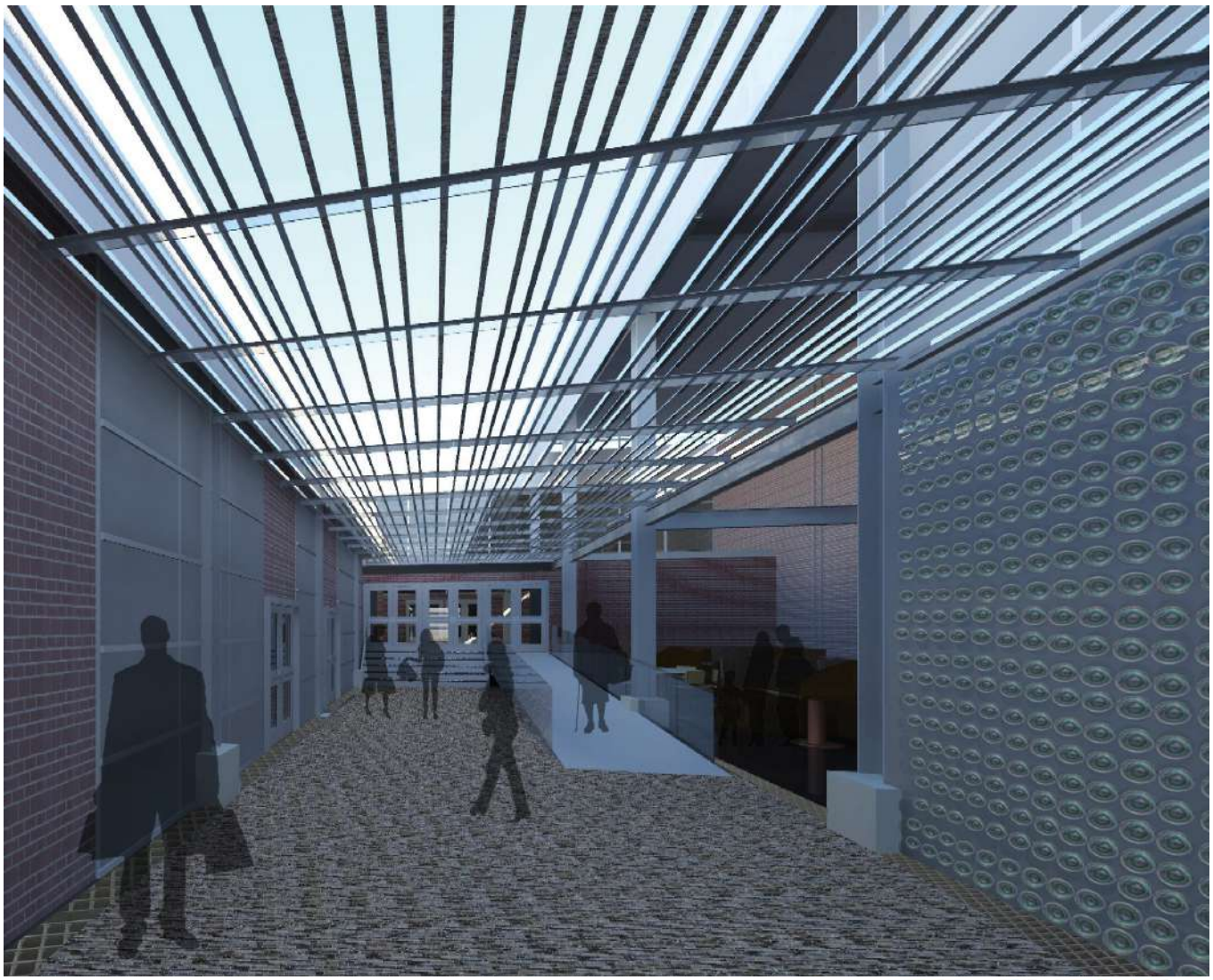


Fig. 7.23: Perspective 4 (Author 2019)

Fig. 7.24: Perspective 5 (Author 2019)



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APPENDIX

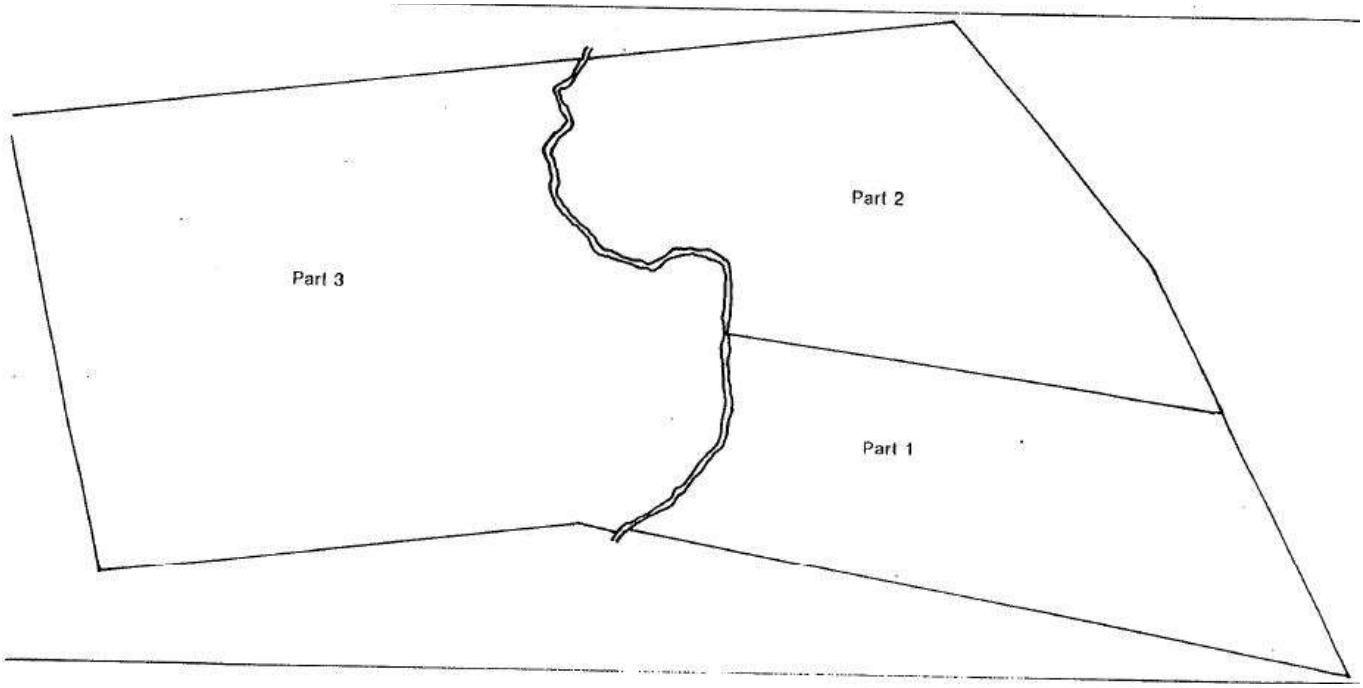


Fig. 9.1: The division of the Farm Vlakfontein (Deeds Office, Pretoria)

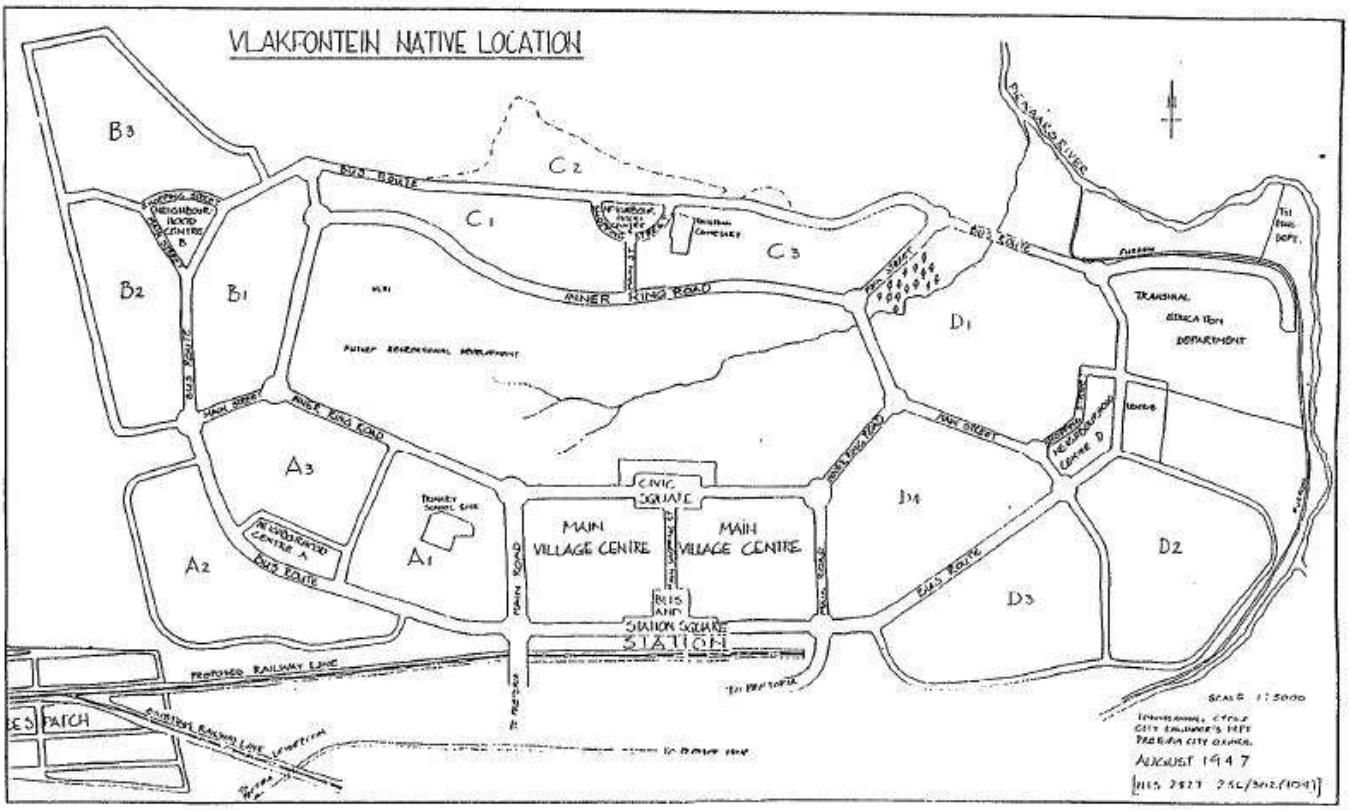


Fig. 9.2: the Vlakfontein native lacation layout in 1947 (Pretoria City Council)

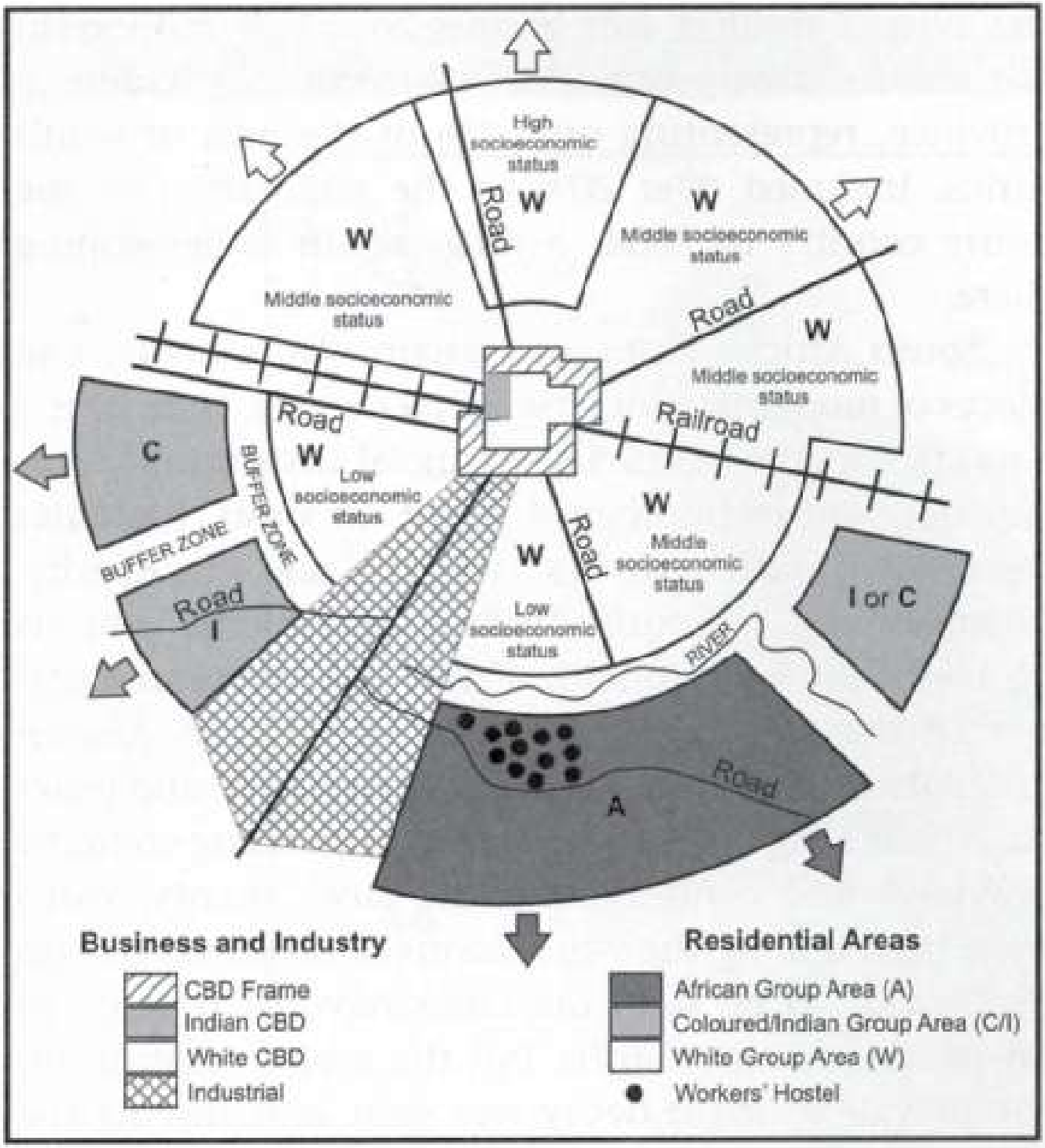


Fig. 9.3: The model apartheid city image adapted

The community makery

Today waste is a major concern and in the current global warming crisis, there is a need to deal with the over flooding landfills and extreme amounts of waste products. This study is focused on the upcycling of waste products such as, plastic waste, paper waste and glass waste in order to produce building materials.

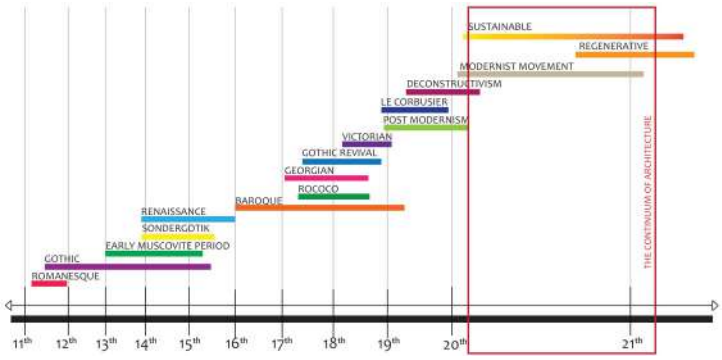


Fig. 01. Above; the continuum of architecture (Author 2019).

INTRODUCTION

We as humankind over the years have borrowed ideas and even have taken from nature. The intention started off as a survival instinct which eventually morphed into humankind climbing for superiority. Throughout the years man began to excessively mass produce inorganic items for their own leisure and completely disregarded the impact of the waste build up in the environment. Today waste is a major concern and in the current global warming crisis, there is a need to deal with the over flooding landfills and extreme amounts of waste products. This study is focused on the upcycling of waste products such as, plastic waste, paper waste and glass waste in order to produce building materials.

The Mamelodi West area was initially set out according to the model Apartheid city which illustrates the natural buffers along the Northern and Eastern boundary. Later on the railway and industrial area boomed in the Southern region thus today demonstrating the diverse amounts of amenities and uses situated in the area. The industrial region reflects a lot of job opportunities and income into Mamelodi west, however there is a clear divide between the residential sector and the industrial sector.

There is a clear need for a tangible link between the industrial region and the residential area of Mamelodi West. With an architecture that could materialise into a haven for Mamelodi residents and as well as aid in the waste crisis threat, there is opportunity to solve not one but two issues in the Mamelodi West area.

A new concept is currently being attempted in Mamelodi west is the process of up-cycling waste. Up-cycling is the process in which materials that are already used are transformed into something of a higher value the second time (Sung 2015:28). Through the process of upcycling the amount of energy and

With new technologies and numerous amounts of emerging materials that are being used today, one of which is mushroom-mycelium, which is a fungi that has the ability to break down waste, including plastic waste according to scientists from Kew Gardens in London. (Aouf, 2018). It has been proven that different types of fungus such as trametes versicolor and pleurotus ostreatus possess the ability to remove dyes, explosives and even pesticides from soil (Aouf, 2018). In addition to the benefits of mushroom-mycelium it can be used as a replacement for building materials as it is fire-resistant, water resistant, has a high insulation rate and is particularly durable (Aouf, 2018). The benefits of fungal-mycelium is that is it proven to be 100% biodegradable (Critical Concrete, 2018) which will benefit the environment severely as mushroom-mycelium products are grown and not manufactured.

This article explores the use of living architecture and how the carbon impact can be minimised. It will investigate ways in which waste can be recycled and reused within the context of Mamelodi West. As well as the relationship between nature, people and the environment. A focus will be placed on the notion of nature's evolution and how temporality influences the built and natural environment.

THE APARTHEID SYSTEM

The term apartheid translated directly into English means 'apartness' was assigned to the law of separating people of diverse races in 1948 in South Africa (Clark & Worger 2013:3). The separation of black and white people within South Africa's history has permeated through time and has left behind divides between towns and cities. In 1948, the victory of the electoral National Party resulted in vast population distributions and cosmic changes in the spatial planning of the urban form (Christopher, 1997: 311-323). Around 1950 onwards there were mass population movements which were defined according to racial groups albeit, there was a revoke of this legislation, today's South Africa still exhibit these shifts within the urban fabric (Christopher, 1997: 311-323).

THE NEW SOUTH AFRICA

South Africa has been experiencing a shortage of landfill sites which has led to further pressure on the already overloaded recycling system (Dludla, 2018). "The National Environmental Management; Waste Act, No 59 of 2008" began on 1 July 2009. The main intentions of the 'Waste Act' were to 'promote an integrated approach in dealing with waste which focuses on prevention, minimization and responsible disposal of waste.' (Recycle Paper, 2018). A huge issue in South Africa is that there is a shortage of landfill sites and municipalities are forced to travel further distances in order to dump waste (Dludla, 2018).

It is stated that six jobs are created by landfilling 10000 tons of waste while thirty-

six jobs are created by recycling the same amount (Van Niekerk, 2005). Therefore proving that it is easier to separate the different types of waste before it is thrown away. However, due to the immense amounts of waste existing in landfills already, there is a definite need for the recycling of the waste already existing in the municipal landfills. Mamelodi houses one of five main waste dumps in Pretoria. Situated in the south of Mamelodi is the 'Hatherley Municipal Dumping Site' which is currently excessively full.

Mamelodi west displays economic interest and is an independent transportation hub. Due to there being a high percentage of mass migration, the aim of this paper is focused on making Mamelodi an independent suburb. There is a need to investigate the rich heritage of Mamelodi through the spatial legacy during the apartheid and post-apartheid era. By intensifying the area, possibility is created towards an independent suburb which could limit mass migration.

MAMELODI'S HISTORY

The initial group of people in the 'Vlakfontein' area were known to be farmers and herdsmen and later on were employed by "de Eerste Fabrieken in de Zuid-Afrikaansche Republiek Beperkt" (Walker et al, 1991). Walker states that these residents were known to be the first industrial workers located in the Transvaal area. "de Eerste Fabrieke" as it later became known as 'The Hatherley distillery and later grew to be a bottle-making factory whereby the sand from the Pienaars River was used to make glass (Walker et al, 1991).

Today Mamelodi West has spread and is situated in a close proximity to Silverton which is a predominant industrial area.

A huge landfill that is situated in mamelodi is the "Hatherley Municipal Dumping Site" which according to the City of Tshwane's head of landfill Management, there is approximately 2 000 000m3 of waste annually. The Mamelodi Township displays vast amounts of littering which according to Garg and Mashilwane (2015), is due to the lack of environmental education and 'laziness' towards not having efficient rubbish bins. Although Mamelodi has a certain percentage of professional, skilled, educated people there is a greater percentage of unskilled people who depend on the government for survival (Garg and Mashilwane, 2015).

A study conducted by (Walker et al, 1991) states that Pretoria was founded in 1855 and a vast amount of 'blacks' lived within the city and closer to their places of work. Maps from 1902 illustrate dwellings in Marabastad and Schoolplaats that were defined as 'black' locations. In 1923, Lady Selborne was declared as a residential area of mixed race but was proclaimed in 1958 to be allocated as a 'white' residential area. This proclamation forced 'black' people to

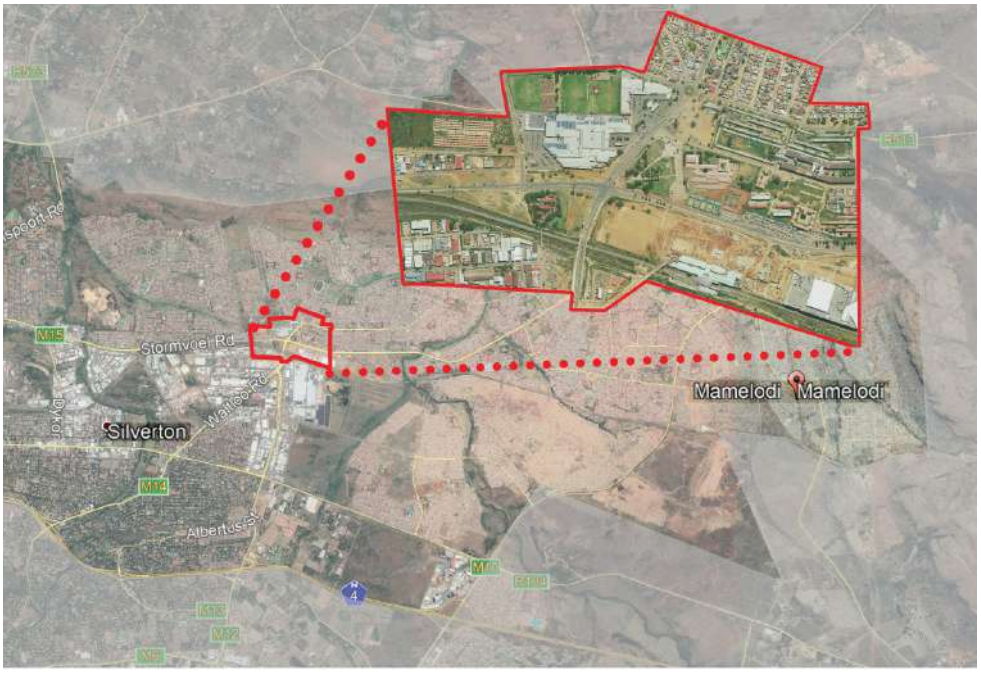
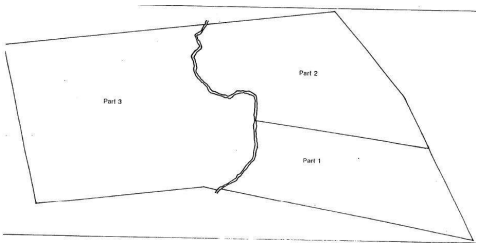


Fig. 02. Above; mamelodi west in locality to the pretoria inner city (schmidth 2019).

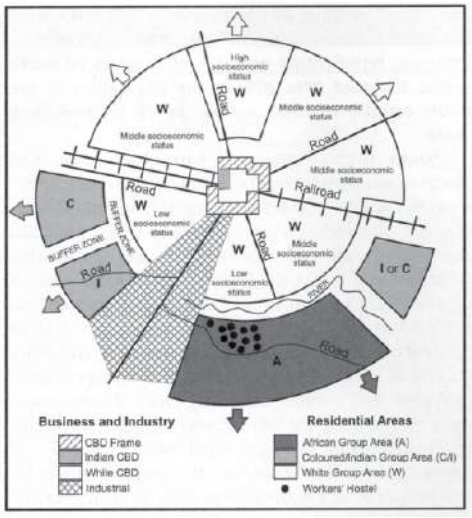
Mamelodi was initially referenced as 'Vlakfontein' A register in the Pretoria Deeds office states that Vlakfontein may have initially been owned by 'C Jansen' which was then sold to 'David R Opperman' in 1861 (Walker et al, 1991). During 1874 'Vlakfontein' was divided into three main parts.

The site is focused on the context of Mamelodi West. Mamelodi was



initially set out according to the model Apartheid city which allocates the natural buffers along the Northern and Eastern boundary and the railway and industrial area located in the South.

The assumptions are since Mamelodi is still dependant on other parts of Pretoria for civic, corporate facilities and other amenities, people are forced to travel outside of Mamelodi for work. Over the last few years, Mamelodi has gained a few civic facilities and infrastructure such as the Denlyn & Mamelodi crossing malls and the New Tshwane Regional Mall. But is that sufficient in adding to



Mamelodi's independence?

The limitations of Mamelodi in its vastness and scale can be an overwhelming place for visitors. Due to the Post-Apartheid South Africa forcefully removing Mamelodi residence from the inner city of Pretoria it is assumed that Mamelodi has become a home and elderly residence do not want to relocate.

The delineations in this dissertation can be on the vastness of Mamelodi and therefore only a certain area will be focused on. Since the concept is focused on the inflow and outflow of waste and working on diverse input and output methods, there can be a vast array of experiments and data required before conclusions can be granted.

The industrial area in the south still employs a large percentage of people from Mamelodi and provides employment for low-skilled labour. Overall Mamelodi is secluded from Pretoria and has the potential to become an independent township on its own (Bhana et al, 2019). This article introduces nature into the built environment and vice versa. The waste issue is a huge problem towards the contribution to global warming and therefore this dissertation will contribute to ideas that could solve the waste issue as well as to how waste can be used to make building material for the current housing demand in South Africa.

THE PARADIGM SHIFT TOWARDS UPCYCLING

Investigating the current site conditions as well as neighbouring sites in order to understand the overarching issues and challenges of the existing typology. Site interpretations will be investigated further. A study into past journal articles and papers on architectural theories can strengthen this papers outcome and intentions. Precedent studies strengthen design ideas which are successfully built and which are existing or have existed in the past. They can be in the form of contextual, formal, functional and technological which has the potential to strengthen an argument or idea.

Further analysis will be conducted

Fig. 03. Above left; the vlakfontein farm division (pretoria, deeds office (Author, 2019)
Fig. 04. Above right; the model apartheid city (Author, 2019)

through qualitative analysis and quantitative analysis. Qualitative analysis entails the systematic observations of the location, surrounding context, pedestrians, traders and consumers. As well as one-on-one interviews with people who live in Mamelodi and visitors of Mamelodi. Survey flyers will be left at informal shops and formal shops whereby consumers and locals alike are able to provide their personal input. Quantitative analysis incorporates data collection, in-depth interviews, research and case studies.

THE APPROACH

An analysis of the existing urban condition was conducted with three main categories as the main focus. In order to enhance social infrastructure, it is essential to promote pedestrian friendly environments albeit allowing for an increase in green public spaces. According to Rodríguez, D.A., Brisson, E.M. and Estupiñán, N. (2009), studies based on relationships between street usage and the built environment mostly emphasis on the presence of amenities such as rubbish bins, benches, bicycle lanes, traffic lights, crosswalks and attention to edge conditions. These amenities involve broader sidewalks, crossing aids and a mix of land uses which support a higher level of pedestrian activity (Rodríguez et al, 2009).

The second category is focused on broken forms. Breaking up large masses such as large shopping malls and promoting more 'free green spaces' for the community (Bhana et al., 2019). According to (Swanwick, Dunnett, and Woolley (2003: 94-106) emphasis greatly needs to be placed on the 'compact city' in the form of high-density holdings as a future city model with importance directed to the benefits of green spaces and urban parks. Due to the amount of green spaces located in South Africa relative to its former racially divided settlement patterns, it is evident that the more affluent areas which was initially assigned to the white suburbs consist of a high area of green spaces and a lower density of housing (McConnachie & Shackleton, 2010: 244-248). Whereas in contrast, the former defined townships have a low area of green spaces with a low density of housing, albeit a high area per person (McConnachie & Shackleton, 2010: 244-248).

The third category is on landmark effect. The landmark effect defines the street edges. An increase in height scales from three to five storeys and different options were addressed to emphasize the existing trade that occurs on street edges (Bhana et al., 2019). According to Rüetschi, Caduff, Schulz, Wolff, & Timpf, (2006), landmarks are visual objects or buildings usually near entrances or in points of reference. They are mainly used as external reference points which can easily be sighted at a distance (Rüetschi et al, 2006).

This site has been selected due to the amount of facilities found in this area as well as the accessibility to transportation and short walking distances between facilities. It has been observed that the highest level of community facilities still remain at the original 'entrance of Mamelodi. Due to the apartheid buffers and boundaries, the land still appears to be largely unchanged (Bhana et al., 2019).

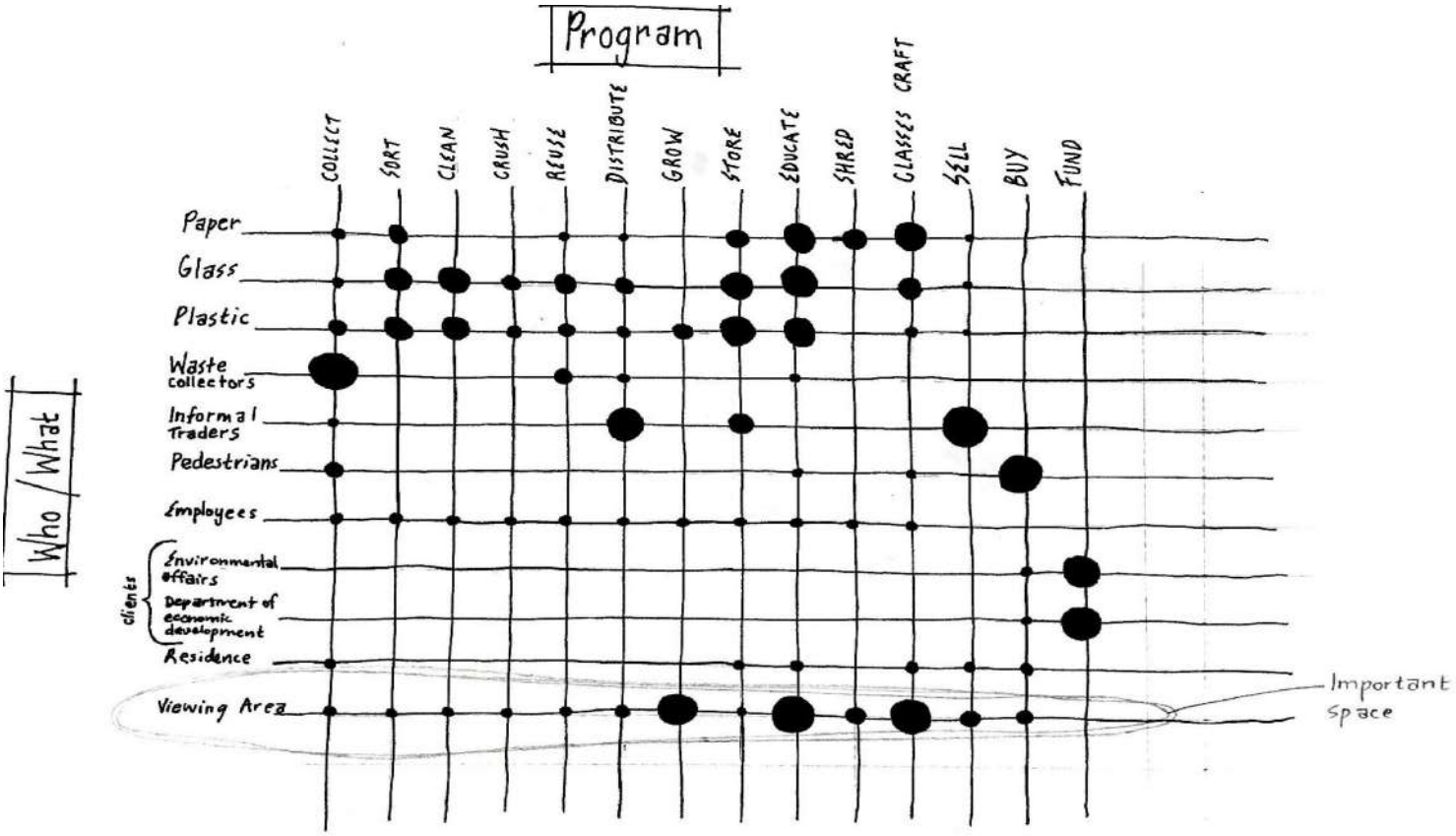
Upon observation to Mamelodi, it was evident that Intensification is an overarching principle. Which focuses on increasing the diversity of the area. An aim to increase other facilities are needed to create a well-rounded society. Not only increasing the amount of people living there but more of a diversity of activities. Due to the concept of intensification, four main topics were focused on, namely civic / corporate facilities as well as encouraging small businesses and entrepreneurship, pedestrian centred environments, education and housing. With a further focus into sub categories as illustrated in the slide (Bhana et al., 2019). Within the context, spaces which are unprogrammed seems to be more appropriated by the community as this allows for a mixed-use approach. On these spaces, there is a variety of use such as selling of fresh produce, tyres and even waste dumping and organic waste burning. It was observed that Informal trade takes precedent where there are people and movement rather than space constraints (Bhana et al, 2019).

THE INPUT AND OUTPUT CYCLE

The program focuses on three main categories namely Recycling, Making & Education. Recycling will be focused on the high levels of waste that is produced by the malls such as paper, glass and plastic waste which is disposed of daily throughout the shops in and around the mall. The unused organic material could be sorted and added to a worm-ery where compost can be produced and used to improve the organic carbon levels of the soil (Paulin and O'Malley 2008).

Making will be in the form of service provision such a repair centre,

Fig. 05. Above; The matrix diagram (Author, 2019)



bags for example.

Education will entail an exchange of adult, teenagers and child knowledge and ideas through the process of give and take. Night classes will be encouraged as this will open up availability and access to the working class as well. Accounts, finance and crafts will be focused on in these classes in order to raise the education rate and empower the community.

The input and output system will ultimately focus on the cycle of upcycling, making, educating, selling and back to upcycling of waste products. It is essential that the program highlights the main services and pedestrian movement as well as each activity associated with it as well as the hierarchy of spaces.

A matrix diagram which clearly reflects the importance of program against who or what. For example, the waste collectors play a major role in the collecting of waste while playing a small role in the distribution. Overall the program that appeared to be very important is the viewing areas where the public can view all the processes associated with upcycling, as they promote education and learning.

BUILDING AS SYSTEM

The formal language is based on the program. Which emphasises the structure and ordering of the programs. A Precedent that was look at was Frank Lloyd Wright's buildings and grids. He mainly makes use of circular, rectangular and triangular grids in his design process. Based on my building as a system, the idea of a circular grid demonstrates the self-progressing nature of the programs and functions. The circular model is one that is well known throughout the world. In the round city of Bagdad, the mosque is placed centrally while the city radiates outwards from it. According to Lassner (1968: 24-36) the growth of the city of Baghdad was based on the administrative centre belonging to the 'Abbasid' empire which then spiralled outwards into particular patterns which was determined by certain city uses. According to Al-

Hasani (2012: 79) the circular city of Baghdad was constructed over a period of four years, incorporating geometric blocks and symmetrical streetscapes. With three main walls forming a hierarchy of spaces, the innermost wall forged a separation between private and public spaces. It was known to be revolutionary in terms of urban planning (Al-Hasani 2012: 79).

LOST SPACES

Within today's cities, suburbs and townships exist vibrant informal activities of trade and exchange of services, however there are a lot of spaces that once had a purpose in the past but which have now become 'lost spaces' (Senett 1990). The notion of 'lost spaces' were defined by Roger Trancik in his book called 'finding lost spaces' where he mentions that the term 'lost spaces' refer to deteriorating or underused spaces which provide uncountable opportunities as they have potential to house multitudes of uses and promote suburbanization (Trancik, 1986 : 2). The concept of suburbanism results where there is a population shift from bustling cities towards smaller towns or suburbs, and residents choose to commute to their places of work with the intention of living away from crime in cities and where land is less expensive.

What are lost spaces?

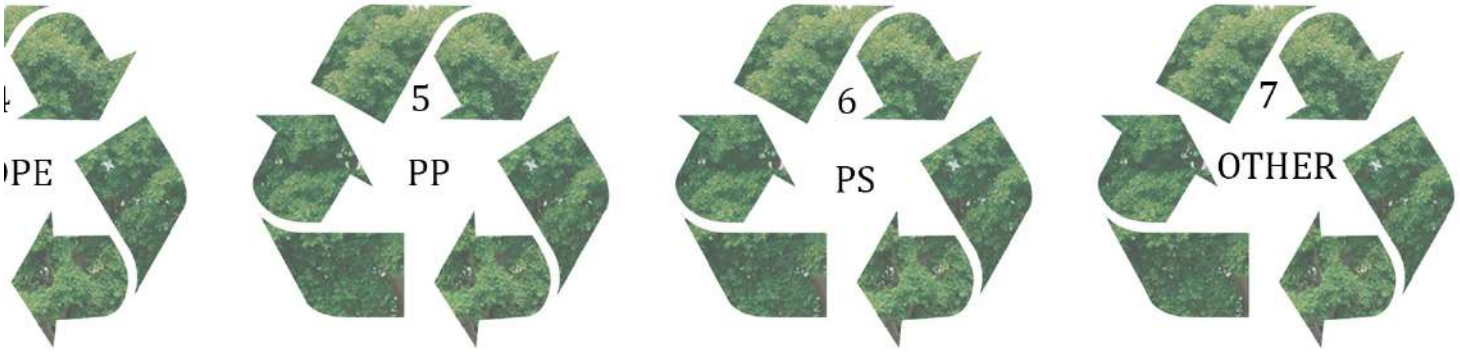
According to Transik (1986) [1]a 'lost space' is defined as any land that is not maintained such as abandoned yards, industrial complexes, empty military sites and even public housing projects that require to be rebuilt because they no longer meet their intended purpose (Trancik, 1986 : 4). Lost spaces is summary can be classified as an antispace without a recognisable purpose and in turn, they have potential to offer a positive contribution and benefit to the surrounding communities (Trancik, 1986 : 4).

Richard Sennet (1990), a professor of sociology in London, highlights the notion of being aware and engaging with one's surroundings while being present in the moment. In his book called 'the conscience of the eye: The design and social life of the cities', he emphasises the blandness of cities as their walls act as divisions that cut off the poorer neighbourhoods from the city Sennet (1990). The chosen site in Mamelodi is situated between an industrial city and the 'poorer neighbourhood' whereby a train track clearly separates them apart. Sennet (1990) proposes the idea of linking these two partings together by revitalizing the 'reality of the outside, as a dimension of human experience'. Due to the 'reality of the outside' (Sennet 1990), it is essential to include an outside space of gathering which transitions pedestrians from the industrial sector towards the 'poorer neighbourhood'.

The theoretical approach

The proposed design is of an upcycling waste centre that will uplift the community and provide educational night classes. Through the upcycling of waste such as paper, plastic and

Fig. 06. Below; Adapted from Seaman (2012), different plastic types (Author, 2019)



includes hierarchical functions such as private spaces moving to public openness. This dissertation's design will focus on the hierarchy of spaces as the 'collection & recycling process' of waste would be private and will move towards the 'education process' which will be in the semi-private area. The 'making process' will be displayed to visitors in the semi-public areas and the 'selling process' will move back into the public area.

MATERIALS FROM WASTE

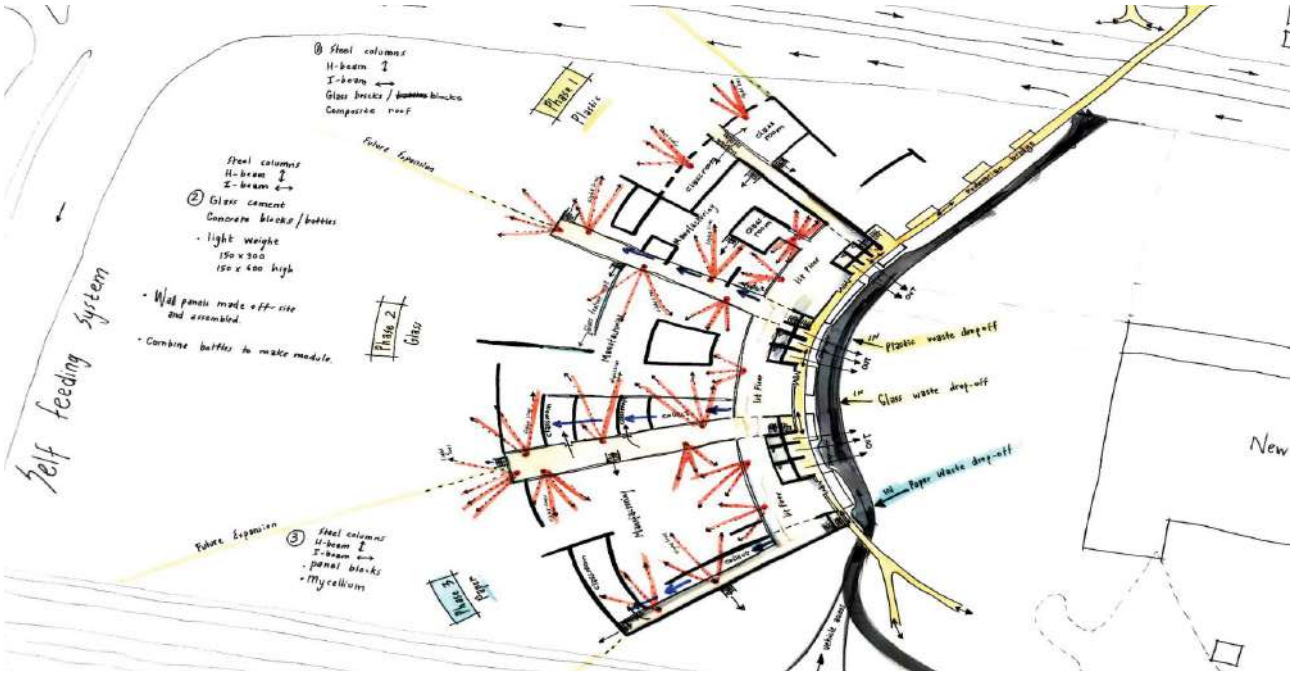
Within the paper industry, waste has the potential to bring about environmental and economic benefits since material waste can be used in the place of raw materials. There is significant attention that is placed on industrial by-product materials within the manufacturing of construction materials worldwide (Raut, Ralegaonkar and Mandavgane, 2013). A study was conducted by Raut, Ralegaonkar and Mandavgane (2013) which investigated 'recycle paper mill residue (RPMR) for making bricks that can be used in construction. The results discovered were that PRMR although it has a fibrous and porous structure, it meets the compressive strength requirements of bricks and has the ability to withstand temperatures of 280 degrees celcius (Raut, Ralegaonkar and Mandavgane, 2013).

The most common form of glass recycling is the 'closed loop' recycling method which entails the collecting, sorting, cleaning, beneficiating, remanufacturing into glass bottles and transporting to a desired destination (Dhir, Limbachiya and Dyer, 2001). This process can become extremely expensive as each step is necessary in the recycling process.

During the recycling of glass, certain requirements are essential in order to sustainably benefit from the recycling process. Glass recycling can be extremely labour intensive since it is necessary to sort and clean debris from it as well as to separate glass into different categories (Fulton, 2008). Although it is extremely labour intensive, there is opportunity for job creation in the context of Mamelodi. Fulton (2008) has been experimenting with the recycling of glass waste in pavement aggregate and has discovered that one main issue that could be detrimental to the finished product is that if the glass is not cleaned thoroughly. Fulton (2008) then states that it is highly beneficial to recycle glass waste as 'virgin rock' is conserved as well as the lifespan of landfill sites are extended.

With the excessive amounts of inconsistent glass in rivers, streams and landfills, the concrete industry has slowly incorporated ways in which glass could be crushed into aggregate and used within concrete mixes (Ismail and AL-Hashmi, 2009). Tests were investigated by Ismail and AL-Hashmi (2009) and it has been recorded that the 80kg of crushed glass waste replaced sand partially and was mixed into 900kg of concrete mixes. It was then tested that the tensile and compressive strength of the concrete mix was higher than the

Fig. 07. Below; Concept Diagram (Author, 2019)



control mix at 28days of curing. It was also proven that the crushed glass waste mix reduced the expansion rate by 66% in comparison to the control mix (Ismail and AL-Hashmi, 2009).

Located south of the selected site is a ready mix company called 'Pronto RMX Silverton' who is a supplier of ready-mix concrete, screeds and mortars. They are associated with testing laboratories and therefore every batch that they manufacture is tested daily (Prontormc, 2017). There is opportunity for this proposed design to clean, sort and crush the glass waste and supply it to the surrounding ready mix companies around the Mamelodi area. Less energy and cost will therefore be used to remanufacture glass bottles and therefore a difference could be made towards the increasing energy demands required for remanufacturing.

Paving stone which is currently becoming commercialised, comprises up to 100% of glass aggregate (Dhir, Limbachiya and Dyer, 2001). It is possible to create a unique type of paver which contains diverse textures and colours which cannot necessarily be obtained with natural aggregate. Tests were conducted to see that if the pavers were to be reinforced with short fibres which were then proved to improve the pavers properties such as the fracture toughness and energy absorption capacity (Dhir, Limbachiya and Dyer, 2001). The outcome of using crushed glass waste in pavers proved to be highly beneficial to the environment as less energy is used as compared to remanufacturing the product into useable bottles.

Plastic

There are seven classification types of plastics according to Seaman (2012), as illustrated above.

PETE is known as 'polyethylene terephthalate' is used in the manufacturing of water bottles, soft-drink bottles and juice containers. PETE is used in consumer products and is the most frequently used.

HDPE is known as 'high-density polyethylene' which is used for milk jugs, cleaning detergent bottles and soap and shampoo containers.

PVC is known as 'polyvinyl chloride' which is used for sweet and fruit packaging.

LDPE is known as 'low-density polyethylene' which is used for high resistant bags and sacks.

PP is known as 'polypropylene' which is used toys, furniture and luggage parts.

PS is known as 'polystyrene' which is used for packaging and eating utensils.

OTHER types such as fiberglass, nylons and other fibers.

Polymer production today is an ongoing utilization as it is low-priced, mass produced after which it is disposed of and forgotten about (Zhuo & Levendis, 2014). Upcycling or recycling can occur through processes such as chemically, thermally, mechanically and even biologically. Chemical recycling to an extent converts some plastic into 'hydrocarbon fractions' (Zhuo

recycling occurs on a micro level through the use of organisms such as fungi, enzymes and bacteria (Zhuo & Levendis, 2014). A focus of this article is placed on the biological recycling process while dealing with mycelium fungi.

MYCELIUM

Over the last few years a global concern for the over flooding landfills and excess amounts of plastic waste has been in numerous discussions. Based on this awareness and environmental concern, attention has been placed on degradable polymers (Shah et al, 2008: 246-265). Biodegradation today is possible with modern technology and findings and is necessary for water-soluble polymers which usually end up in oceans, rivers and dams in addition cannot be incinerated not recycled. According to Shah, Hasan, Hameed, and Ahmed (2008: 246-265) there needs to be a clearer understanding between the microorganisms, plastic material and the biochemical process involved in order to perform successful biodegradation.

[3]A current emerging material is mushroom-mycelium, which is a fungi that has the ability to break down waste, including plastic waste according to scientists from Kew Gardens in London. (Aouf, 2018). It has been proven that different types of fungus such as trametes versicolor and pleurotus ostreatus possess the ability to remove dyes, explosives and even pesticides from soil (Aouf, 2018). In addition to the benefits of mushroom-mycelium it can be used as a replacement for building materials as it is fire-resistant, water resistant, has a high insulation rate and is particularly durable (Aouf, 2018). The benefits of fungal-mycelium is that is it proven to be 100% biodegradable (Critical Concrete, 2018) which will benefit the environment severely as mushroom-mycelium products are grown and not manufactured.

In a book called "Mycelium Running, how mushrooms can help save the world" by Paul Stamets (2005), discusses how Fungi is the neurological web of nature as it always remains in a consistent molecular connection to its surroundings. The Mycelium web has the ability to expand across thousands of miles and even has a close relation to animals on a cellular level (Stamets, 2005). The mycelium fungi has evolved and survived over millions of years and has used its network cell chains to secrete acids into their immediate environments in order to break down food, which is similar to the digestive system of animals (Stamets, 2005).

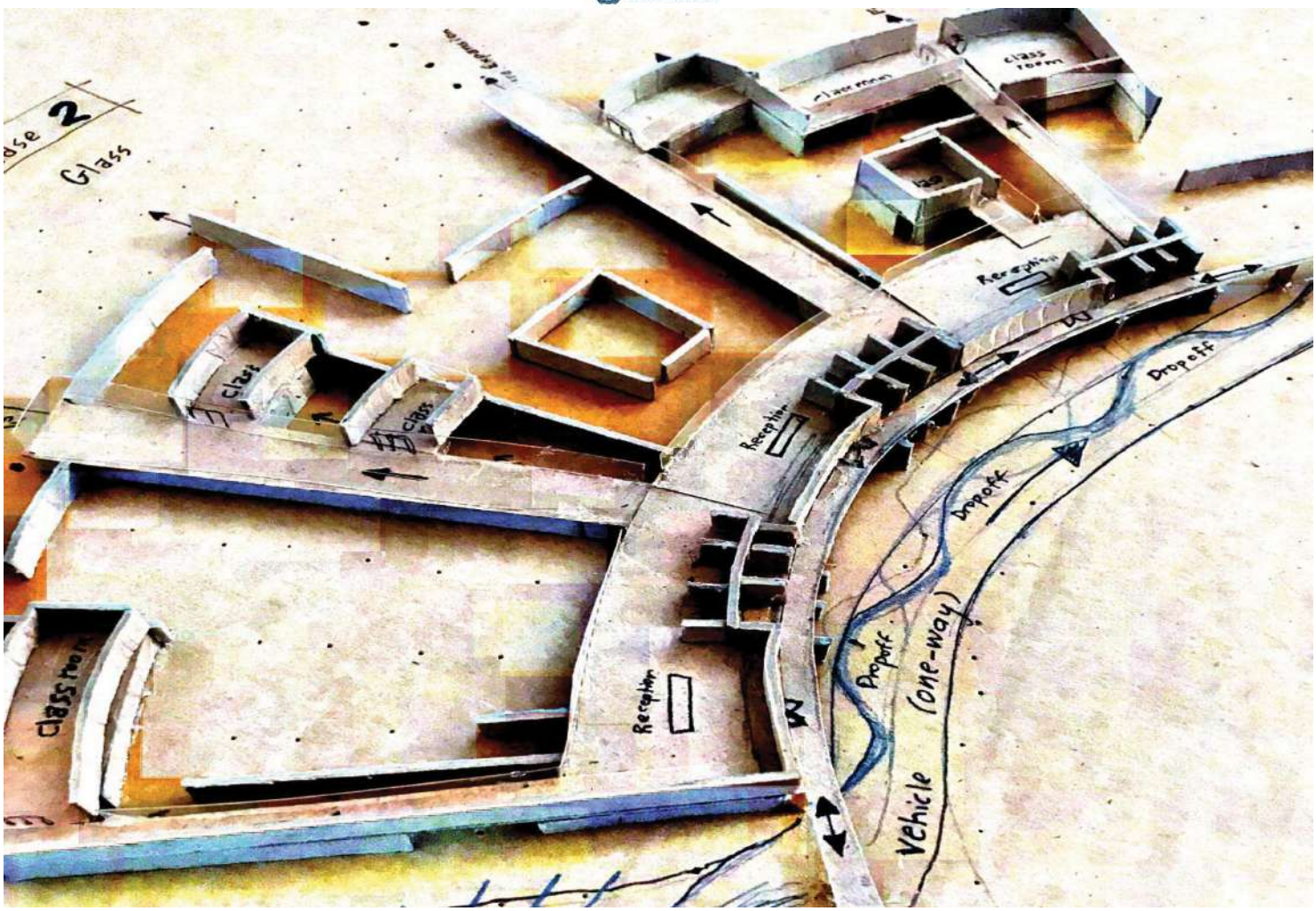
CONCLUSION

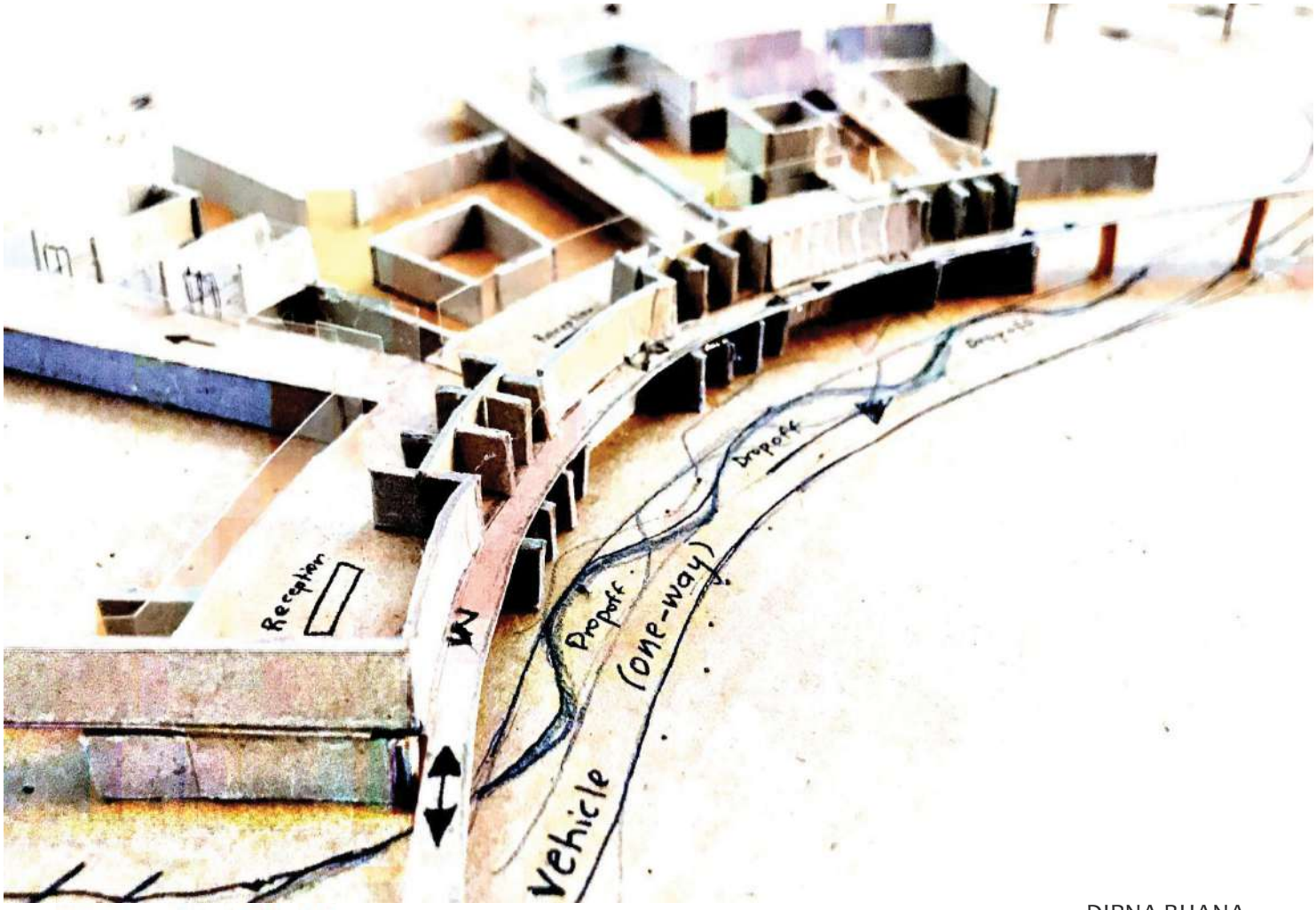
It is essential to understand all the tangible and intangible properties that exist on a particular site before any architecture can be placed. It is crucial to engage with the surroundings of the site and be present in the moment according to Richard Sennet (1990). In order to create successful social life of cities or suburbs, the walls the segregate neighbourhoods from the city needs to be broken down. Since Mamelodi west is clearly experiencing the notion of suburbanism as the population shift emerges from the bustling cities towards the suburb there is positive opportunity for architectural intervention.

The existing urban condition of Mamelodi west in conjunction with the main areas of focus namely 'green spaces', broken forms, landmark effect and intensification have allowed for the following conclusions. Due to the existing lack of green spaces in Mamelodi west since it was initially proposed to have a low area of green spaces with a low density of housing, albeit a high area per person (McConnachie & Shackleton, 2010: 244-248), this project aims for an increase in broken forms and a higher level of public green spaces. Through the minimisation of lost and derelict spaces, the pedestrian movement patterns and informal traders will be forced to utilise the new public green space as a result.

This project will promote more social infrastructure within the public green spaces through the use of public amenities such as rubbish bins, benches, bicycle lanes, traffic lights, crosswalks and attention to edge conditions. With a mix of land uses within the new architectural design, it will support a higher level of pedestrian activity according to Rodríguez, D.A., Brisson, E.M. and Estupiñán, N. (2009).

In conclusion since this site has been selected due to the amount of facilities found in this area as well as the accessibility to transportation and short walking distances between facilities, these current lost spaces hold the potential to uplift the community and explores the use of living architecture and how the carbon impact can be minimised. This project will serve as a step towards the relationship between nature, people and the environment and will focus on the notion of nature's evolution and how temporality influences both the built and natural environment.





DIPNA BHANA

Fig. 08. Opposite Top; Maquette exploration 1 (Author, 2019)
Fig. 09. Opposite Bottom; Maquette exploration 2 (Author, 2019)

Endnotes

1. A 'lost space' is defined as any land that is not maintained such as abandoned yards, industrial complexes, empty military sites and even public housing projects that require to be rebuilt because they no longer meet their intended purpose (Trancik, 1986 : 4). Lost spaces is summary can be classified as an antispace without a recognisable purpose and in turn, they have potential to offer a positive contribution and benefit to the surrounding communities (Trancik, 1986 : 4).
2. Biological recycling occurs on a micro level through the use of organisms such as fungi, enzymes and bacteria (Zhuo & Levendis, 2014).
3. A current emerging material is mushroom-mycelium, which is a fungi that has the ability to break down waste, including plastic waste according to scientists from Kew Gardens in London. (Aouf, 2018).

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