

MOVING MBOMBELA

A MULTI-MODAL TRANSPORTATION HUB RECONNECTING SOUTH AFRICA'S LOWVELD

KEAGAN CHRISTOPHER DOYLE - 1734337


MBOMBELA
TRANSPORT
HUB
MOVING
SABIE
KRUGER PARK
NIGHT TRAINS
PLACE OF THE RISING SUN
GATEWAY
STATION
MARKET
LINK
NELSPRUIT
prasa

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Keagan Christopher Doyle

21 February 2025

Fig 0.1
cover
Moving Mbombela
(Author, 2024)

Fig 0.2
previous spread
An adventure through the Lowveld
(Author, 2024)

ACKNOWLEDGEMENTS

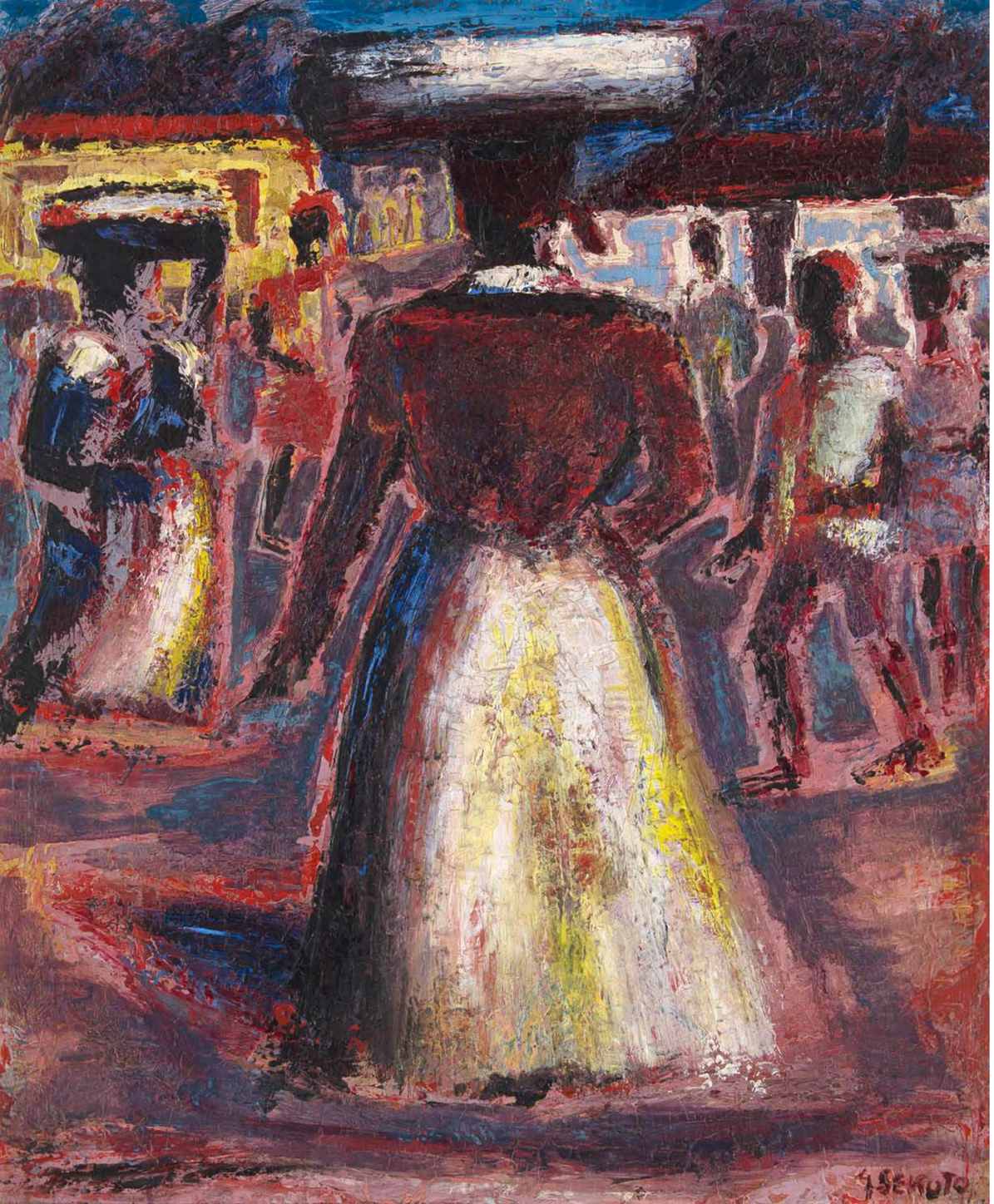
First and foremost, I want to offer my heartfelt thanks to my supervisor, Gustavo Triana, for his unwavering support, insightful guidance and patience throughout the research process. Your expertise and encouragement have been invaluable at every stage. Thank you for giving me the space and time I needed to complete this project and for being there whenever I sought your guidance. To Hilton, Mike, Sundeep, Brigitta and Edward, thank you for your guidance and input that helped with many aspects of this project.

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To my family, I owe endless thanks for their understanding, love, and constant belief in my abilities. Your support gave me the strength to persevere through the most challenging moments. Each of your unique contributions made every step that much easier, and I owe it all to you. To my mum, if it comes down to one thing that made it all possible, it would be you.

I would like to extend my thanks to all the professionals, organisations, and participants who provided the data and insights essential to this research. Dennis, Marina, Peter, and Rohan; this work would not have been possible without your contributions, and for that, I offer my sincere thanks.

Finally, I want to take a moment to acknowledge myself. This journey did not start on a whim, nor was it an easy one. This Thesis embodies the journey of discovery of myself and what is important to me. This Thesis is, in many ways, a tribute to a dream of my younger self; a realization of the aspirations and curiosity that have shaped me over the years.



“Our decisions about transportation determine much more than where roads or bridges or tunnels or rail lines will be built. They determine the connections and barriers that people will encounter in their daily lives - and thus how hard or easy it will be for people to get where they need and want to go.”

Elijah Cummings
2019
Testimony before the United States
House of Representatives in 2019

Fig 0.3
‘Figures on a street’ by Gerard Sekoto
(Sekoto, 1947)

ABSTRACT

In the heart of Mpumalanga Province in South Africa, Mbombela serves as a gateway and crucial hub in the Lowveld. Despite its strategic location, the city and its surrounding communities face infrastructural challenges such as poor road conditions and limited transportation access. Therefore, there is a disconnect between key destinations, all of which hinder the Region's potential. This Thesis explores the transformative potential of a multi-modal transportation hub in Mbombela aimed at addressing the city's connectivity, past social injustices and eco-tourism.

The Thesis unpacks the history of the Eastern Railway Line, examining its origins and the poignant legacy of the night trains that ferried forced labourers from Ressano Garcia to Johannesburg. It identifies the gaps in Mbombela's connectivity and assesses how the selected site, with its historical significance, can serve as a focal point for addressing these issues. By identifying and integrating important existing road and rail networks with community hubs and tourist attractions, the proposed Transportation Hub aims to revitalize the city's infrastructure and socio-economic landscape. Central to this undertaking is the concept of connectivity. The main program is derived from this, combining bus and train terminals with mixed-use spaces, including retail, government facilities, restaurants, and informal trading zones, promoting a more dynamic and interconnected urban environment. The Hub's design seeks to integrate parametricism and Africanism, creating an architectural language that resonates with local culture, while embracing innovative design principles. It also prioritizes accessibility and inclusivity, positioning it as a new urban space that acts as a catalyst for renewed community engagement, economic empowerment, and cultural exchange.

Additionally, the Thesis explores the potential synergy between transportation and commemoration. The design aims to reassess the richness, or the lack thereof, of the typical traditional monument or statue. Looking at local practices and rituals as forms of memorial; in conjunction with architecture and public space, the memorial becomes the space rather than a distinct object. The space given back to the people is the antithesis of the experience of being confined to the cattle cars and coal trucks used to transport forced labour. It is a spatial form of remembrance embedded within the daily life of the city. This space aims to evoke reflection and remembrance through its architectural form and materiality, creating a meaningful connection to the past while serving as a hub for movement – another freedom that was not afforded to those forced to work in the mines.

The project aims to rediscover the transport hub in an African city and rehabilitate the transport network of the Lowveld, providing an opportunity for growth and connectivity. At the same time, it seeks to empower communities and honour their histories, recognising that understanding our future direction requires an awareness of where we have come from. Through this approach, the project envisions a future where infrastructure not only supports movement and development ,but also serves as a powerful tool for remembrance and cultural continuity.

Fig 0.4
XX
(Sekoto, 1947)



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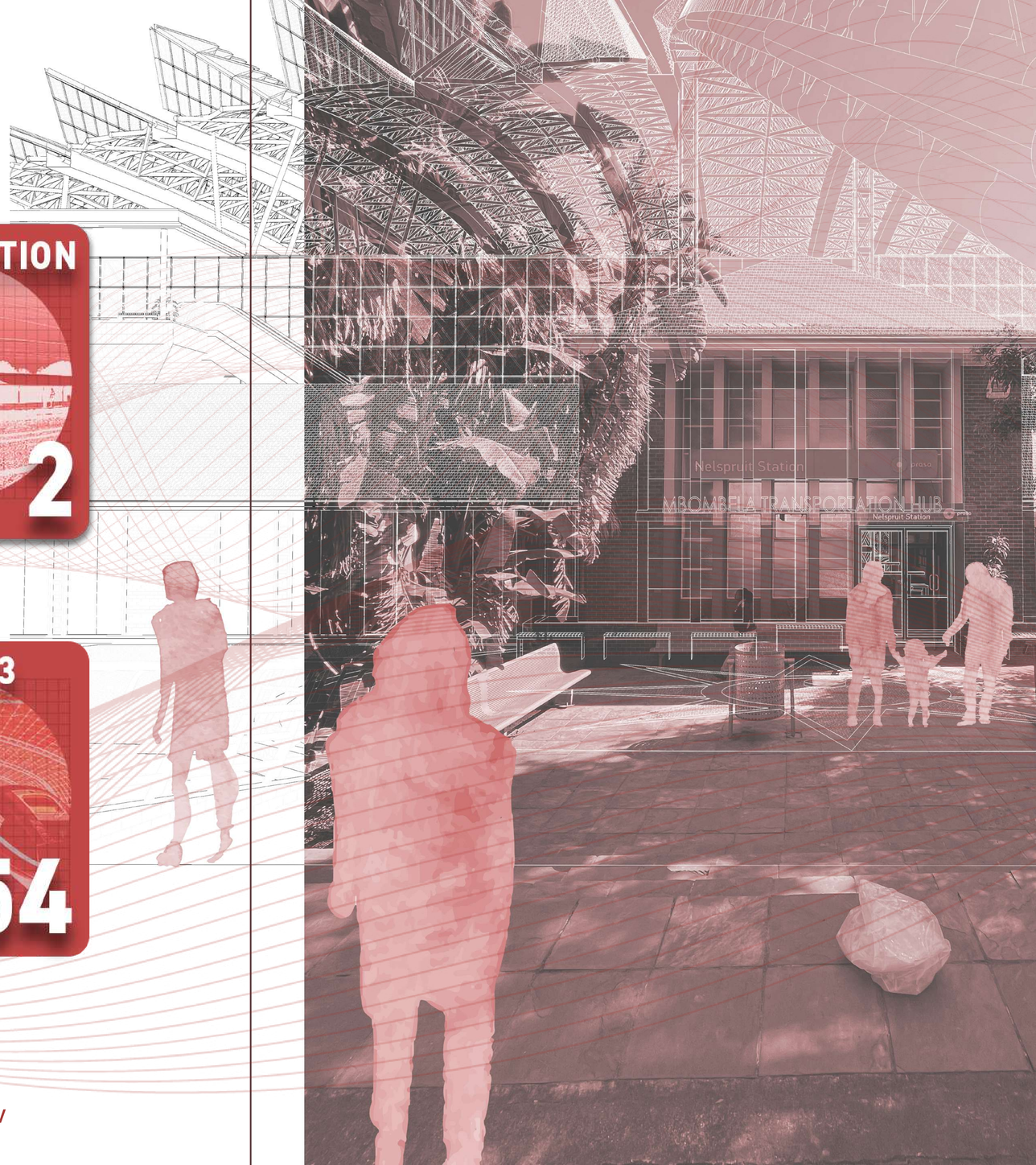
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THE RESEARCH REPORT

PREFACE

When I was in my primary school years, my grandparents lived in a small town called Sabie in the Mpumalanga Province of South Africa. I lived in Johannesburg with my mother and brother, and we would often visit my grandparents over the school holidays. The village of Sabie was founded on alluvial gold mining in the area and then the industry turned to forestry when the gold ran out. I recall trains coming into town from Nelspruit and blowing their horns as they passed my grandparent's neighbourhood. We would quickly run out into the street to see the train passing over the street and wave as it rolled by. The journey home on the N4 ran mostly along the railway line and I would dream of one day being able to take the train to the Lowveld and enjoy the idyllic journey through the mountains and descend into the valley where Sabie lay.

An odd thing to dream about as a child, but the dream never withered away like most childhood dreams. When I left high school, I went on to study civil engineering at the University of the Witwatersrand. It was unenjoyable, to say the least, and so I changed my career path to Architecture after having worked part-time for an Architect before applying to the School of Architecture and Planning at the University of the Witwatersrand. As I had already missed the application process for the following year, I had to wait and reapply for the year after. In the meantime, I busied myself with learning SketchUp and designing forms and buildings – developing the technical drawing skills that I acquired in high school through Engineering Graphics and Design.

I met with a few Architects during that time to get a better understanding of what the career entailed, and I became more certain of my choice in career. After discovering SketchUp, I began to design a train station. The building I designed explored themes of mining, colonialism and African methods of weaving and form-making. Albeit quite literal in its expression, the building expressed a melting pot of contentious themes that I had not fully comprehended at the time. When I was admitted to the School of Architecture and Planning at the University of the Witwatersrand, my train station and the rest of my portfolio were put on a shelf and never revisited; until now.

With my Master's Thesis, I was unsure of what the project was going to be about and what questions I would be asking myself. Moreover, what was going to be the project that taught me something about myself as an Architect? What would speak to my journey and what kind of Architect did I want to become?

The train station I designed five years prior came to mind and I felt it needed to come full circle. The project that essentially started my journey in Architecture should be the one I closed out my degree with.

My master's thesis therefore encompasses the same ideas of mining, colonialism, and African architecture and processes of making. It explores transportation in South Africa and particularly, trains. The research in this process has unearthed a despicable history of mining labour, the power of colonial rule, and the greed of man. It has also revealed possibilities in architectural expression through movement, transportation, access, remembrance and development.

"Railroad trains are such magnificent objects we commonly mistake them for Destiny"

E.B. White
1942
One Man's Meat

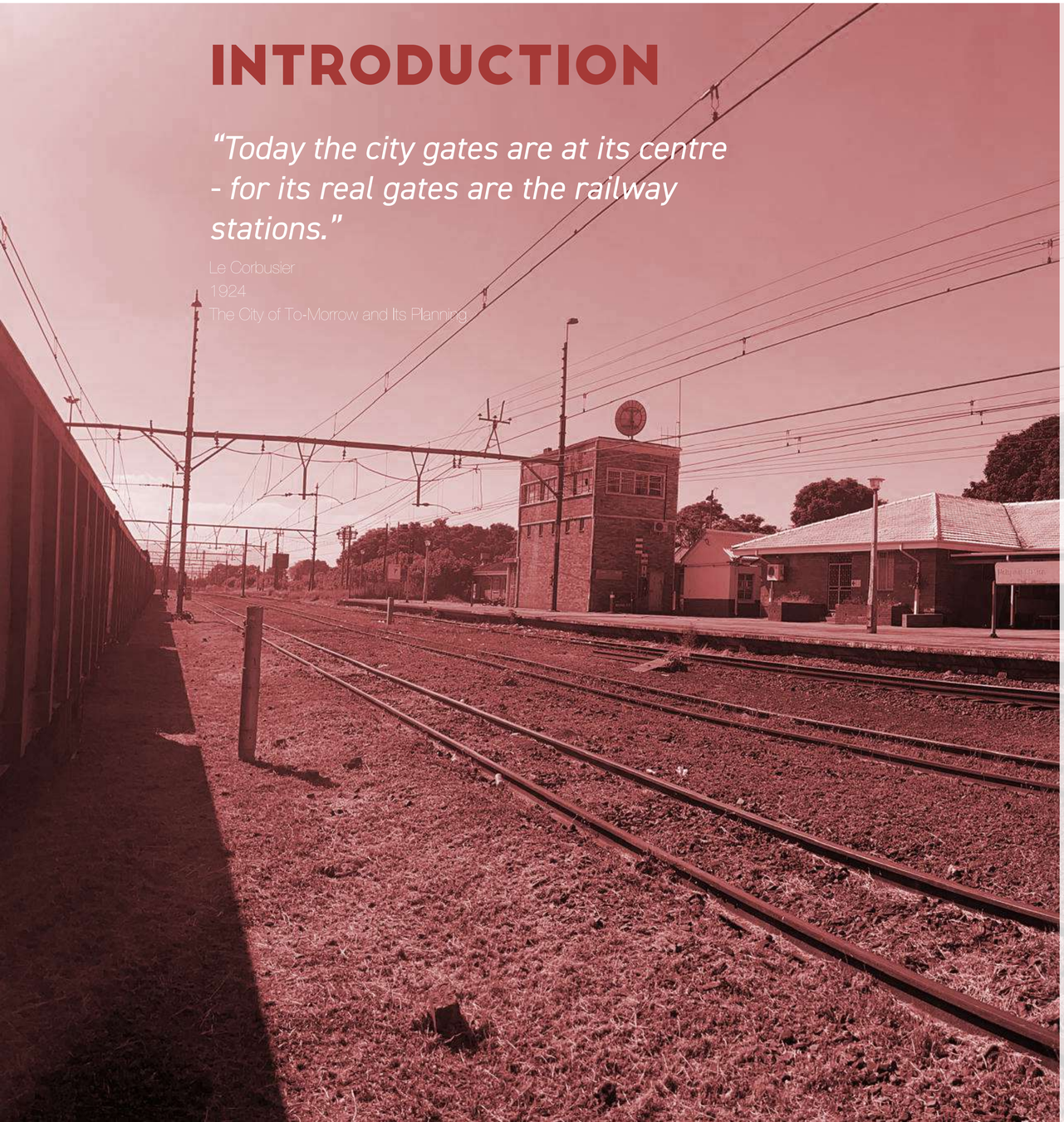


Fig 0.5
Photograph of the Lowveld Escarpment in Motion
(Author, 2024)

INTRODUCTION

"Today the city gates are at its centre - for its real gates are the railway stations."

Le Corbusier
1924
The City of To-Morrow and Its Planning



The Nelspruit Train Station, a major train station in the province of Mpumalanga, is located in the heart of the central business district of Mbombela, formerly known as Nelspruit. Historically, it has been an important focal point for commerce and movement as it is located along the all-important Eastern Line that connects the Highveld of the Gauteng province to the Mozambican coastline. This line was constructed as a means for the Boer Republic to have access to a coastal port that was not controlled by the British Empire and was speedily constructed upon the discovery of gold in Johannesburg. Nelspruit was then a small stop along a vital supply line; as we shall discover later on, it was used as a supply line for more sinister transportation.

This thesis will go about reimagining this historic site by designing a modern multi-modal transportation hub that is centred around facilitating rail reintroduction to the South African economy, as a means of moving people and goods around to propel economic participation locally, nationally, and internationally. However, it is more than just a train station planted on the plateau, it honours the Eastern Line's past, while redefining its future of enhanced connectivity and economic vitality.

The Eastern Line, extending from Booysens in Johannesburg to Maputo in Southern Mozambique, has played a pivotal role in shaping the socio-economic landscape of the region. This route, established by ox-wagon traders at first, was aimed at facilitating the Boer economy of the Transvaal by directing their produce (mainly harvested crops) to a coastal port that was not controlled by the British. Before the Union of South Africa, the Boer Republic could only send their export to the Cape or Natal provinces for international export, as it was a long journey to said ports. The Eastern Line was a shorter route to the export market which meant less costs and more profit. The discovery of gold in the Witwatersrand, however, accelerated the establishment of this line. It also gave the British, whose mines were drying up one after the other, a strong desire to take control of the Transvaal. This ultimately led to the Anglo-Boer wars, which were lost by the Boers, and ultimately a union was formed between the British Colonies and the Boer Republic – the Union of South Africa. The mines along the gold reef were quickly contributing to becoming the largest gold reef ever discovered in the world and as such, attracted a lot of attention. The mine needed workers to extract this precious metal and here is where the Eastern Line became the feeding network for that labour. The Nelspruit Train Station emerged as a significant way-point for the 'night trains' that ferried countless migrant labourers from the Sul de Save to the mines in Johannesburg, underpinning the industrial might of the nation. This legacy of movement and labour is a cornerstone of the site's historical narrative and will be commemorated in the new design.

Mbombela (formerly Nelspruit) is categorised by its sub-tropical climate, with warm, wet summers and mild, dry winters. The site,

now part of the city ecosystem, as well as the natural one, presents unique challenges and opportunities for architectural design. The proposal will address the climatic conditions through the use of passive systems, local materials and forms that express these design solutions. The socio-economic landscape of Mbombela has also evolved significantly from its roots in colonial trade and more people are participating in the economy on different levels of formality and more people are moving about the city and doing so freely. But, as with many governmental entities in modern South Africa, there has also been a devolution in the economic system of the city that has had a ripple effect on the rest of the country. This transformation in economic participation and infrastructural neglect informs the design approach and in fact, feeds the purpose of this intervention overall. This design proposal seeks to reintegrate the rail system within the greater public transport system within the urban and rural fabric, with inclusivity and reliable access as its main agenda.

The proposed multi-modal transportation hub will prioritise the movement of people and goods to propel economic participation. By integrating rail, bus, taxi, and private vehicle services, the design aims to strengthen and streamline connectivity, reduce congestion and bolster the economic activity of the province. This multi-modal approach is essential for enhancing the efficiency and user experience of the transport network, ultimately contributing to the broader economic development goals of the province and the country. It may perhaps be seen as a model answer to begin the repair work needed in the transport sector that has been caused by fatal decisions made by the government, that have ultimately led to the devolution of the economy of the country.

A poignant feature of the new hub will be a monument dedicated to the migrant labour force that built the economy which we as South Africans enjoy the benefit of. The memory of the conditions and journeys these migrant labourers endured, serve to remind us of the abhorrent system they were subjected to. It will form part of a larger master plan that integrates heritage with functionality, ensuring that the station is not only a transit point but also a place of reflection and remembrance.

The design strategy will emphasise form and materiality, drawing inspiration from both local context and contemporary architectural discourse. The use of parametricism – a design approach that uses algorithmic thinking and computational techniques – will allow for innovative design solutions that respond to specific conditions identified in and around the site. This approach will be explored within the framework of African architecture, urban planning and heritage architecture. The aim is to develop a harmonised and advanced design solution that addresses function, traditional values, aesthetics, and contextual responses.

To summarise, this thesis will provide a comprehensive analysis of the Nelspruit Train Station site, examining its historical significance, the current conditions, and its future potential. The proposed design will address the multifaceted challenges of multi-modal transportation, aiming to create a hub that is efficient, inclusive and reflective of its rich heritage. Through thoughtful consideration of form, materiality, and context, the new transportation hub will not only enhance connectivity, but will also serve as a testament to the enduring legacy of those who traversed its tracks in pursuit of a better life.

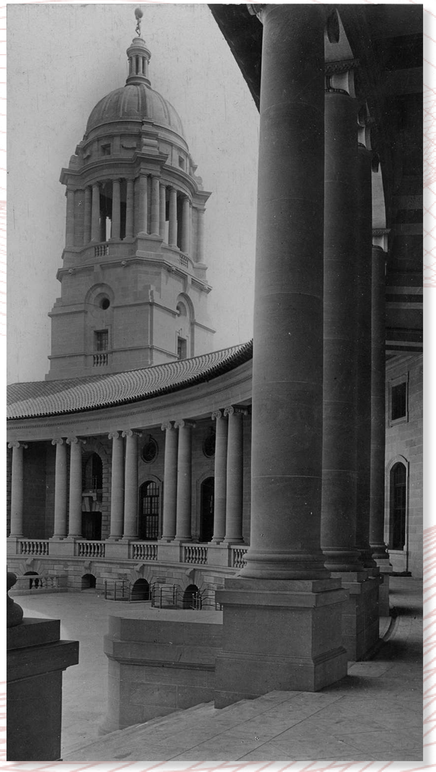


Fig 0.7
Photograph of Nelspruit Station - Track-side
(Author, 2024)

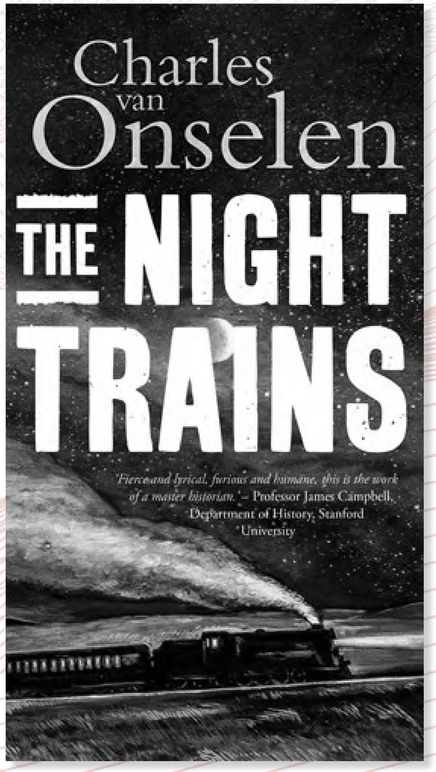
CHAPTER 1
THE HISTORY OF THE EASTERN LINE



THE ZUID-AFRIKAANSCHE REPUBLIEK



THE UNION OF SOUTH AFRICA



THE NIGHT TRAINS



SAR&H TO TRANSNET

CHAPTER GLOSSARY

BOER (Noun)

(Dutch: 'husbandman,' or 'farmer'), a South African of Dutch, German, or Huguenot descent, especially one of the early settlers of the Transvaal and the Orange Free State. Today, descendants of the Boers are commonly referred to as Afrikaners.

MBOMBELA (Noun)

(siSwati: 'a lot of people in a small space'), a city in South Africa, the capital of Mpumalanga province on the Crocodile River.

MJEJANE (Noun)

The name of a Chief who ruled over the Malelane region (East of Mbombela) around a century ago.

MPUMALANGA (Noun)

(siSwati: 'East', or 'Place of the rising sun'), one of the nine provinces of the Republic of South Africa.

NZASM (Acronym)

(Dutch: 'Nederlandsche Zuid-Afrikaansche Spoorweg-Maatschappij'(NZASM) English: 'Netherlands-South African Railway Company'), a private Dutch enterprise, founded with the purpose of building the Delagoa Bay Railway from Mozambique to Pretoria.

SHOSHOLOZA (Noun)

(isiZulu: 'move forward'), a popular Zulu choral song about persevering.

STIMELA (Noun)

(isiZulu: 'train' from *isistimela*), a song written by Hugh Masekela about the trains that carried forced African labour to the mines of South Africa.

TRANSVAAL (Noun)

Former province of South Africa. The Transvaal's name, which means 'across the Vaal,' originated with the Afrikaners who in the 1830s migrated to the region after crossing the Vaal River.

WITWATERSRAND (Noun)

A rocky ridge in Johannesburg, South Africa: contains the richest gold deposits in the world and coal and manganese.

Fig 1.1
previous spread (far left)
Portrait of Paul Kruger
(GL Archive, 1890)

Fig 1.2
previous spread (left)
Colonnade in Amphitheatre (Looking West), Union Buildings, Pretoria.
(UPSpace, Van Der Wall Collection, n.d.)

Fig 1.3
previous spread (right)
Charles van Onselen 'The Night Trains' Book Cover
(Charles van Onselen, 2020)

Fig 1.4
previous spread (far right)
SAR&H Logo 1934 & Transnet Logo 2007
(Transnet, n.d.)

THE ZUID-AFRIKAANSCHE RUPUBLIEK

Prior to the Treaty of Vereeniging in 1902 and the inception of the Union of South Africa in 1910,[1] the Transvaal was run by the Boer Republic Government – a largely agrarian and "more Romantic/Calvinist"[2] group. Their settlement and establishment in the Transvaal came after the Great Trek which "was an eastward migration of Dutch-speaking settlers who travelled by wagon trains from the Cape Colony into the interior of modern South Africa from 1836 onwards, seeking to live beyond the Cape's British colonial administration."[3]

In the early 1870s, the idea of a train line linking the landlocked Transvaal to Delagoa Bay (now Maputo), was first introduced "after the discovery of diamonds in the north-eastern Cape in the late 1860s".[4] ZAR President, Thomas Francois Burgers and his ministers were however suspicious of British interference, as their insatiable desire to expand their colony seemed to forever knock on the Boer's back door. Burgers had no vision for the Eastern Line to "develop a rival urban industrial base to that emerging in the diamond fields to the southwest".[5] Instead, the idea was that besides providing a steady economic and military supply line relatively "free of British influence, the rail link might supplement the gradual, more ordered development of an agrarian republic that would benefit indirectly from the urban markets developing in the north-eastern Cape".[6] In 1875, Burgers began the planning of the construction of a railway line from Lourenco Marques(now Maputo) and Lydenburg(now Mashishing) and by 1877, the British had annexed the Zuid Afrikaansche Republiek after the Boers went to war with Pedi High Chief Sekhukhune.[7]

Four years passed and in 1881, the first Anglo-Boer war broke out where the Boers ultimately won independence from the British. In 1883, Paul

1 'The Union of South Africa 1910 | South African History Online', accessed 23 July 2024, https://www.sahistory.org.za/article/union-south-africa-1910.
2 'The Union of South Africa 1910 | South African History Online'.
3 'Great Trek (1835-1840) | Military History Books | Helion & Company', accessed 23 July 2024, https://www.helion.co.uk/conflicts/great-trek.php.
4 Charles van Onselen, The Night Trains (C. Hurst & Co. Publishers Ltd., 2020).
5 Charles van Onselen.
6 Charles van Onselen.
7 Joep Stevens, 'The Selati Railway Line, Sabi Bridge and Skukuza - A History', May 2024, James Stevenson-Hamilton Library & Museum - Skukuza KNP.

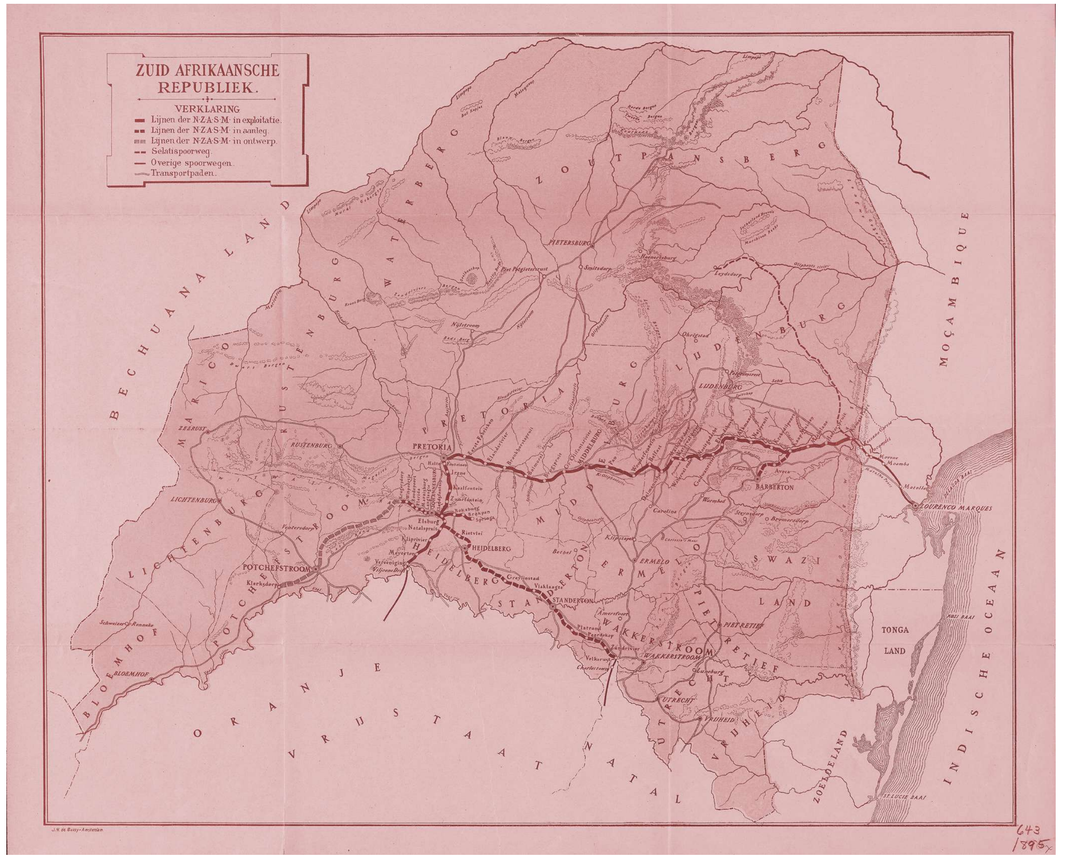


Fig.1.5
Map of Zuid Afrikaansche Republiek
(J.H. de Bussy, 1895)



Fig 1.6
Eastern Entrance to the NZASM Tunnel
(The Heritage Portal, 2017)

Kruger was elected as State President and led the country until the second Anglo-Boer War that ended in 1902. In his early presidency, there was slow progress on the Eastern Line, but the Boer republic desperately sought an independent trade route from the British.[8]

However, a timid mix of guns and grain did little to convince investors in Europe of the viability of a new train line. At least, not until the discovery of gold in the Witwatersrand in 1886 – what would become the largest gold reef in the world. The fate of the Eastern line was sealed in this discovery and taken further by the British after their victory in the Second Anglo-Boer War from 1899-1902.[9] In 1887, the Nederlandsche Zuid-Afrikaansche Spoorweg-Maatschapij (NZASM) (translated means Dutch-South African Railway Company) was registered with the aim of completing the Eastern Line from the Mozambican border at Komatipoort, to Pretoria.[10]

By the end of 1890, the Mozambican Line was complete from Delagoa Bay to Ressano Garcia[11] and five years later in the winter of 1895, the Eastern Line was officially opened. Tensions rose between the British and the Boer republic just as the gold production from the Witwatersrand rose from a global four percent in 1886 to a hefty 27 percent by 1898[12]. While it is argued that it was not the gold alone that caused the second Anglo-Boer war,[13] it was certainly a strong motive for the British Empire to take control of the Republic as the gold fields discovered in the Witwatersrand became the largest gold field ever discovered, contributing fourty percent of the global gold supply by 1914.[14] The Boer Republic fell at the end of 1902 with the signing of the Vereeniging Treaty (Union Treaty) and the establishment of the Union of South Africa in 1910.[15]

8 Stevens.
9 'Find the Kruger Millions', accessed 23 July 2024, https://www.umjindi.co.za/pages/menu/history/kruger-millions.html.
10 Stevens, 'The Selati Railway Line, Sabi Bridge and Skukuza - A History'.
11 Charles van Onselen, The Night Trains.
12 Charles van Onselen.
13 'The Union of South Africa 1910 | South African History Online'.
14 Charles van Onselen, The Night Trains.
15 'The Union of South Africa 1910 | South African History Online'.

THE UNION OF SOUTH AFRICA

From the beginning of the peace talks between the settler colonies, the British government made clear their willingness to negotiate peace that fostered unity, with the condition that British culture and loyalty to the crown would be its foundation. To make the deal attractive to the Boer population, Dutch would be granted "equal status to the English in legislation and that self-rule would eventually be granted to the Union colonies".[16] However, Britain continued the suppression of traditional African structures of governance through its policies of indirect government. It was this secondary concern for the majority of the population that ultimately paved the way for the political upheaval and inhumanity that followed for the next eighty years. The cause for this tone toward the Black population, is said to stem from the response to the Bambatha rebellion – "a notable Black South African response to the encroachment that resulted from the constitutional tug-of-war between the British and the Boer republics".[17]

The root of the Bambatha rebellion was said to be the pressure the colonial authorities put on "traditional societies to force indigenous peoples into the European-controlled labour market".[18] The rebellion ended after a guerrilla warfare battle in May 1906 where Bambatha was eventually captured and killed.[19]

In 1908, a National Convention was held between the colonial governments of the four colonies, to discuss the policies of their unification. Policies concerning labour, education, equality between the English and Boer, extending a franchise to Black South Africans, and the apportioning of constitutional authority were negotiated. It was ultimately Louis Botha who formed the first government as Prime Minister of the Union of South Africa on 31 May 1910.[20] It was at the start of this Union that we begin to discover the story of The Night Trains.

16 'The Union of South Africa 1910 | South African History Online'.
17 'The Union of South Africa 1910 | South African History Online'.
18 'The Union of South Africa 1910 | South African History Online'.
19 'The Union of South Africa 1910 | South African History Online'.
20 'The Union of South Africa 1910 | South African History Online'.



Fig 1.7
The Union Buildings Circa 1920s
(The Heritage Portal, 2016)

THE NIGHT TRAINS

Before the wars and the union, the gold reef was slowly being unearthed, one gold nugget at a time. The mines stretched from East to West along the Witwatersrand. Small townships began to develop along this mining belt and so did the railway line. As the mines grew deeper, so did their insatiable appetite for labour:

> *With the Rand mines so desperate for huge quantities of ultra-cheap labour from China, and the Portuguese at least as desperate to ensure rail traffic sufficient to underwrite the future of the port of Lourenco Marques, the colonising principals struck a series of deals at the expense of a third party – Africans drawn from the south of the Save River (the Sul do Save) in Mozambique. In return for a guaranteed percentage of the rail traffic bound for the new gold fields, the Portuguese eventually granted the Witwatersrand Native Labour Association (WNLA) sole recruiting rights for cheap black mine labour from the Sul do Save, with the majority of miners to be transported to and from the Rand by WNLA trains.* [21]

The vision for the Eastern Line by President TF Burgers (1870s), was never one for a passenger line, however it did ferry passengers. Ironically, even today it is still not seen as a passenger line. "It is estimated that between 1910 and 1960 some five million passengers were ferried between Booysens station in Johannesburg, and the Komatipoort/Ressano Garcia station complex on the Mozambique-South Africa border".[22]

Despite this logistical feat for close to half a century, it has garnered very little attention. It seems strange as this endless supply line of Black labour along the Eastern Main Line is what contributed considerably to the profitability of the gold mining industry, which allowed the ruling white class to benefit economically for more than a century.[23]



Fig 1.8
The Night Train
(Cesar Diaz Ayres, 2024)

21 *Charles van Onselen, The Night Trains.*
22 *Charles van Onselen.*
23 *Charles van Onselen.*

The WNLA's 307 down-train and the 804 up-train carried these 'recruits' mostly under cover of darkness. Largely for logistical reasons, this was done to bypass the busy line's heavy day-time traffic carting minerals to and from the mines to Lourenco Marques. It was also done to hide this shameful trafficking from unwanted criticism from European voters in a racially oppressive system. However, this night train strategy came at a perilous cost, at times when the trains navigated the dangerous contours of the modern Middle Passage – Waterval Boven down to Waterval Onder:

> *The train accidents that gave rise to the largest number of fatalities among returning workers, those in 1918 and 1949, occurred in the small hours of the morning. Accidents taking place in the middle of the night did noting to facilitate search and rescue operations.*[24]

The South African Railways (SAR) viewed this mass transportation of Black migrant trains as carrying goods, or 'human freight', and did little to expedite their movement through the system. Classifying the train in terms of 'passenger', 'freight' or 'mixed' determined the level of competency of the train driver and the speed at which the train travelled.[25] These recruit trains were coupled with freight cars intended to transport coal and other freight or animals. These cars were never intended to be used to transport passengers – but once again, transport passengers they did.

The Portuguese government abolished the 'legal' obligation of forced labour, but enforced a 'moral' obligation to work in order to pay taxes in Mozambique. If the men of the Sul do Save did not willingly board the 804 up-train to Booysens, they were put in forced labour locally without pay. So, for a day and a half, these conscripted men were confined to cattle cars and coal trucks, undernourished and without access to potable water. They were crammed into these freight cars and often locked in order to prevent deserters from escaping before reaching Booysens station. The 307 down-train was much the same, only then were the men almost dead. From being overworked in the mines, to being riddled with disease, these men who exhausted their bodies for the extraction of minerals were unceremoniously dumped back in Mozambican territory for them to die untreated, or worse, to spread their contracted illnesses among their villages.[26] But even for the healthy Mozambicans carrying home their modest possessions and cash savings, the down-train necessitated running a gauntlet. At every station from Germiston to Nelspruit to Ressano Garcia, the train would stop for unauthorised extended periods. An economy developed from trade between the hungry and sleep-deprived Mozambican passengers and the people living in the towns at each station. From robbers to hawkers, this bi-weekly train was a bank on wheels and the Mozambicans often returned home with little to show for their contracted work.[27]

There is little that serves as a reminder of the system that caused so much ruin in a time of racial oppression and exploitation:

> Around 1910, by which time the railway was already firmly embedded in African imaginations, one curious European was moved to record a fragment of what he called an 'epic poem' recited by his servant. The train was, the young black man chanted, 'the one that roars in the distance...the one that crushes to pieces the warriors and smashes them!' [28]

Shosholoza, a traditional African song, began as a folk song for the gold and diamond miners travelling between Zimbabwe and South Africa. The word is a mixture of Ndebele and Zulu words meaning "to push forward, endeavour, or strive" and the sound of the word itself is symbolic of the steam train that carried these miners away from their homelands.[29]

24 *Charles van Onselen.*
25 *Charles van Onselen.*
26 *Charles van Onselen.*
27 *Charles van Onselen.*
28 *Charles van Onselen.*
29 *'Shosholoza. Moving Fast, Moving Strong', Firelight Foundation, 1 June 2011, https://www.firelightfoundation.org/blog/2011/06/01/shosholoza-moving-fast-moving-strong.*

Shosholoza – *Go, keep moving*

Kulezo ntaba – *Go on and board the train*

Stimela siphume South Africa – *From the mountain down in South Africa*

Wen' uyabaleka – *Keep moving, run away*

Kulezo ntaba – *Go on and board the train*

Stimela siphume South Africa – *From the mountain down in South Africa*

The song was adopted by South Africans as a song for struggle and solidarity, and the late former President, Nelson Mandela, wrote in his book 'A Long Walk To Freedom' how he sang this song when he was imprisoned on Robben Island – the train was a metaphor for Apartheid. From its inception of being an anthem for struggle, it has now been adapted to a South African war-cry at sports fixtures to encourage players to persevere.[30]

In 1973, South African-born jazz singer Hugh Masekela, wrote his own composition – *Stimela*; the song captures the chaos and tyranny of the trains that carried men from all over Africa to work in the 'belly of the earth', the working conditions, the social impact and the psychological madness that ensued:[31]



Fig 1.9
Hugh Masekela
(SAHO, 1966)

30 *'Shosholoza', Living Room Choir ANEW (blog), 3 April 2018, https://thelivingroomchoir.com/shosholoza/.*
31 *Charles van Onselen, The Night Trains.*

STIMELA - HUGH MASEKELA



CLICK TO PLAY ON YOUTUBE

There is a train that comes from Namibia and Malawi
There is a train that comes from Zambia and Zimbabwe
There is a train that comes from Angola and Mozambique
From Lesotho, from Botswana, from Swaziland
From all the hinterlands of Southern and Central Africa
This train carries young and old, African men
Who are conscripted to come and work on contract
In the gold and mineral mines of Johannesburg
And it's surrounding metropolis, sixteen hours or more a day
For almost no pay

Deep, deep, deep down in the belly of the earth
When they are digging and drilling that shiny mighty evasive stone
Or when they dish that mish mesh mush food
into their iron plates with the iron shank
Or when they sit in their stinking, funky, filthy
Flea-ridden barracks and hostels
They think about the loved ones they may never see again
Because they might have already been forcibly removed
From where they last left them
Or wantonly murdered in the dead of night
By roving, marauding gangs of no particular origin
We are told
They think about their lands, and their herds
That were taken away from them

With the gun, and the bomb, and the teargas, the Gatling
and the cannon
And when they hear that Choo-Choo train
A-chugging, and a pumping, and a smoking, and a pushing
a pumping, a crying and a steaming and a chugging and
a whooo whooo!
They always cuss, and they curse the coal train
The coal train that brought them to Johannesburg
Whooo whooo!

[Chorus]
Stimela sihamba ngamalahle - *"The train, it uses coal to move"*
Sivel' eDalagubhayi - *Zulu phonetic name for Delagoa Bay*
Sangilahla kwaGuqa - *"It dropped me off in kwaGuqa"*
Bathi sizomba amalahle (Sizomba amalahle) - *"They said we'll dig coal (We'll dig coal)"*
Stimela sihamba ngamalahle - *"The train, it uses coal to move"*
Sivel' eDalagubhayi - *Zulu phonetic name for Delagoa Bay*
Sangilahla kwaGuqa - *"It dropped me off in kwaGuqa"*
Bathi sizomba amalahle (Sizomba amalahle) - *"They said we'll dig coal (We'll dig coal)"*

[Verse]
Iyohhh...
Sind' inyul' enkomponi - *"Surviving purely in the compound"*

Ngath' uyabhayiza wena bathi (Stimela!) - *"I said you're not street smart"*

Sihleli njengezinja, siyelele mame – *"they said we're living like dogs"*

Emigodini mama (Bathi stimela) - *"We sit like dogs, we sleep mama"*

Sikhalel' izihlobo zethu (Masibuyeleni! eDalagubhayi) - *"We mourn for our relatives"*

Sikhalel' izingane zethu wololo! (Masibuyeleni! eDalagubhayi) - *"We mourn for our children"*

Sikhalela macheri wethu, mama oh! (Masibuyeleni! eDalagubhayi) - *"We mourn our cherries" (Cherrie is slang for girlfriend or young woman)*

Sikhalel' abazali bethu! - *"We mourn our parents"*

Yelele yelele yelele yelele yelele

[Chorus]

Stimela

Sihamba ngamalahle

Sivel' eDalagubhayi

Stimela

Sihamba ngamalahle

Sivel' eDalagubhayi

Stimela

Sihamba ngamalahle

Sivel' eDalagubhayi

[Bridge]

Helele bathi Stimela ma wo!

Stimela

Sihamba ngamalahle

Sivel' eDalagubhayi

Bathi, Stimela ma wo!

Stimela!

Sihamba ngamalahle

Sivel' eDalagubhayi

Whooo whooo!

[Chorus]

Stimela

Sihamba ngamalahle

Sivel' eDalagubhayi

Stimela

Sihamba ngamalahle

Sivel' eDalagubhayi[32]

32 *Hugh Masekela – Stimela (The Coal Train), accessed 24 July 2024, https://genius.com/Hugh-masekela-stimela-the-coal-train-lyrics.*

Every year on November 16th, dignitaries from the South African and Mozambican governments gather at this site to pay respects to those who died (63 passengers) in the crash of a derailed train on 16 November 1949. There is only one, fenced-in public display of remembrance set beside the mass graves of those who died, that offers little insight to the entire history of this forced labour trade, a commemorative stone erected in 2010[33]. "The men, women and children of the Sul do Save deserve so much better...lest we forget and lose forever the opportunity of remembering how the sad events that befell the train at Waterval Boven were illustrative of a system, not an 'accident'."[34]





Fig 1.10
top
Waterval Boven Train Disaster Monument 2018
(Charles van Onselen, 2019)

Fig 1.11
Waterval Boven Train Disaster Monument 2019
(Charles van Onselen, 2019)

33 *bonganimashisane, '69th Anniversary of Waterval Boven Train Disaster', Mpumalanga News (blog), 15 November 2018, https://www.citizen.co.za/mpumalanga-news/news-headlines/2018/11/15/69th-anniversary-waterval-boven-train-disaster/.*

34 *Charles van Onselen, The Night Trains.*

SAR&H TO TRANSNET

At the formation of the Union of South Africa in 1910, one of the many points of disagreement was about the ownership of the railways and harbours and thus, the South African Railways and Harbours came into being as one organisation to serve the whole country.[35] New lines were built and by 1924, electrification of train lines began emerging after the establishment of parastatals Iscor and Eskom. The demands of the rail and harbour systems grew as South Africa moved through the two World Wars, producing war materials and shipping them off to the battlefields. After the Second World War, South Africa continued to enjoy economic growth, which allowed for the rail infrastructure to expand further to meet the needs of the sudden industrial expansion. By 1955, Centralised Traffic Control (CTC) came into effect and by 1960, diesel locomotives were introduced on a large scale.

In 1961, South Africa became a Republic, independent of British rule. SAR&H would grow in leaps and bounds, taking delivery of its first locally manufactured electric locomotive in 1963. Records for tonnage and length of train cargo were being broken and pushed to the limits, truly putting SAR&H on the global map for its exporting and transportation capabilities. It was in the 1970s that the government decided to rebrand the SAR&H along more business lines and so it became known as South African Transport Services (SATS) which encompassed railway, harbour, road, aviation and pipeline operations and it was formalised by the end of 1981. Less than a decade later, this state-run organisation was transformed into a limited company, and so Transnet was born. Spoornet was the rail business division which was renamed again in 2007, to Transnet Freight Rail.



Fig 1.12
SAR&H Logo 1934
(Transnet, n.d.)

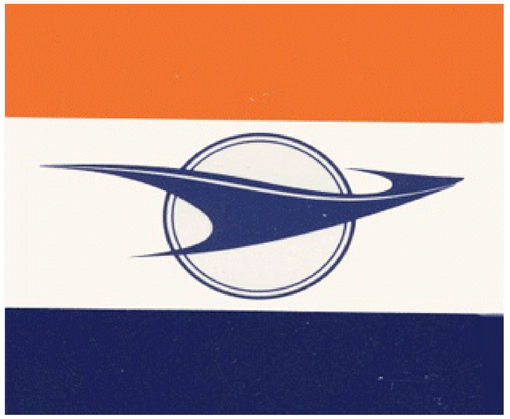


Fig 1.13
SATS Logo 1981
(Transnet, n.d.)

35 *Transnet Freight Rail Heritage, 'RAILWAY COUNTRY - 150 Years of Rail in South Africa', accessed 24 May 2024, https://www.transnetfreightrail-tfr.net/Heritage/150years/150YearsRail.pdf.*



Fig 1.14
Spoornet Logo 2003
(Transnet, n.d.)



Fig 1.15
Transnet Logo 2007
(Transnet, n.d.)

The transport network of South Africa has come a long way since the 1800s and continues to develop to meet the transport needs of the country. In recent times however, the railway network has become heavily criticised for its general deterioration and decline of commuter and passenger services. Freight is also being diverted to the ever-increasing interlink freight trucks as a consequence of mismanagement and the derelict state of the rail network across the country. This only exacerbates the issue by further reducing traffic on the rail network and forcing lines to close as they are no longer profitable. Towns who once relied on these incoming trains for income have begun to slowly die out.[36]

Historically speaking, the railway line and its stations have played a vital role in the lives of South African communities. The iron road and iron horse served as a connection to the outside world, before cars and minibus taxis became an affordable and therefore popular mode of transport. The railway station was often a hub of public and business life – a mechanism of trade, arrival and departure, and social meeting. The station master was considered a pillar of society along with the doctor, headmaster, bank manager and clergyman.[37] Great pride was taken in the condition of the station and a competition was held annually by SAR&H for the best one. This is in stark contrast to the way stations are thought of today in South Africa. It is therefore not difficult to imagine why so many towns, which often only existed because of the station, have become a shadow, if not a phantom of their former selves – to say nothing of the people that once lived there.

36 *Can South Africa's Failing Railways Be Saved? (2001), 2018, https://www.youtube.com/watch?v=GQ2IlhQzm0g.*
37 *Transnet Freight Rail Heritage, 'RAILWAY COUNTRY - 150 Years of Rail in South Africa'.*

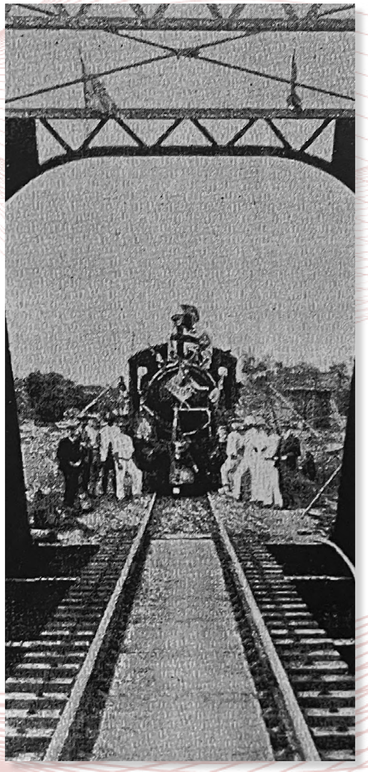
CONCLUSION

The history of the Zuid Afrikaansche Republiek, which later merged with the British to become the Union of South Africa, is marked by a complex interaction of political, economic, and social elements. The railway line construction, initially envisioned as a route to support an agricultural economy and maintain independence from the British, became a crucial conduit for the new gold mining industry. However, this development came at a significant human cost, particularly for the African labourers who were subjected to inhumane conditions and exploitation. The establishment of the Union in 1910 marked a new chapter in South Africa's history, however, it was built on a foundation of racial inequality and colonial conquest, which continued to have a profound impact on the socio-political landscape for nearly a century after its inception. The story of the railways, from its role in economic expansion, to a darker legacy of forced labour, serves as a reminder of the deep-seated injustices that have shaped South Africa's past and continue to reverberate into the present. The lack of substantial recognition of and remembrance for those who suffered during this period, underscores a need for deeper reflection and acknowledgement of this troubled history.

CHAPTER 2
SITE ANALYSIS



HISTORICAL CONTEXT



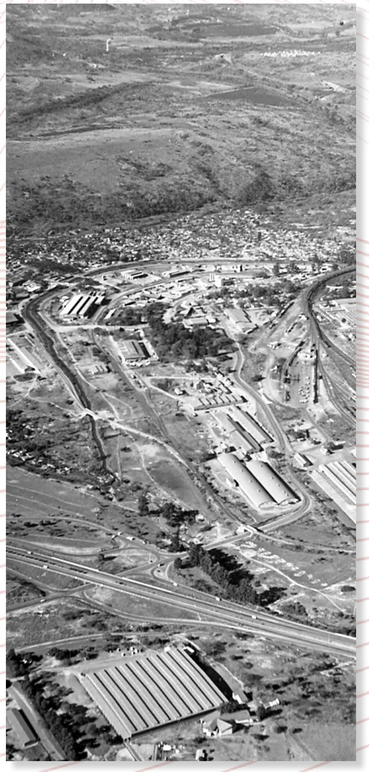
THE EASTERN RAILWAY LINE



GEOGRAPHY & CLIMATE



THE STATION



URBAN CONTEXT & MAPPING

CHAPTER GLOSSARY

MBOMBELA (Noun)

(siSwati: 'a lot of people in a small space'), a city in South Africa, the capital of Mpumalanga province on the Crocodile River. *Former name: Nelspruit*

MJEJANE (Noun)

The name of a Chief who ruled over the Malelane region (East of Mbombela) around a century ago.

MPUMALANGA (Noun)

(siSwati: 'East', or 'Place of the rising sun'), one of the nine provinces of the Republic of South Africa.

Fig 2.1
previous spread (far left)
Aerial Photograph of Nelspruit
(The South African Landscape, 1976)

Fig 2.2
previous spread (left)
The Selati Line
(Ron Hopkins, 2020)

Fig 2.3
previous spread (middle)
Lowveld Escarpment
(Author, 2024)

Fig 2.4
previous spread (right)
The Nelspruit Train Station
(Author, 2024)

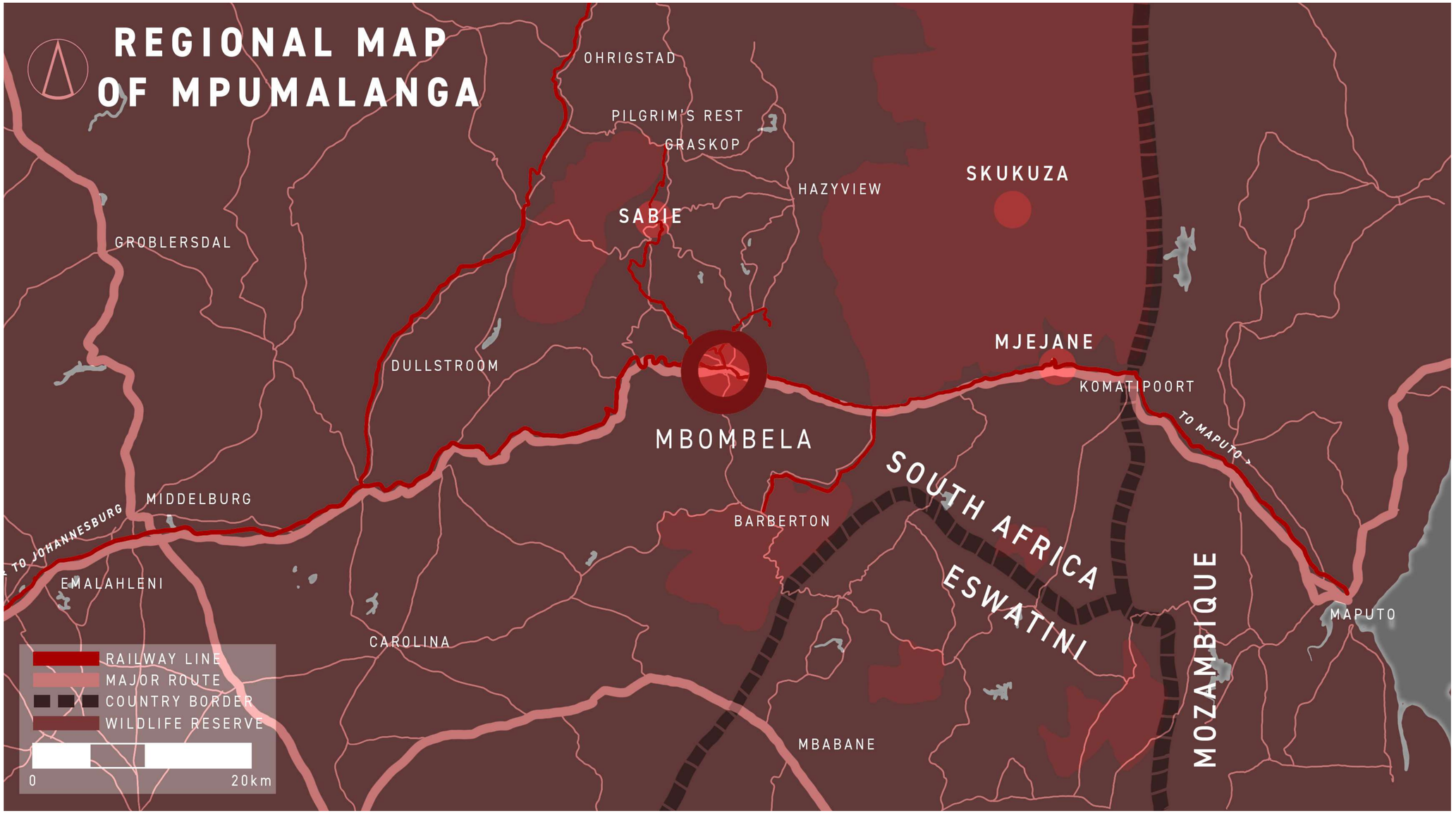
Fig 2.5
previous spread (far right)
Aerial view of Nelspruit
(David Butcher, 2021)

HISTORICAL CONTEXT

The site is located in the modern-day city of Mbombela. The city is the provincial capital of the Mpumalanga province, which is one of the nine provinces of South Africa. The provincial borders of Mpumalanga were redefined from the former Transvaal province (a region north of the Vaal River) in 1993, and translates to 'the place of the rising sun'. Mbombela was formerly known as Nelspruit and was renamed in 2009. It is a siSwati and Zulu word that means 'a lot of people in a small space'.

The city (Nelspruit) was proclaimed a village in 1905 once a train station was built on the Nel's family farm and was then made a municipality in 1940[1]. This iron road was the project initiated by the Boer Republic (Zuid-Afrikaansche Republiek) and the Nederlandsche Zuid-Afrikaansche Spoorweg Maatschappij (NZASM) that aimed to build a rail route that connected Lorenzo Marques (now Maputo) to the ZAR.


BOTSWANA
UNION OF SOUTH AFRICA
Lesotho
MOZ
Walvis Bay
Windhoek
Gobabis
Rehoboth
Nariab
Salzbrunn
Tses
Keetmanshoop
Seeheim
Luderitz
Aus
Bogenfels
Karasburg
Warmbad
Orange
Port Nolloth
O'okiep
Kakamas
Upington
Hotazel
Sishen
Postmasburg
Vryburg
Kimberly
Douglas
Prieska
Sakrivier
Bitterfontein
Calvinia
Carnarvon
Springfontein
De Aar
Belmont
Bloemfontein
Koffiefontein
Edenburg
Naauwport
Rosmead
Hutchinson
Graaff Reinet
Beaufort West
Cradock
Tarkastad
Queenstown
Cookhouse
Somerset East
Seymour
Klipplaat
Kirkwood
Alicedale
Grahamstown
East London
Port Alfred
Alexandria
Port Elizabeth
Knysna
Mossel Bay
George
Oudtshoorn
Avontour
Calitzdorp
Touws River
Ladismith
Worcester
Paarl
Capetown
Simonstown
Fransch Hoek
Protem
Bredasdorp
Porterville
Prince Alfred
Saldanha
Graafwater
Hofmeyr
Jamestown
Barkly East
Aliwal North
Matatiele
Maclear
Umtata
Port St Johns
Kokstad
Franklin
Madonela
Kelso
Mid-Illovo
Port Shepstone
Izotsha
Underberg
Donnybrook
Pietermaritzburg
Richmond
Durban
Point
Wests
Bergville
Ennersdale
Harrismith
Warden
Vrede
Arlington
Bethlehem
Ladybrand
Winburg
Marquand
Maseru
Reitfontein
Vereeniging
Vanderbijlpark
Vereeniging
Bultfontein
Vredefort
Kroonstad
Johannesburg
Krugersdorp
Meyerdiende
Middleveit
Thabazimbi
Nylstroom
Vaalwater
Pietersburg
Potgietersrus
Pietersburg
Pietersburg
Pietersburg


REGIONAL MAP OF MPUMALANGA
OHRIGSTAD
PILGRIM'S REST
GRASKOP
HAZYVIEW
SKUKUZA
SABIE
GROBLERSDAL
DULLSTROOM
MJEJANE
KOMATIPOORT
TO MAPUTO
MBOMBELA
TO JOHANNESBURG
MIDDELBURG
BARBERTON
SOUTH AFRICA
ESWATINI
MOZAMBIQUE
EMALAHLENI
CAROLINA
MAPUTO
MBABANE
RAILWAY LINE
MAJOR ROUTE
COUNTRY BORDER
WILDLIFE RESERVE
0
20km

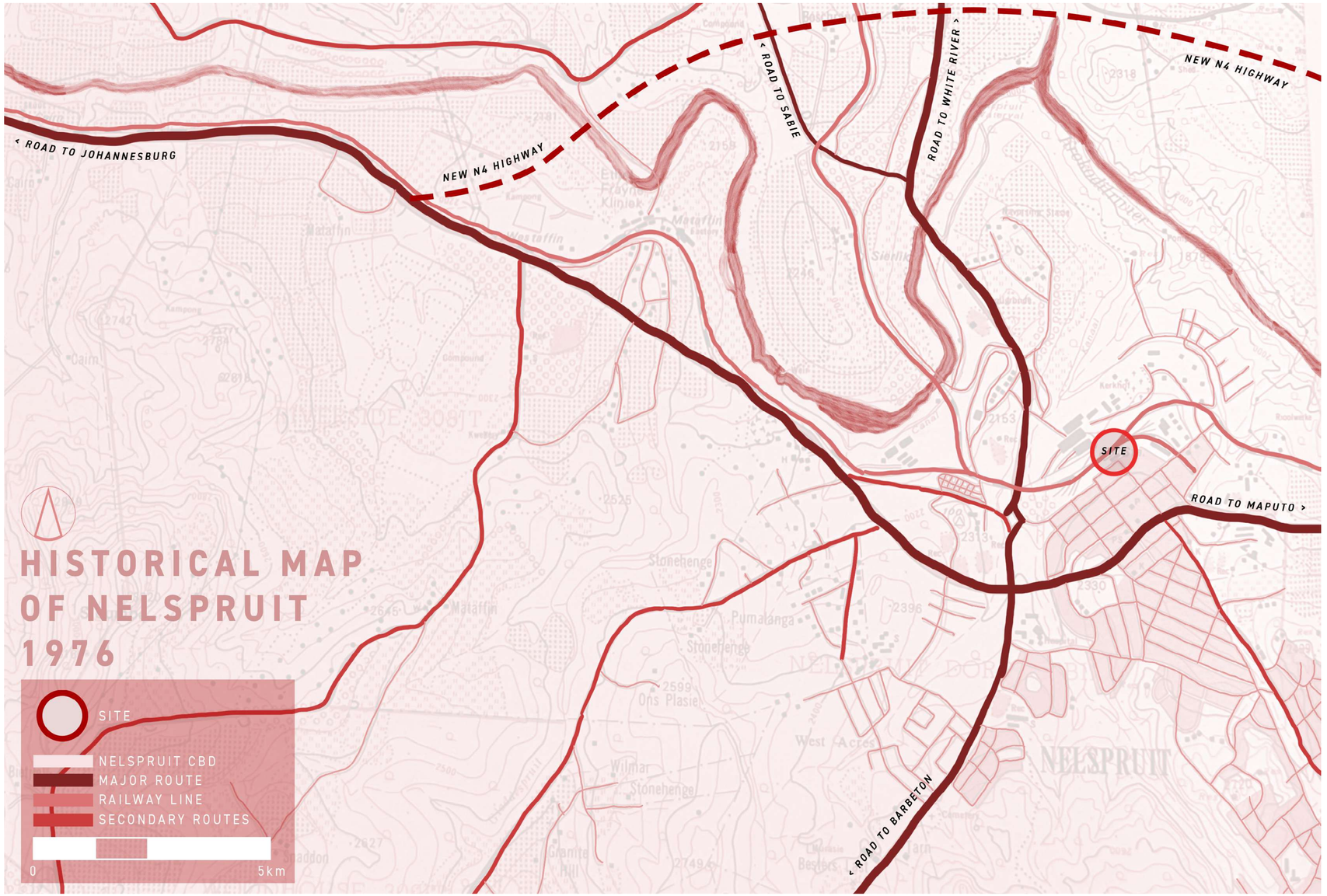


Fig 2.7
previous spread
Map of Mpumalanga - Derived from Google Maps
(Author, 2024)

Fig 2.8
Map of Nelspruit - Derived from 'The South African Landscape'
(Author, 2024)

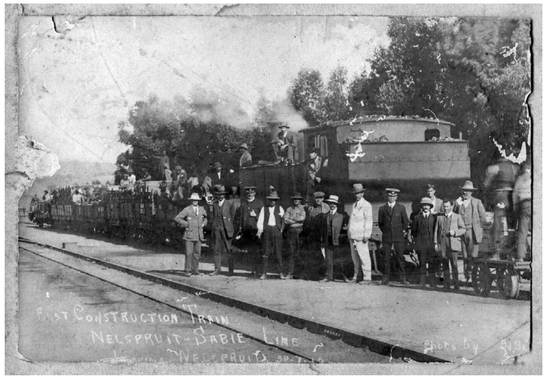


Fig 2.9
First construction train on the Nelspruit to Sabie line
(SAR Publicity and Travel Department, 1910)



Fig 2.10
Nelspruit Railway Station, Transvaal
(HiltonT, circa 1960)



Fig 2.11
Old bridge over the Nels River to White River
(Lowvelder, n.d.)



Fig 2.12
Bags of oranges on station platform
(SAR Publicity and Travel Department, 1967)



Fig 2.13
Nelspruit, 1954. SAR Class GMAM at station
(SAR Publicity and Travel Department, n.d.)



Fig 2.14
Nelspruit district. De Kaap valley
(SAR Publicity and Travel Department, n.d.)



Fig 2.15
Road Gang in Nelspruit, singing and digging
(David Butcher, 2021)



Fig 2.16
Farewell from traditional dancers
(SAR Publicity and Travel Department, 1947)

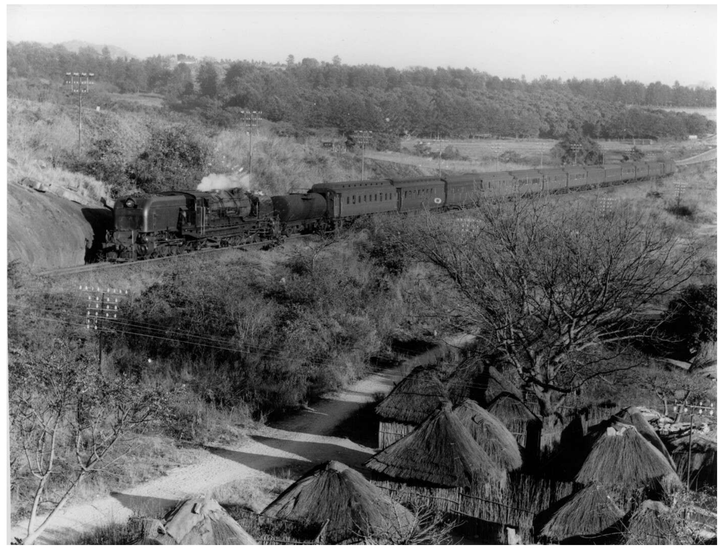


Fig 2.17
SAR Class GMAM No 4058 with passenger train passing tribal village.
(SAR Publicity and Travel Department, 1955)

THE EASTERN RAILWAY LINE
SABIE

The Sabie Train Station is located on the fringe of the southern boundary of Sabie. The station, like many small stations in South Africa, has been left to ruin as a result of the disuse of the rail network[2]. The station at present has been stripped of all furniture and fittings and is overgrown with weeds and other vegetation. The building has become a shelter for the homeless and ash piles from fires can be found along the platform.

The station has a freight storage shed across the tracks and has seen the same vandalisation and overgrowth that the station has. The tracks are also overgrown with weeds and this site is difficult to access as a result. This station is an accurate example of what the fate for train stations in South Africa have become as a result of cable theft, lack of infrastructural maintenance, and general incompetence in rail management.

The rail through Sabie used to serve as a freight line for timber and gold. Gold has long run out in the area, but timber is still the life supply of the town. Rail inadequacy has forced timber mills to resort to road transportation and has further entrenched the fate of rail here.



Fig 2.18
above
Sabie Train Station
(Author, 2024)



Fig 2.19
bottom left
Sabie Train Station Shed
(Author, 2024)

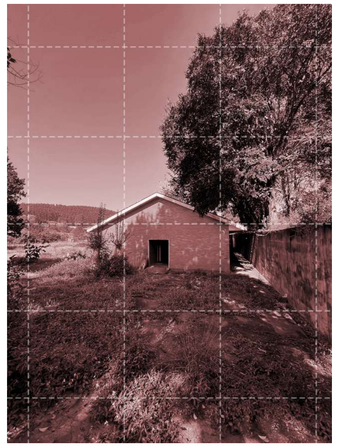


Fig 2.20
bottom middle
Sabie Train Station Elevation
(Author, 2024)



Fig 2.21
bottom right
Sabie Train Station Interior
(Author, 2024)

2 *'Rail Infrastructure Theft Remains Rampant, Regulator's Report Shows', BusinessLIVE, accessed 19 May 2024, https://www.timeslive.co.za/news/south-africa/2023-10-25-train-infrastructure-theft-still-rampant-rail-regulator-report-shows/.*

THE EASTERN RAILWAY LINE
KRUGER SHALATI

The Shalati train on the Selati Bridge, in Skukuza, is rooted very deeply in South Africa's history. Formerly known as the Sabi Game Reserve, the Kruger National Park was the country's first national park and was declared so by the then president, Paul Kruger in 1898. James Stevenson-Hamilton, the first warden of the park, advocated for the protection and preservation of the wildlife between the Crocodile River and Sabie River[3].

Fig 2.22
The Shalati Bridge
(Author, 2019)

Fig 2.23
Kruger Shalati - The Train on the Bridge
(Kruger Shalati, n.d.)





Fig 2.24
The Selati Line
(Hopkins, 2019)

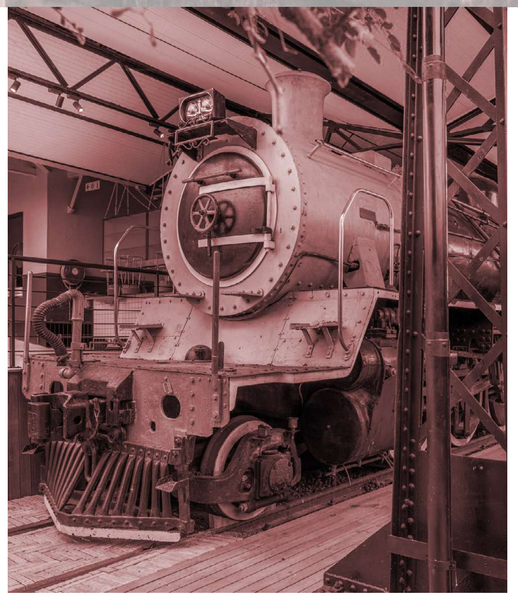


Fig 2.25
Photo of Locomotive No.3638 at Skukuza
(Author, 2024)

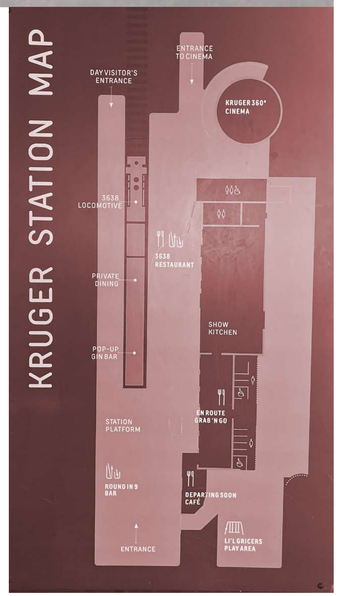


Fig 2.26
Photo of Kruger Station Map
(Author, 2024)

3 *Ron Hopkins, Kruger National Park - Past to Present - A Pictoral Journey, n.d., accessed 6 May 2024.*

THE EASTERN RAILWAY LINE
THE ROUND-IN-NINE TOUR

Stevenson-Hamilton promoted the use of the railway built through the park as a means to bring people to see the wildlife, rather than hunt it. The Round-in-Nine tour was a nine-day trip by rail from Pretoria to Delagoa Bay and back. The trip featured an overnight stop on the Sabie bridge where passengers enjoyed the view over the Sabie River viewing the wildlife[4]. The tour was very successful and is said to have been the planting of the seeds of the safari industry we know today.

The popularity of the rail and freight influx from Tzaneen however, had a negative effect on the wildlife in the park. Many animals were killed or injured by the trains passing through the park and so it was decided that a new route be built along the border of the park. By 1973, the last train passed through the park and a restaurant was built as a replica of the station at the Skukuza rest camp.

Today, tourists can experience the train on the bridge as it was intended almost a century ago. The Kruger Shalati offers an experience that fostered the creation of the very reserve the train finds itself located in. Having come full circle, it is astounding how impactful transportation became in the preservation of the natural environment that is the Kruger National Park.



Fig 2.27
Tours in the Transvaal Advert - SAR&H
(Hopkins, 2019)



Fig 2.28
Romanticised Portrayal of the Campfire on the 'Round-in-nine' Tour
(Stevens, 2024)

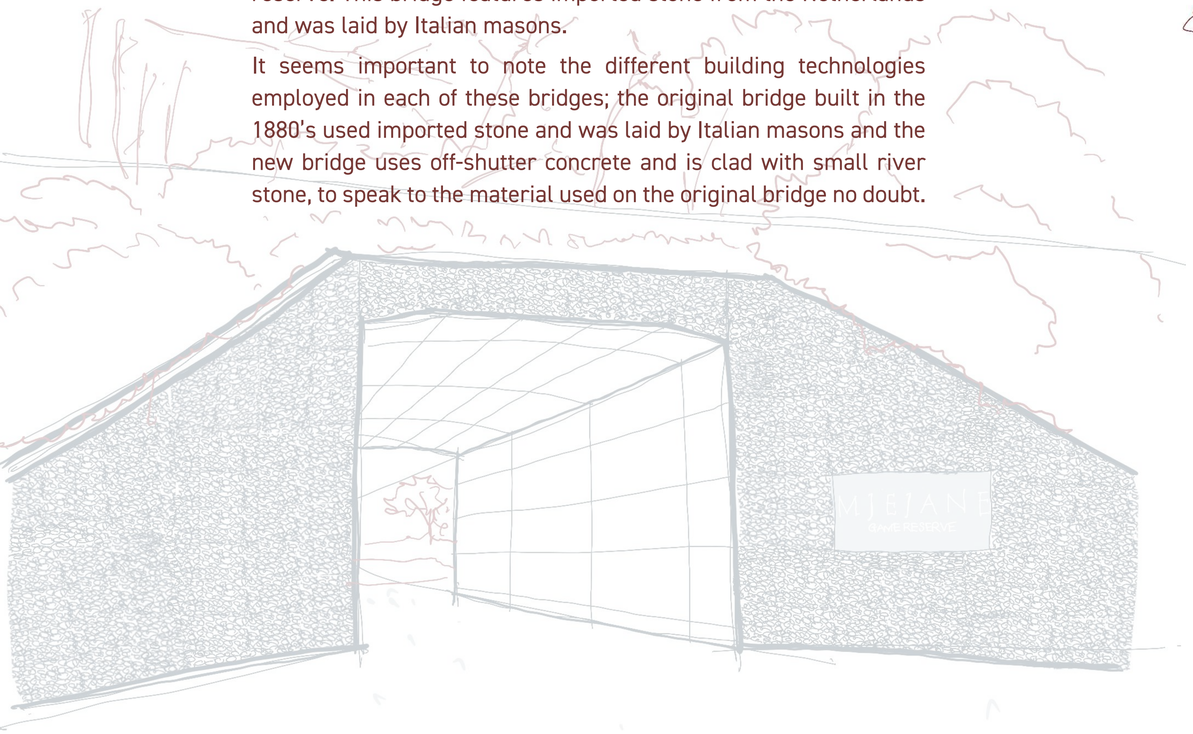
4 *Hopkins.*

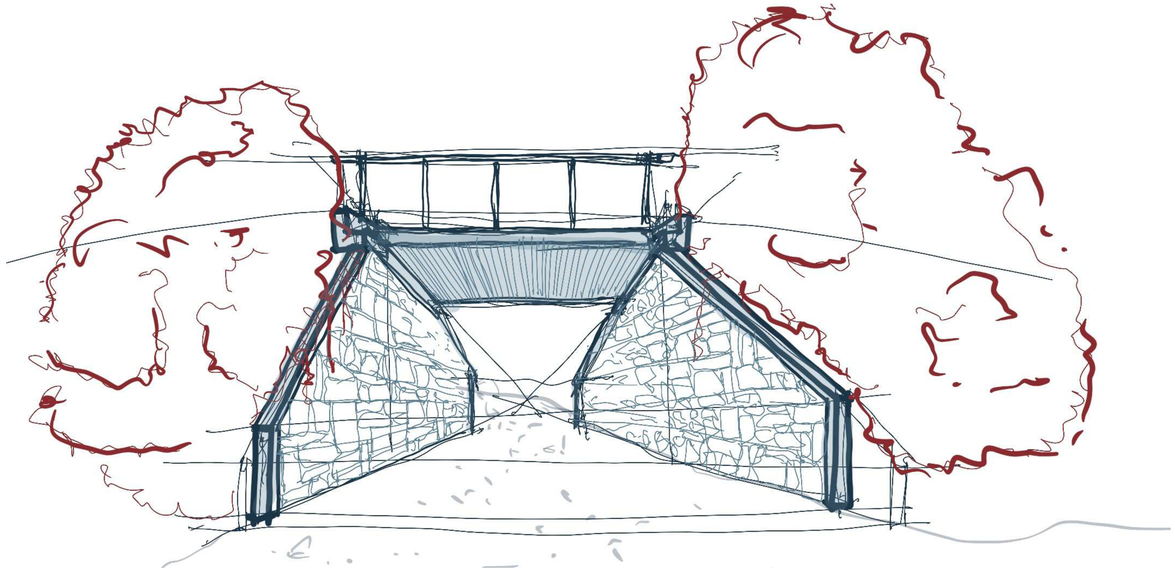
THE EASTERN RAILWAY LINE
MJEJANE GAME RESERVE

Mjejane Game Reserve is located at the southern boundary of the Kruger National Park. The old Eastern Railway Line cuts through the reserve and is the boundary between the King's land (local chiefdom), Big 5 country and the Kruger National Park.

There is a heritage site in the reserve that preserves an original rail bridge over one of the many small rivers that run through the reserve. This bridge features imported stone from the Netherlands and was laid by Italian masons.

It seems important to note the different building technologies employed in each of these bridges; the original bridge built in the 1880's used imported stone and was laid by Italian masons and the new bridge uses off-shutter concrete and is clad with small river stone, to speak to the material used on the original bridge no doubt.







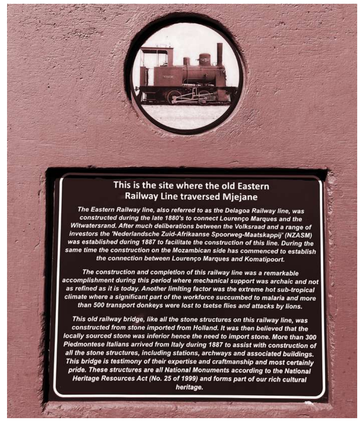


Fig 2.29
above
Sketch of the old Eastern Railway Bridge at Mjejane
(Author, 2024)

Fig 2.30
left
Sketch of the old Eastern Railway Bridge at Mjejane
(Author, 2024)

Fig 2.31/32
right
Photo of plaque on the bridge
(Author, 2024)

GEOGRAPHY & CLIMATE

Mbombela lies along the Crocodile River among granite hills and fertile fruit farms. It is located in a sub-tropical climatic zone, and it is characterised by its warm, wet summers and mild, dry winters. The average temperature high is 27°C and the average low is 14°C, thus the mean temperature is around 20°C. Rainfall is concentrated in the summer months where temperatures often exceed 30°C and results in the lush green landscape that defines the region[5]. These weather conditions significantly influence the design and maintenance of infrastructure, requiring considerations for effective draining, heat mitigation and the incorporation of green spaces to allow for passive cooling.

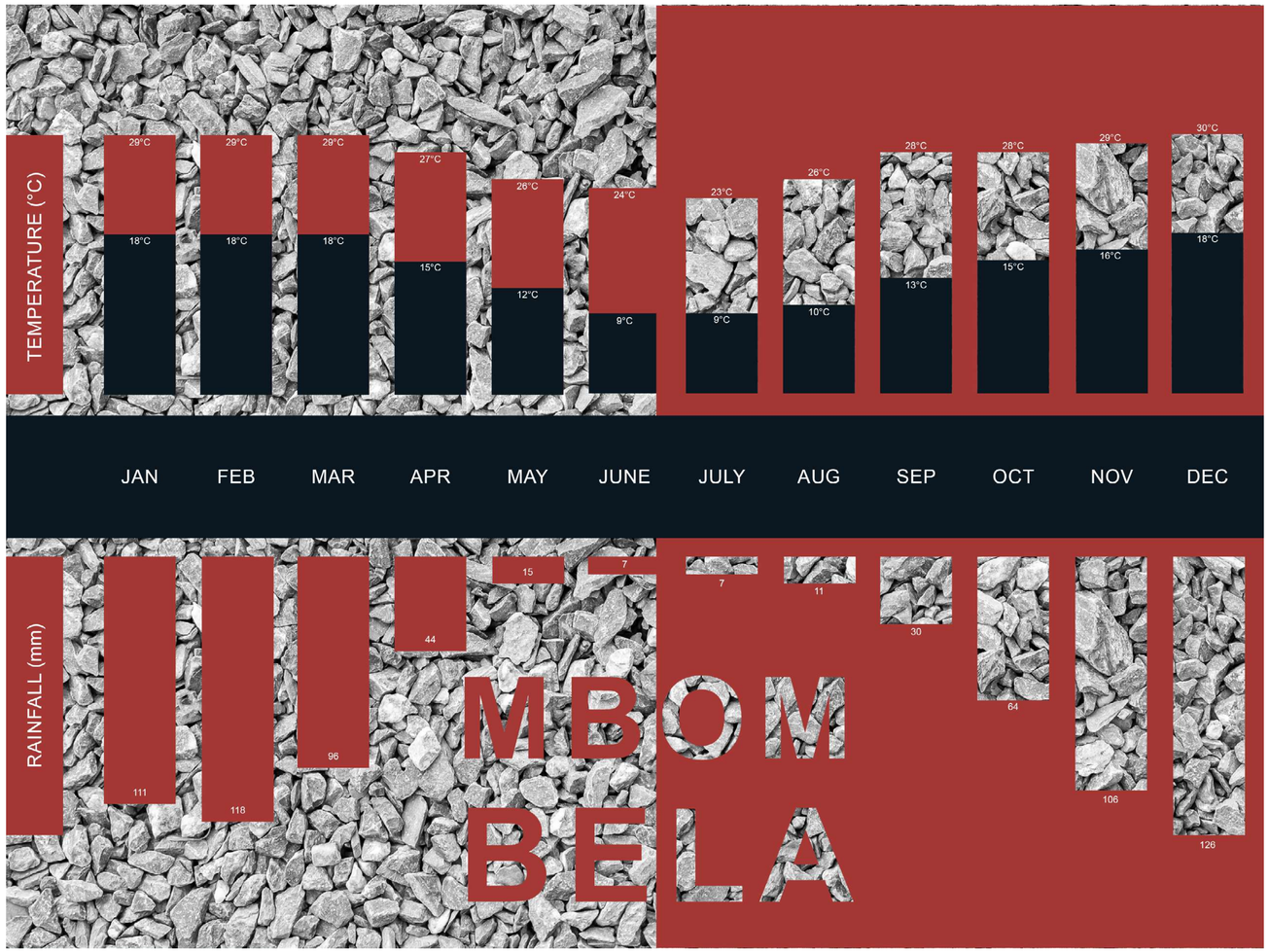


Fig 2.33
Graphic showing annual climate of Mbombela
(Author, 2024)

5 *'Nelspruit Climate, Weather By Month, Average Temperature (Mpumalanga, South Africa) - Weather Spark', accessed 16 August 2024, https://weatherspark.com/y/96313/Average-Weather-in-Nelspruit-Mpumalanga-South-Africa-Year-Round#google_vignette.*

THE STATION

The Nelspruit Train Station is strategically located in the urban centre of the city of Mbombela, providing a crucial link in the regional and national transportation network. The site is accessible from Andrew Street, a main route that connects the western part of the city to its centre. Samora Machel Drive (R104) is the main east-west route through Mbombela and used to be the only way to go past Nelspruit. Today, the main highway (N4) now bypasses the city en-route to Komatipoort (the South African-Mozambican boarder post). The site is accessible only from its southern boundary, as the tracks lay north of the station and there is no other access point east, or west of the station.

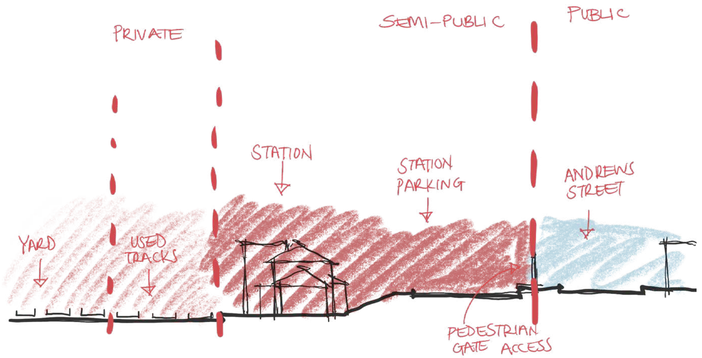


Fig 2.34
Schematic Section of Nelspruit Station
(Author, 2024)



Fig 2.35
Nelspruit, 1960. SAR Class GMAM
(SAR Publicity and Travel Department, 1960)



Fig 2.36
North Elevation of Nelspruit Station
(Author, 2024)

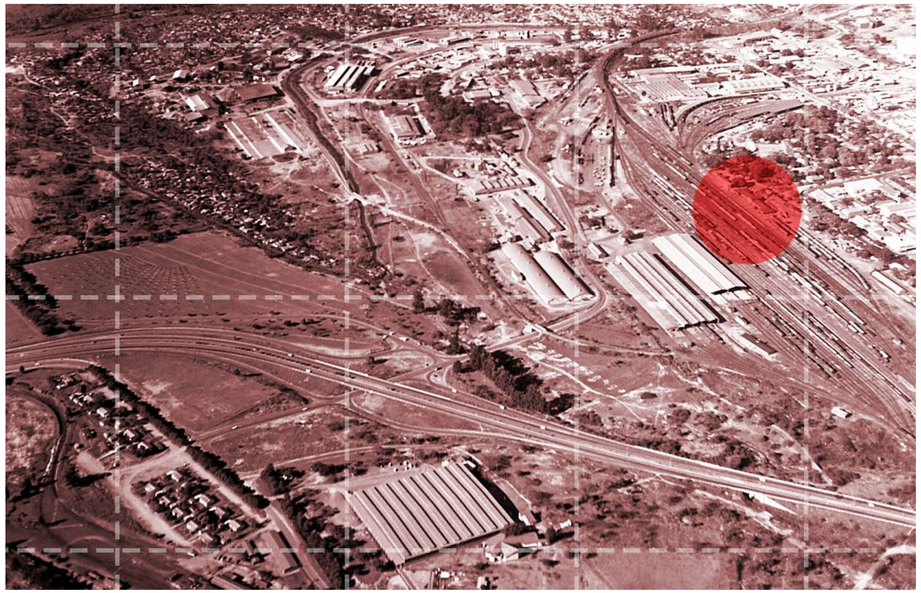


Fig 2.37
Aerial view of Nelspruit
(David Butcher, 2021)



Fig 2.38
Genius Loci - Site Findings
(Author, 2024)



Fig 2.39
Schematic Map of Mbombela CBD - Derived from Google Maps
(Author, 2024)



Fig 2.40
Schematic Map of Chosen Site CBD - Derived from Google Maps
(Author, 2024)

TAXI RANK, PLAZA & HENSHALL STREET

Fig 2.41
Site Map Overview
(Author, 2024)

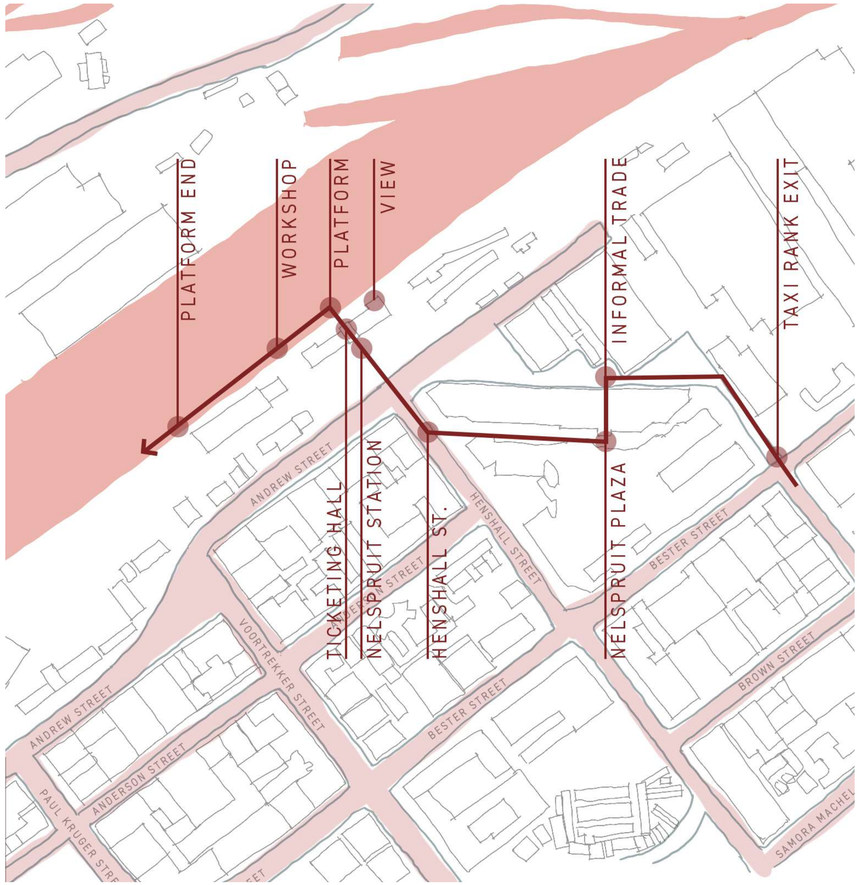


Fig 2.42-46
Collection of images of Surrounding Areas
(Google Street View, 2024)











NELSPRUIT TRAIN STATION

Fig 2.47
Site Map Overview
(Author, 2024)



Fig 2.48-51
Collection of Photographs of Nelspruit Station
(Author, 2024)









THE TICKETING HALL

Fig 2.52
Site Map Overview
(Author, 2024)

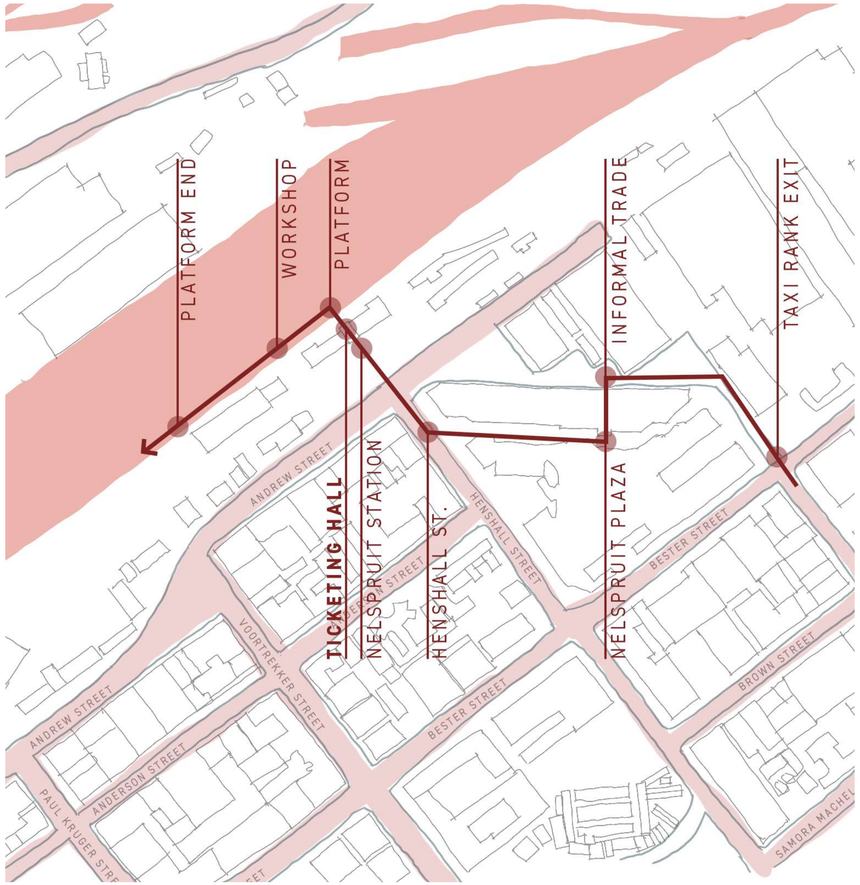
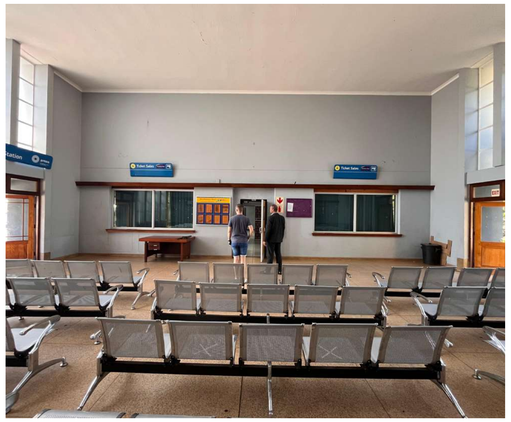
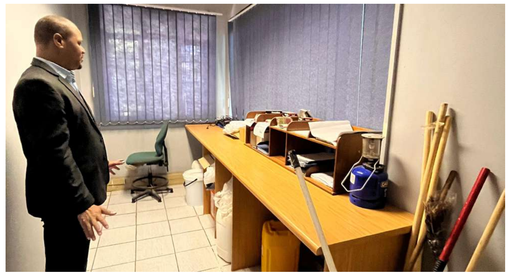
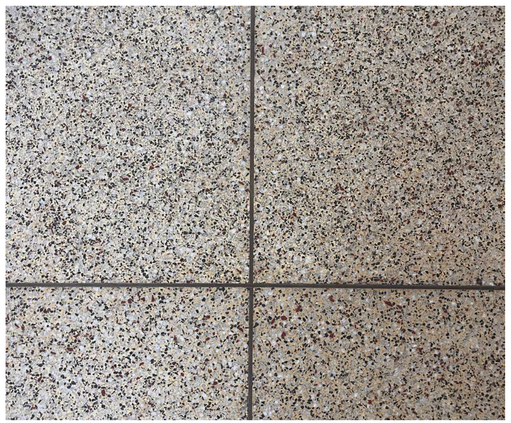
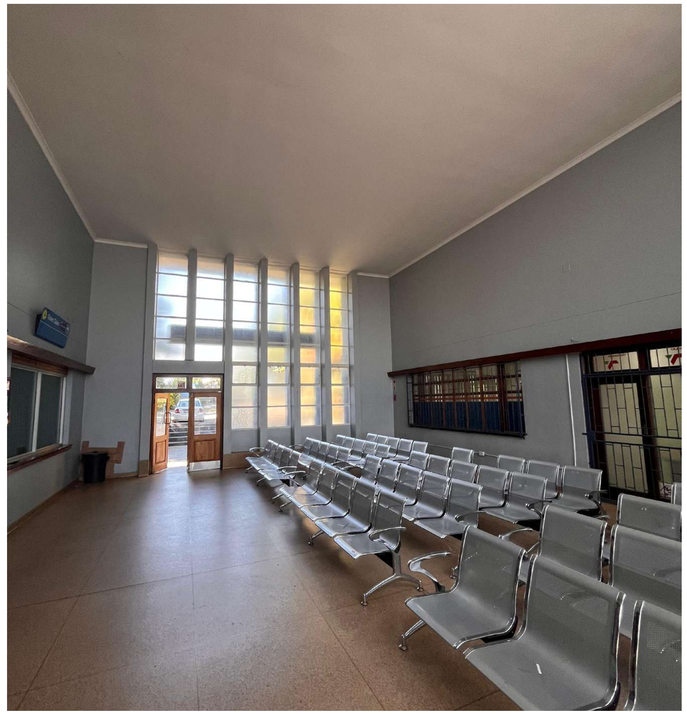


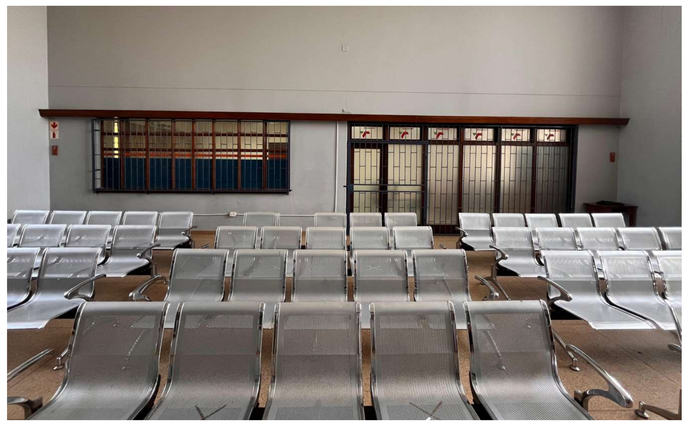
Fig 2.53-57
Collection of Photographs of the Ticketing Hall
(Author, 2024)











THE PLATFORM

Fig 2.58
Site Map Overview
(Author, 2024)

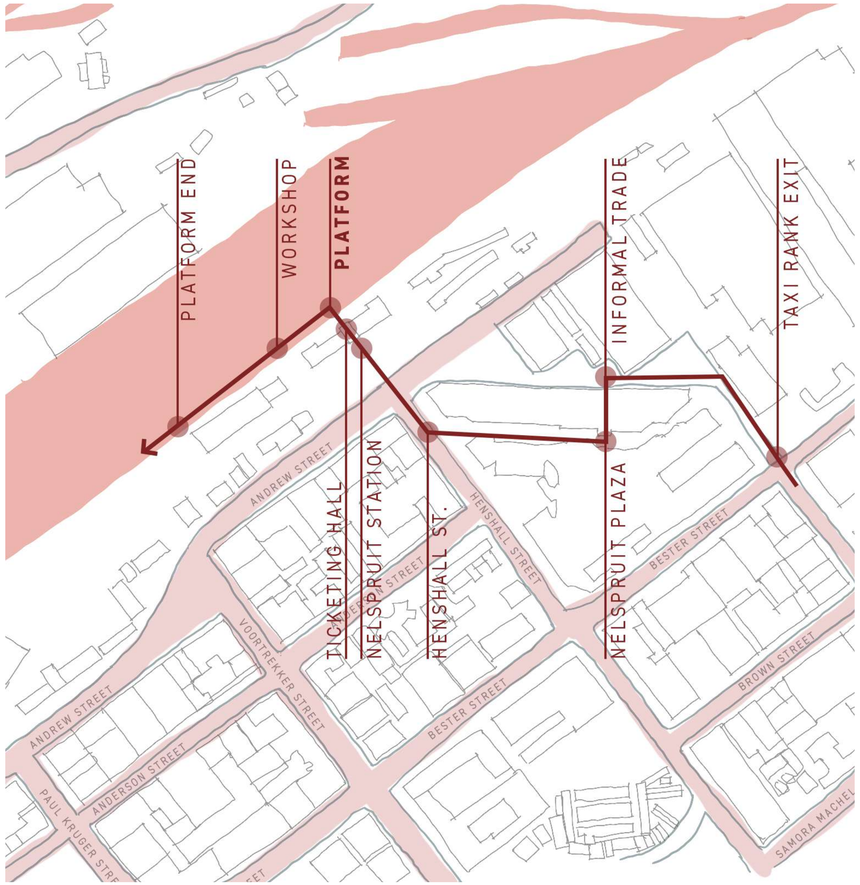
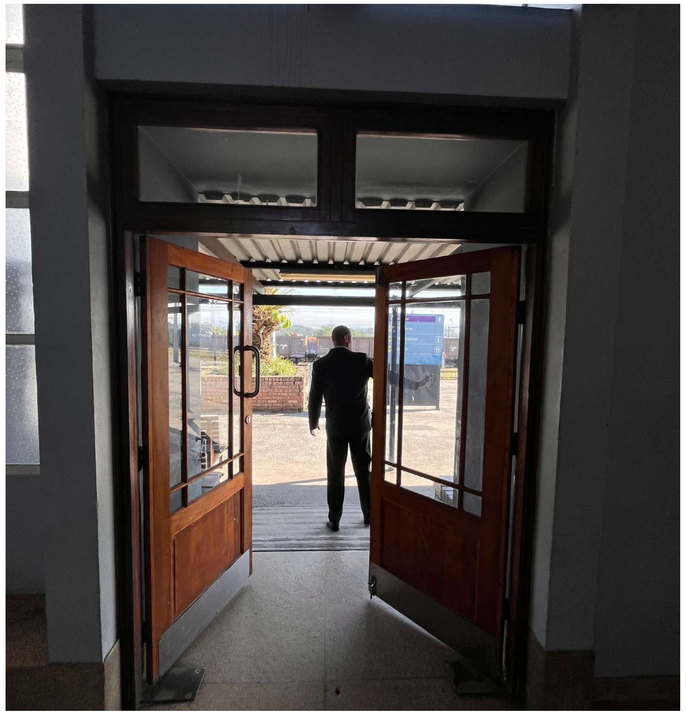
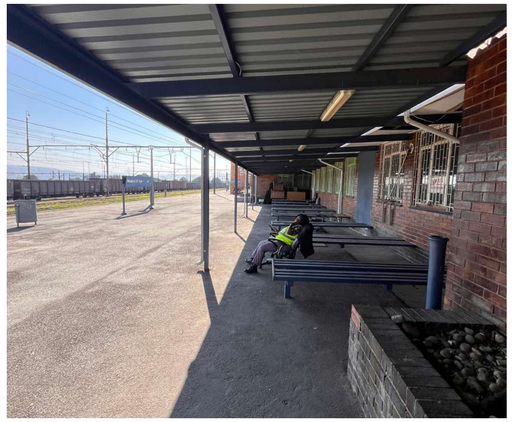


Fig 2.59-63
Collection of Photographs of the platform area
(Author, 2024)









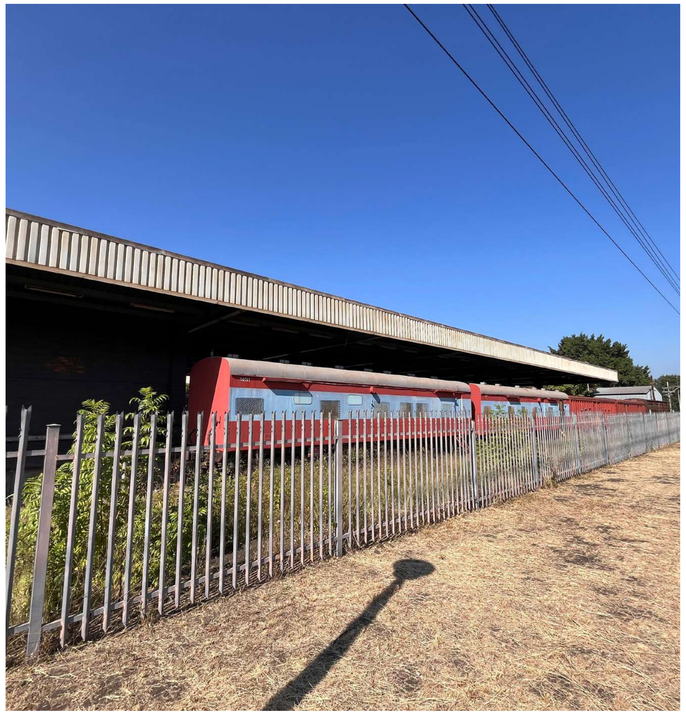


THE WORKSHOP

Fig 2.64
Site Map Overview
(Author, 2024)



Fig 2.65-68
Collection of Photographs of the workshop
(Author, 2024)









PLATFORM END

Fig 2.69
Site Map Overview
(Author, 2024)

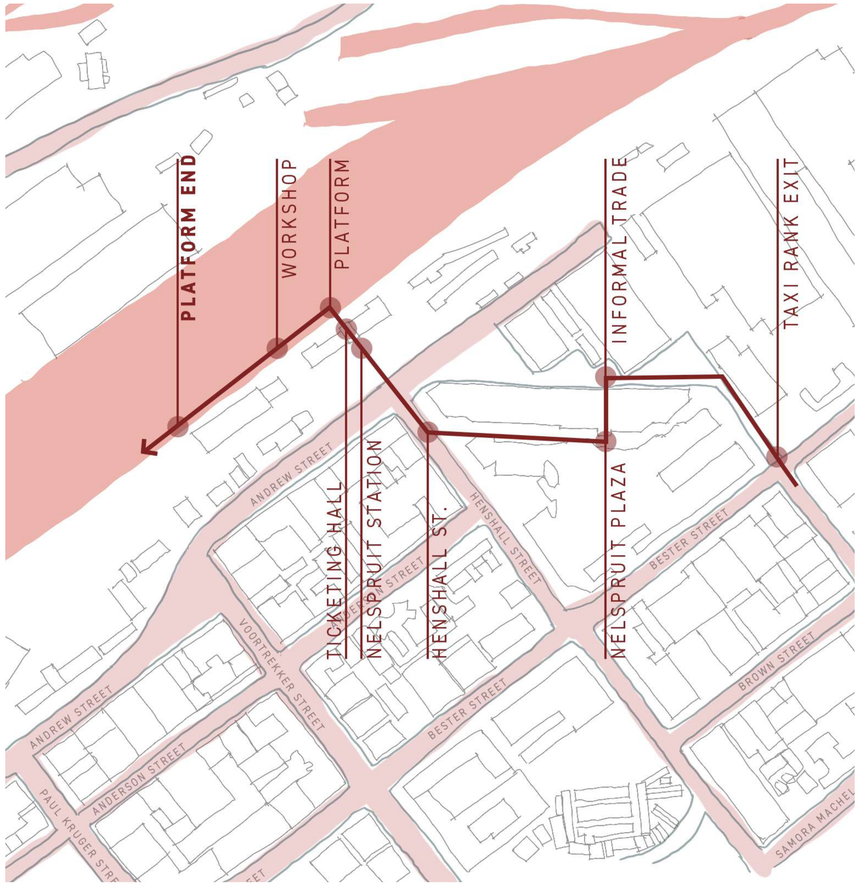


Fig 2.70-72
Collection of Photographs of the platform end
(Author, 2024)









Fig 2.73
South Elevation of Nelspruit Station
(Author, 2024)

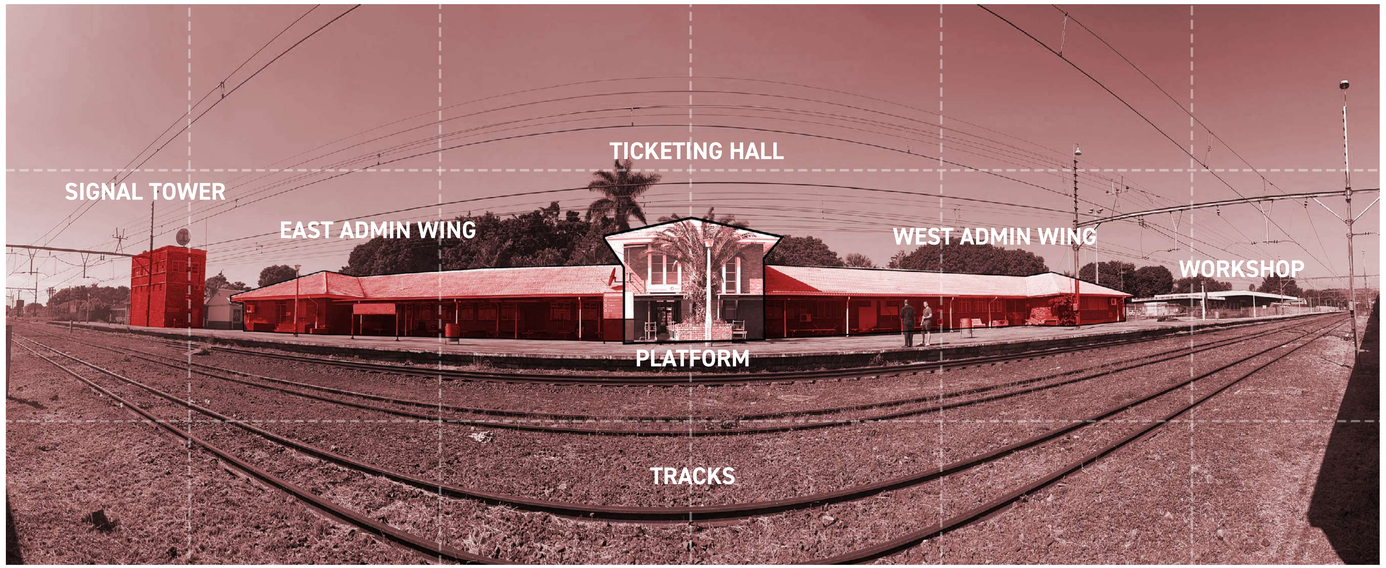


Fig 2.74
North Elevation of Nelspruit Station
(Author, 2024)

The station building itself is a heritage building (as it is over sixty years old), consisting of a central ticketing hall and two administrative wings to the east and west. The station stands as a testament to the historical significance of the railway in the region's development. However, the station and its grounds are currently in a state of disrepair where the facility has been subjected to neglect over decades. This neglect has been exacerbated by the impact of the COVID-19 pandemic, which left the station unmaintained and unmanaged. As a consequence of the recent vandalism and theft in the rail network at large, Nelspruit Station has been limited in functionality, serving only private trains, such as, Rovos Rail and the Transnet freight trains. The train yards adjacent to the station include multiple tracks, with only three tracks currently in use for moving trains. The remaining tracks are used for carriage parking and servicing carts and locomotives. These yards are crucial for the maintenance and operation of the rail network, particularly for freight services.

The current station is fenced off with two controlled access points on Andrews Street – a vehicular access point where vehicles are searched by security for any stolen property, and a pedestrian access point located at the entrance to the taxi rank and shopping plaza which is also overseen by security.



Fig 2.75
Platform & tracks facing east
(Author, 2024)

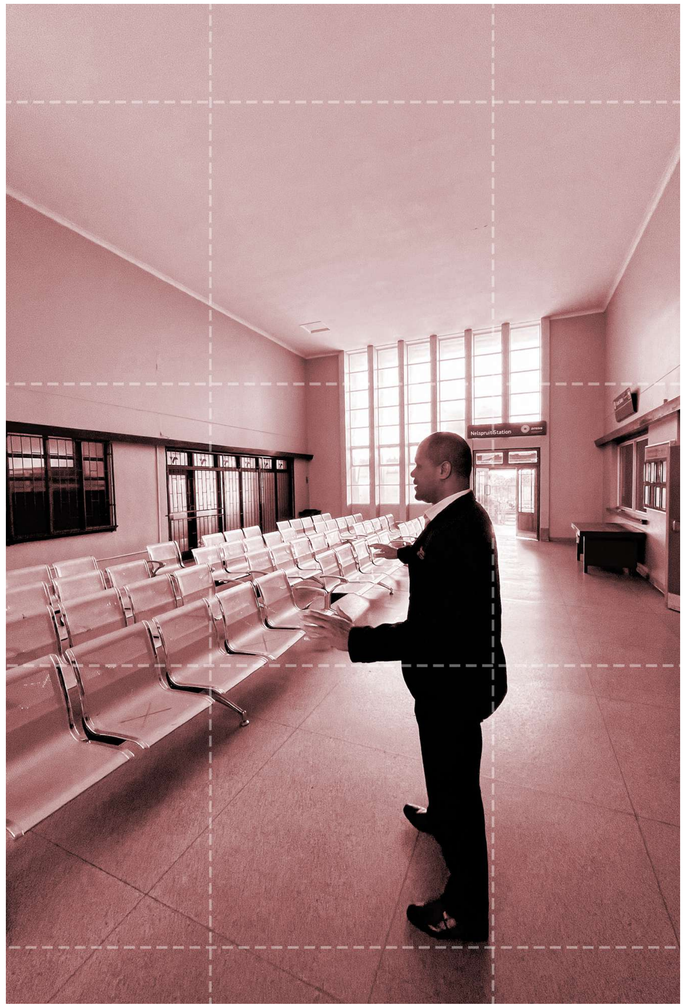


Fig 2.76
Ticketing Hall interior
(Author, 2024)

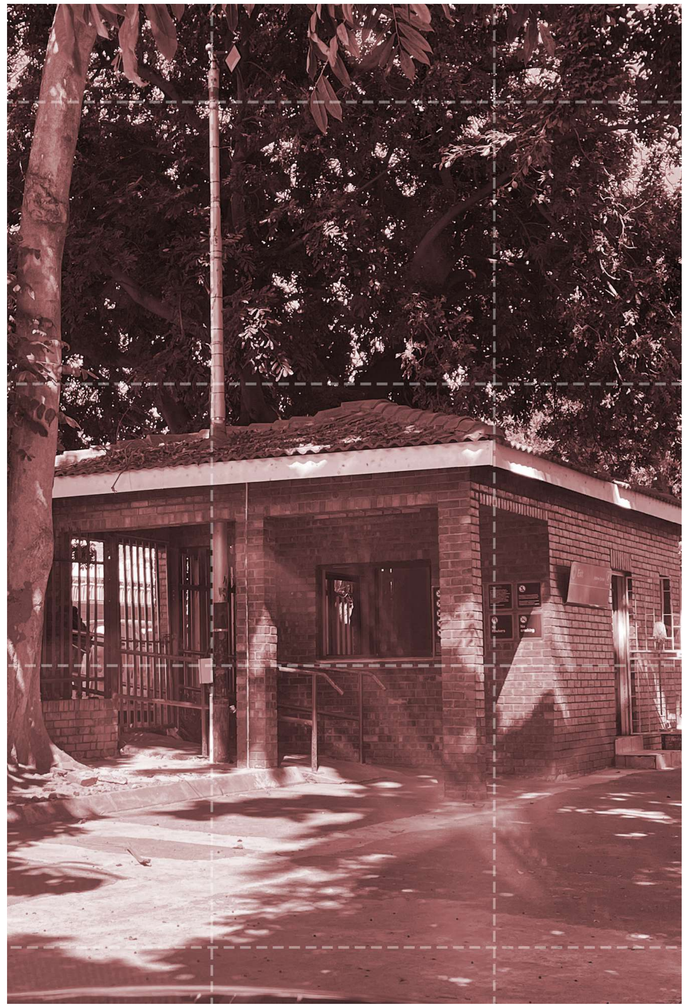


Fig 2.77
Pedestrian entrance near taxi rank
(Author, 2024)

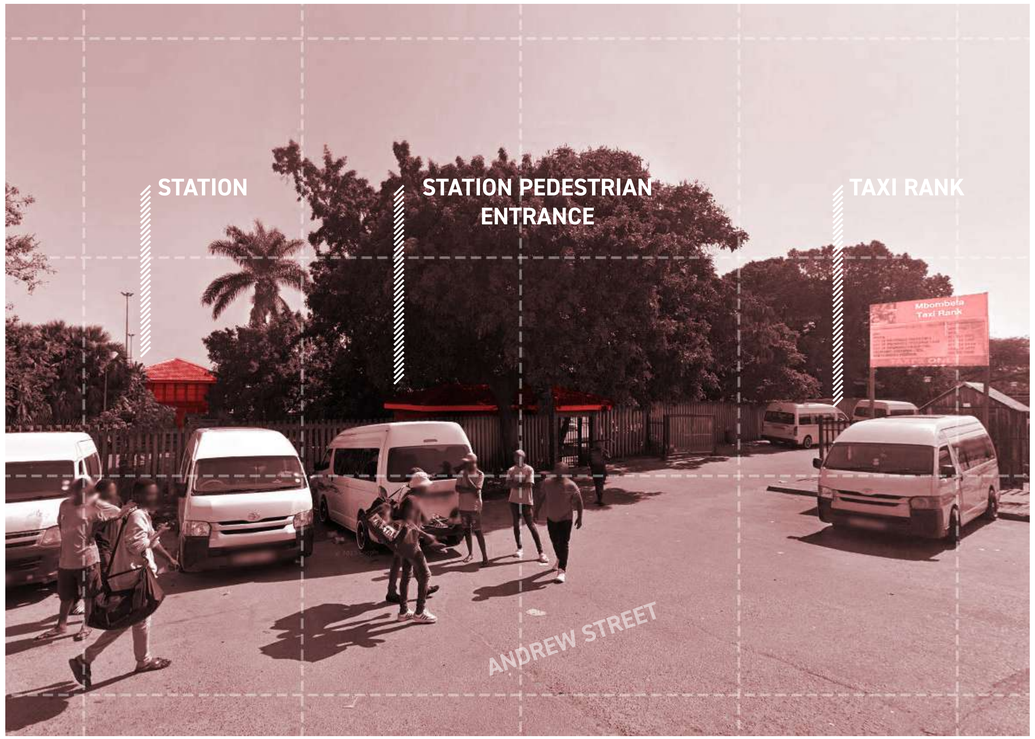


Fig 2.78
Mbombela Taxi Rank Entrance
(Google Street View, 2023)

The adjacent plaza and taxi rank are hubs of economic activity, that support a diverse range of informal and formal trading. Street vendors, small shops, and eateries cater to daily commuters and shoppers. This area is an essential part of the local economy as it provides economic opportunity and employment to the locals. This relationship between the taxi rank and the plaza highlights the importance of



Fig 2.79
Nelspruit Plaza
(Google Street View, 2021)

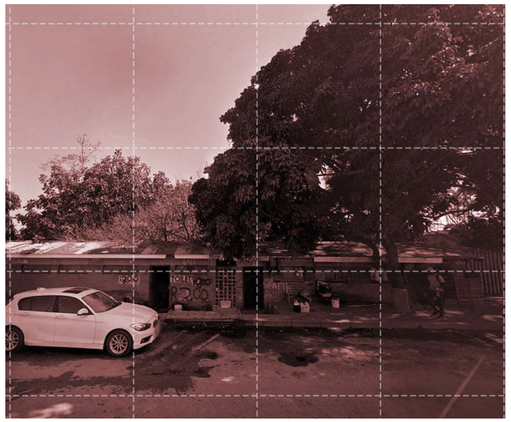


Fig 2.80
Andrew Street Public Toilets
(Google Street View, 2023)



Fig 2.81
Mbombela Taxi Rank 1 Bester N Street
(Google Street View, 2020)

interdependency between transportation and economic vitality.

The city is also a vital gateway to several prominent tourist attractions, significantly influencing the local economy. The airport and train station see visitors from all over the country, as well as all from over the world who want to get to these prominent tourist attractions. They include:

Kruger National Park: South Africa's largest game reserve known for its diverse wildlife and safari experiences.

Panorama Route: A scenic drive that includes breathtaking views of the natural landscape including God's Window, Blyde River Canyon, and Bourke's Luck Potholes.

Hiking Trails and Waterfalls: There are numerous hiking trails and waterfalls such as the Fanie Botha trail, Mac Mac Falls and Lone Creek Falls that attract outdoor enthusiasts.

Lowveld National Botanical Garden: Highlighting the region's flora, including a vast collection of prehistoric cycads and a tropical rainforest.

Cultural Settlements and Heritage Sites: Tribal villages like Kghodwana Traditional Ndebele Village, and settlements like Pilgrim's Rest, offer insight into the region's rich cultural heritage.

Natural Wonders and Theme Parks: Caves such as Sudwala offer tourists the opportunity to explore prehistoric rock formations, landscapes and even biomes.

Agriculture: The surrounding area is known for its farming of fruits and nuts, which are an integral part of the local economy and export

Fig 2.82
Moving Mbombela
(Author, 2024)





Fig 2.83
Phelophepa Healthcare Train
(Roche, 2012)

markets.

The COVID-19 pandemic has had a profound impact on the world, and the Nelspruit Station is no exception. The lockdowns and subsequent economic downturn led to a significant reduction in rail operations, leaving the rail network largely unmanned and therefore insecure. The rail network has suffered large damages due to vandalism and theft for many years and has come into sharp focus subsequent to the pandemic[6]. The rail network's suffering has meant less traffic on rail lines and has impacted many stations across the country. Many small towns that made their living from passing trains have been rendered abandoned[7]. Mbombela's redeeming quality is its size and diverse economy, however, this has handicapped the economy substantially. Currently, only private and freight trains pass through the station, with the site occasionally repurposed as a clinic when the Transnet Phelophepa Healthcare Train is stationed there[8].

The Nelspruit Station is positioned along the east-west line connecting Pretoria and Johannesburg to Maputo. The station predominantly serves as a conduit for chrome and coal from Emalahleni to Mozambique, as well as handling other significant payloads such as timber, oil, fruit and various other mineral ores. Additionally, the station lies along the north-south line linking Eswatini to Beitbridge. It is therefore a critical juncture in South Africa's rail network, underscoring the station's potential as a pivotal inter-modal transportation hub, capable of enhancing regional and international trade and transport.

The Nelspruit Station, despite its current state of neglect, holds significant potential for redevelopment as a modern transportation hub[9]. The site's rich historical context, strategic location, and connection to major rail and road networks, make it an ideal candidate for revitalisation. By addressing the current challenges and leveraging the socio-economic and tourism opportunities in the region, a reformed Mbombela Inter-modal Station can become a vibrant, functional and integral part of the community of Mbombela and the broader transportation network. The integration of heritage conservation, climatically responsive design solutions and infrastructural and economic development strategies, will be key to realising this design.

6 *David Burroughs, 'Extensive Cable Thefts and Looting Halts South African Rail Services', International Railway Journal, 30 September 2020, https://www.railjournal.com/infrastructure/extensive-cable-thefts-and-looting-halts-south-african-rail-services/.*
7 *'Sa Towns Are Dying Because the Train Stopped - Google Search', accessed 24 July 2024, https://www.google.com/search?q=sa+towns+are+dying+because+the+train+stopped&sca_esv=bbda2a020c4763aa&sca_upv=1&rlz=1C1VDKB_enZA1105ZA1105&sxsrf=ADLYWIJK9xyM65D13C1h43uDyHIJzmzaZA%3A1721815017017&ei=6c-gZo5co7aFsg-EhqyQCg&ved=0ahUKEwjO9NTjtL-HAxUjW0EAHQQDC6IQ4dUDCA8&uact=5&oq=sa+towns+are+dying+because+the+train+stopped&gs_lp=Egxnd3Mtd2l6LXNlcnAiLHNhIHRvd25zIGFyZSBkeWluZyBiZWNhdXNlIHRoZSB0cmFpbiBzdG9wcGVkMggQABiABBiiBEjdQFCPIivOXACeAGQAQCYAccCoAHWCaoBBTItMS4zuAEDyAEA-AEBmAIFoAKhB8ICChAAGLADGNYEGEfCAggQIRigARjDBJgDAIgGAZAGCJIHBzIuMC4xLjKgB6gL&sclient=gws-wiz-serp#fpstate=ive&vld=cid:25a0f080,vid:G02IlhQzm0g,st:0.*
8 *Pongrass Import, 'Phelophepa Train Get Thousands of Lowvelders' Health Back on Track', Lowvelder (blog), 19 September 2021, https://www.citizen.co.za/lowvelder/news-headlines/local-news/2021/09/19/phelophepa-train-get-thousands-of-lowvelders-health-back-on-track/.*
9 *'Mpumalanga Business 2022-23 by Global Africa Network Media - Issuu', 15 August 2022, https://issuu.com/globalafricanetwork/docs/mpumalanga_business_2022-23.*

VEHICULAR CHANNELS

Mbombela is a relatively small city, covering approximately 73 square kilometres. It is twenty-two times smaller than Johannesburg, South Africa, and eighty-six times smaller than Shanghai, China. The city features a main north-south arterial route, Madiba Drive, and an east-west route, Samora Machel Drive. The map indicates traffic volumes and vehicle density, with significant traffic concentrated around the site due to the proximity of the taxi rank and bus terminals.



Fig 2.84
Vehicular Channels
(Author, 2024)

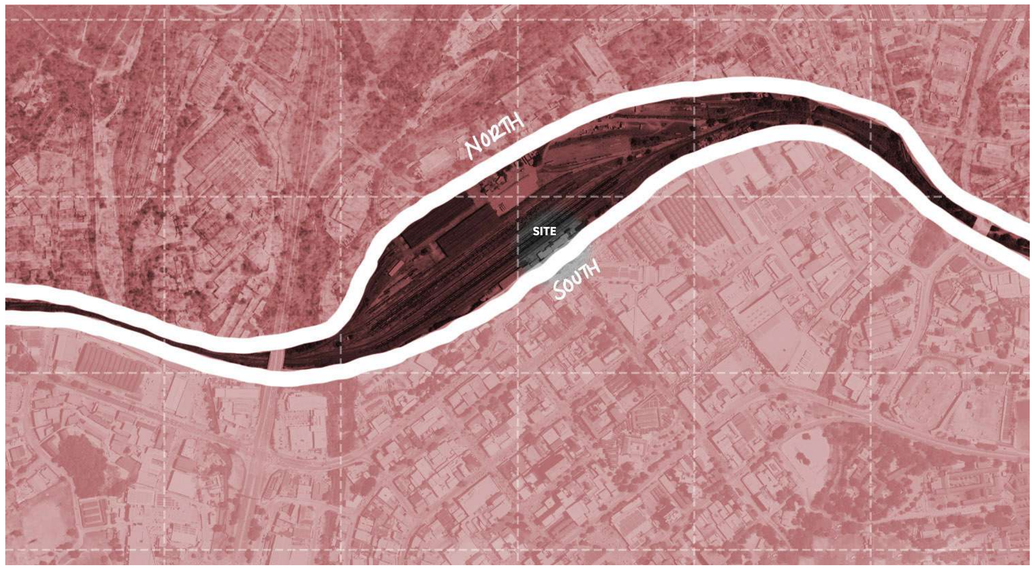


Fig 2.85
A Dividing Element
(Author, 2024)

A DIVIDING ELEMENT

Like many railways that pass through cities worldwide, the tracks inevitably create a divide in the urban fabric. Traditionally, train stations are positioned beside the tracks, with a connecting bridge leading to the various platforms. Nelspruit Station is no exception and has not benefited from the modernisation seen at newer stations that bridge the tracks and connect the city. Here, the tracks continue to act as a dividing element, separating the northern industrial sector from the central business district. The only connection between the city centre and the northern industrial belt are Madiba Drive to the west, Samora Machel Drive to the east, and a small underpass where the tracks narrow, east of the station.

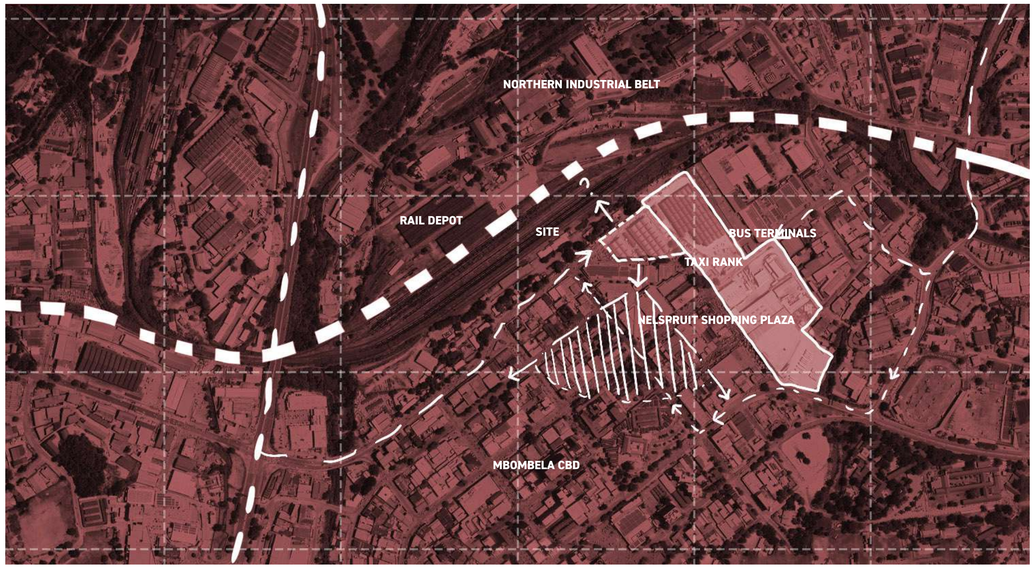


Fig 2.87
Responding to existing conditions
(Author, 2024)

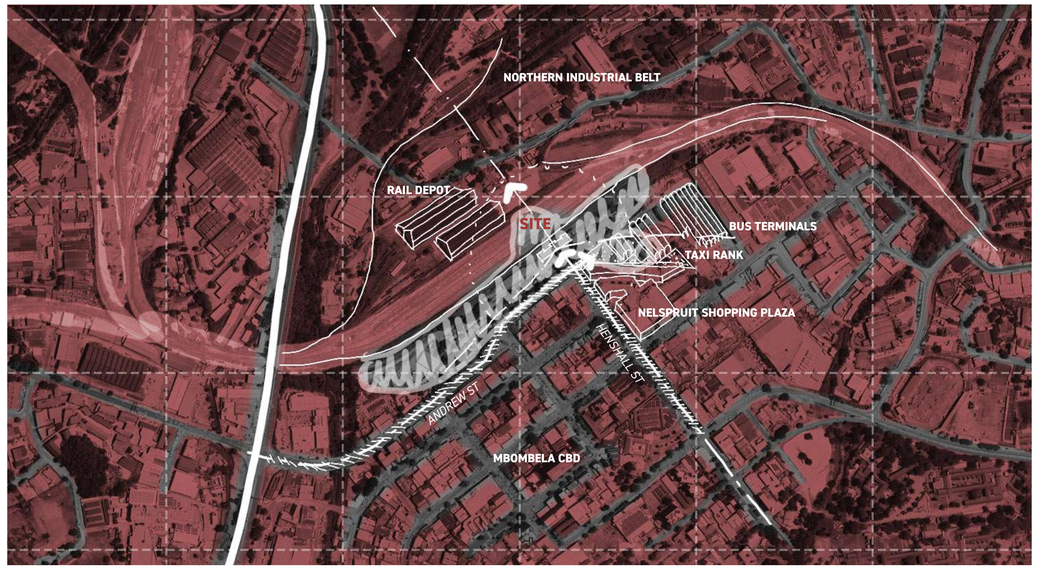
RESPONDING TO EXISTING CONDITIONS

The station is strategically positioned between highly active spaces and elements, such as, the Nelspruit Shopping Plaza, Mbombela Taxi Rank, the bus terminals, and the industrial belt across the tracks. The site aligns with Henshall Street and has the potential to serve as a public forum that links the station with the shopping plaza and taxi rank while extending over the tracks to connect the CBD to the industrial belt in the north. The distance between the two, however may lead to thinking of this intervention as a two-phased approach, where the Transportation Hub comes first, and a linking bridge, second.

RELATIONSHIPS TO THE URBAN ENVIRONMENT

The site is located across from the Nelspruit Shopping Plaza, a single-storey shopping centre that features shaded walkways and internal streets. The Mbombela Taxi Rank occupies the public square, while the bus terminals flank the eastern side of the city. The Nelspruit Shopping Plaza faces the city centre, and the space between the shops and streets is bustling with activity. Informal kiosks are set up by vendors selling fruit, sweets, and airtime, while others offer second-hand clothes, shoes, and handbags. The pavements are crowded with shoppers and commuters. Notably, there is a distinct boundary between the station and the city—an unusual feature for a public facility.

Fig 2.86
Relationships to the Urban Environment
(Author, 2024)



GREEN SPACES

While Mbombela does have a nature reserve to the south of the city and a botanical garden to the north, the CBD lacks green space for public recreation. Instead, people gather in market squares and along the streets while shopping or commuting. This presents an opportunity for the public interface of the proposed design to incorporate a green space element that not only encourages people to use the facilities, but also creates a central green space that draws people to the city centre, offering a respite from the bustle of the city.

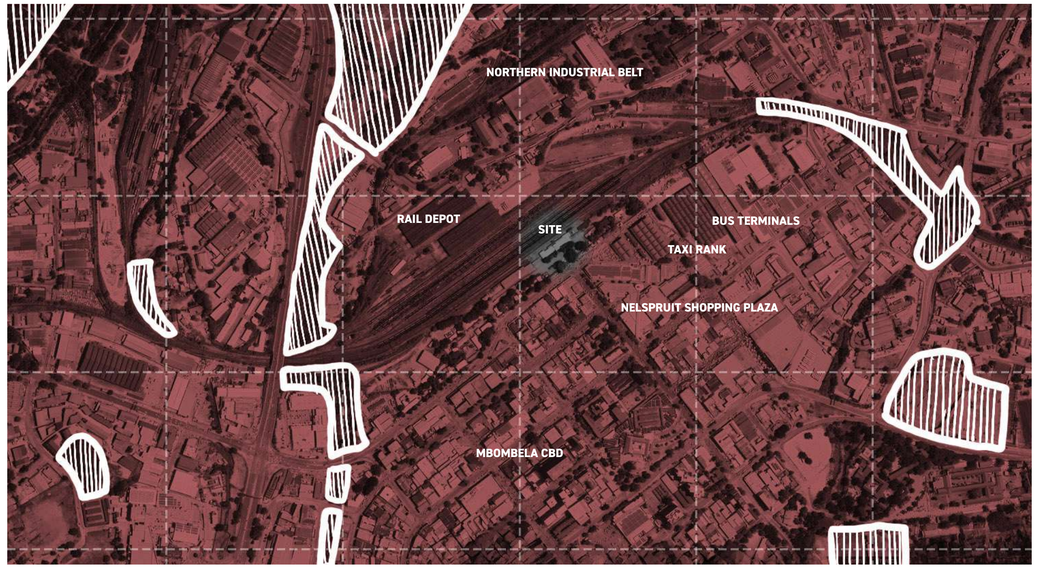


Fig 2.88
Green Spaces
(Author, 2024)

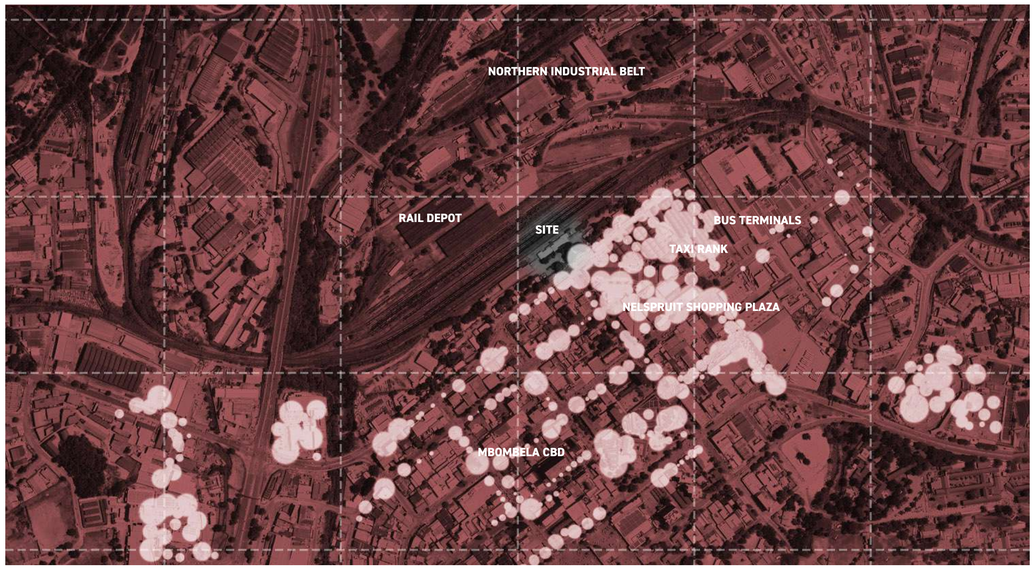


Fig 2.89
Pedestrian Concentration & Volume
(Author, 2024)

PEDESTRIAN CONCENTRATION & VOLUME

The map shows an abstraction of the volumes of pedestrians and their points of concentration in the city centre. It is interesting to note the comparison between the green space map and this one, as it illustrates how green space appears to frame the environment of the city, rather than be a part of it.

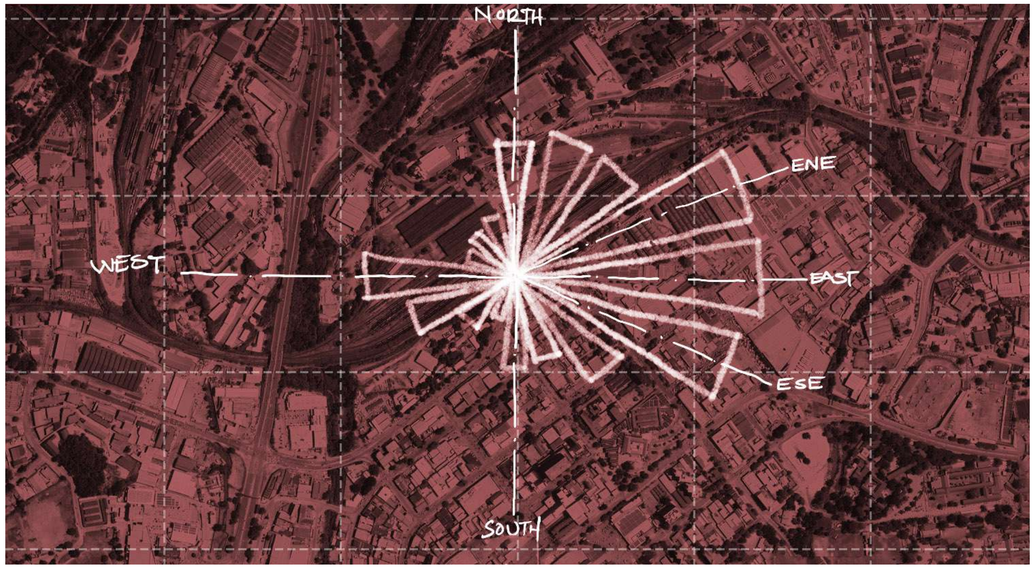
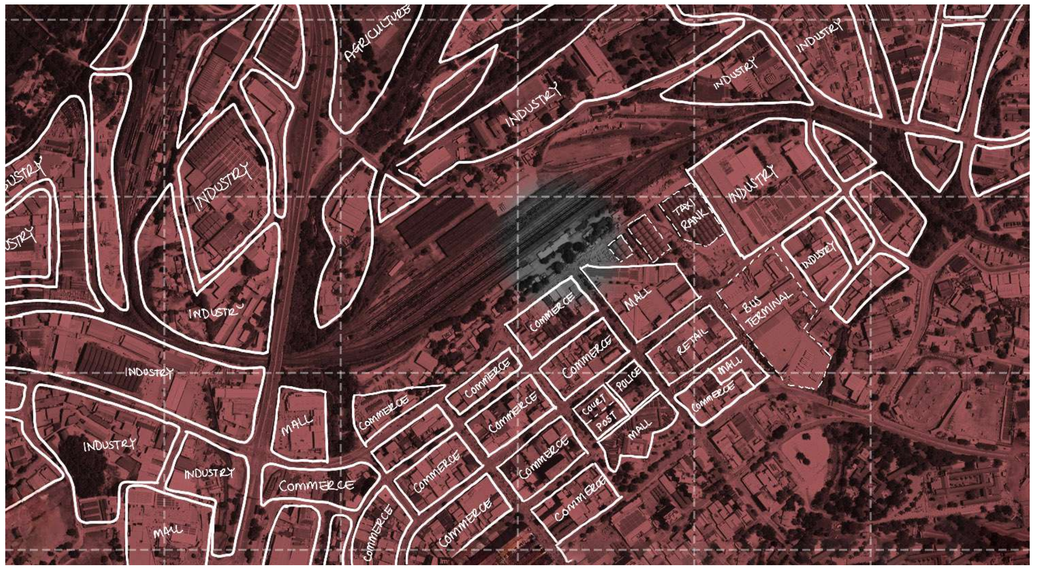


Fig 2.90
Prevailing Wind
(Author, 2024)

PREVAILING WIND

Due to the humidity and high temperatures in the region, and with sustainability as a key design driver for the project, it seems logical to harness the site's natural elements to improve the building's performance and thus its sustainability. The annual prevailing wind is predominantly westward. However, due to the exposure, the city's buildings would naturally block much of this wind, so the building should also respond to southward and eastward winds to allow for passive cooling within the building.

Fig 2.91
Land Use & Zoning
(Author, 2024)



LAND USE AND ZONING

Since the site is located within the city, it is surrounded by commercial and industrial properties. This means that the station would be catering to people working in the area or travelling through the city. It therefore has the opportunity to address the needs of those who travel in and out of the business centre.

SITE BOUNDARY

BUS/TAXI TERMINALS

NEW BOULEVARD

NEW STATION BUILDING

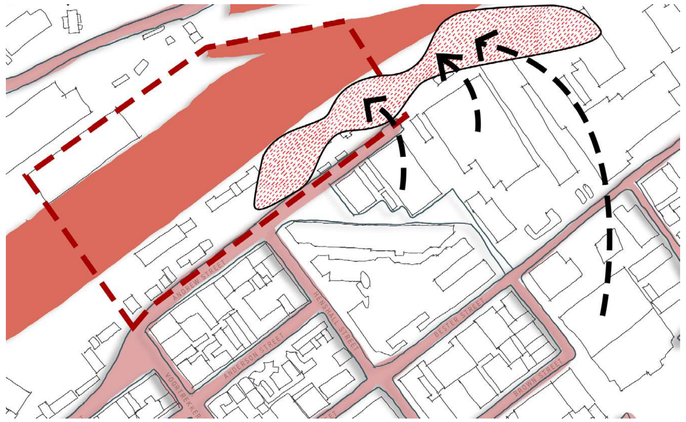
PEDESTRIAN ROUTE

OPENING OF PUBLIC PLAZA

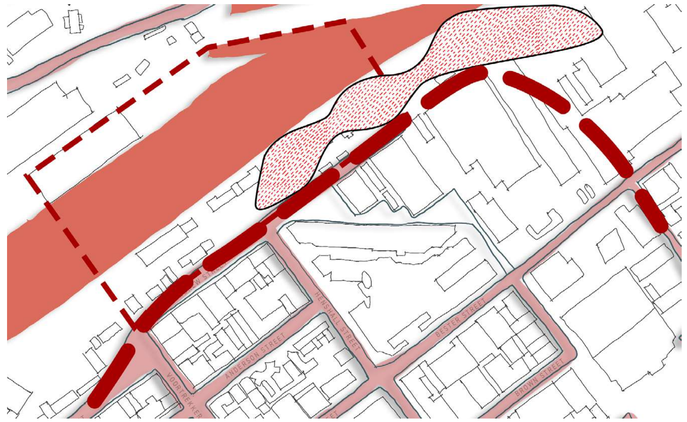
Fig 2.92
Schematic Design Strategy Map
(Author, 2024)



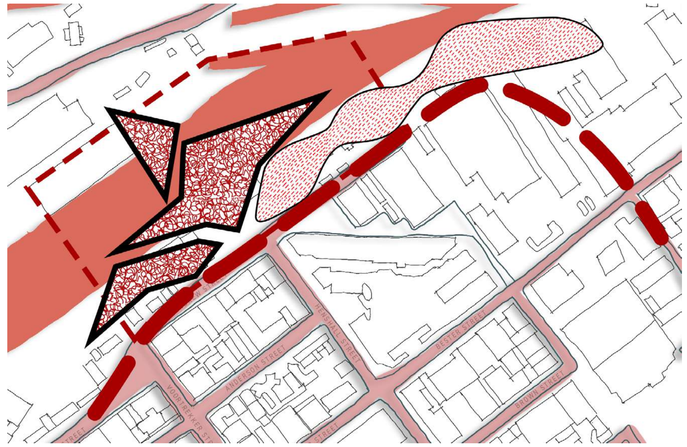
IDENTIFY THE SITE



RELOCATE THE BUS SERVICES - OPEN UP THE PLAZA



CREATE A NEW VEHICULAR ROUTE



ESTABLISH THE MAIN HUB AND CONNECT TO BUS TERMINALS



IDENTIFY PEDESTRIAN ROUTES

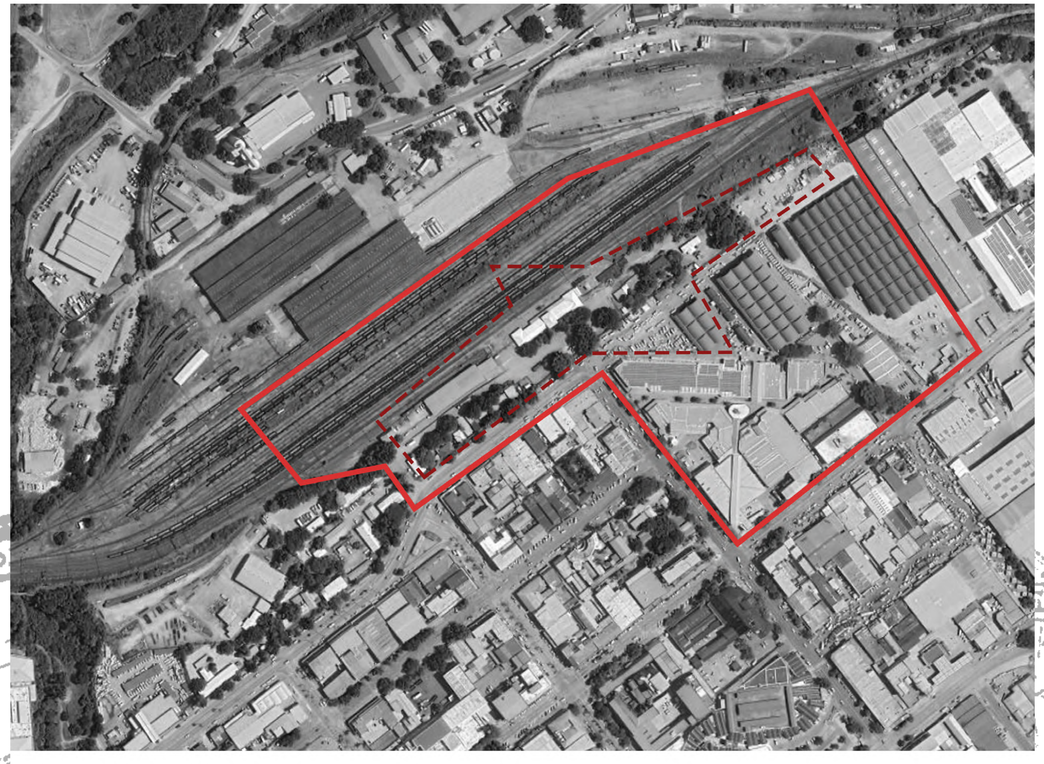


COMPLETE STRATEGY

STATUTORY DATA

Statutory data maps provided by the Chief Surveyor General's office for the city of Mbombela, are official cartographic documents that outline legally recognized geographic information relevant to land administration and urban planning. These maps include detailed representations of property boundaries, land parcels, cadastral information, zoning regulations, infrastructure layouts, and other key elements critical for land management.

Fig 2.93
Aerial Map of the Chosen Site - Derived from Google Maps
(Author, 2024)



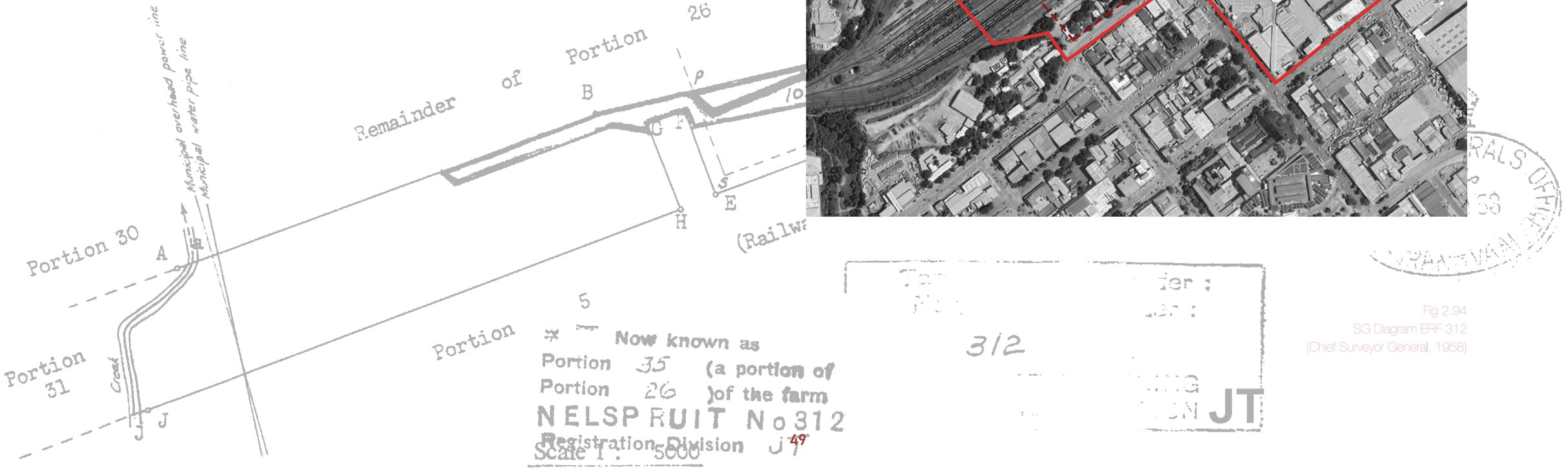
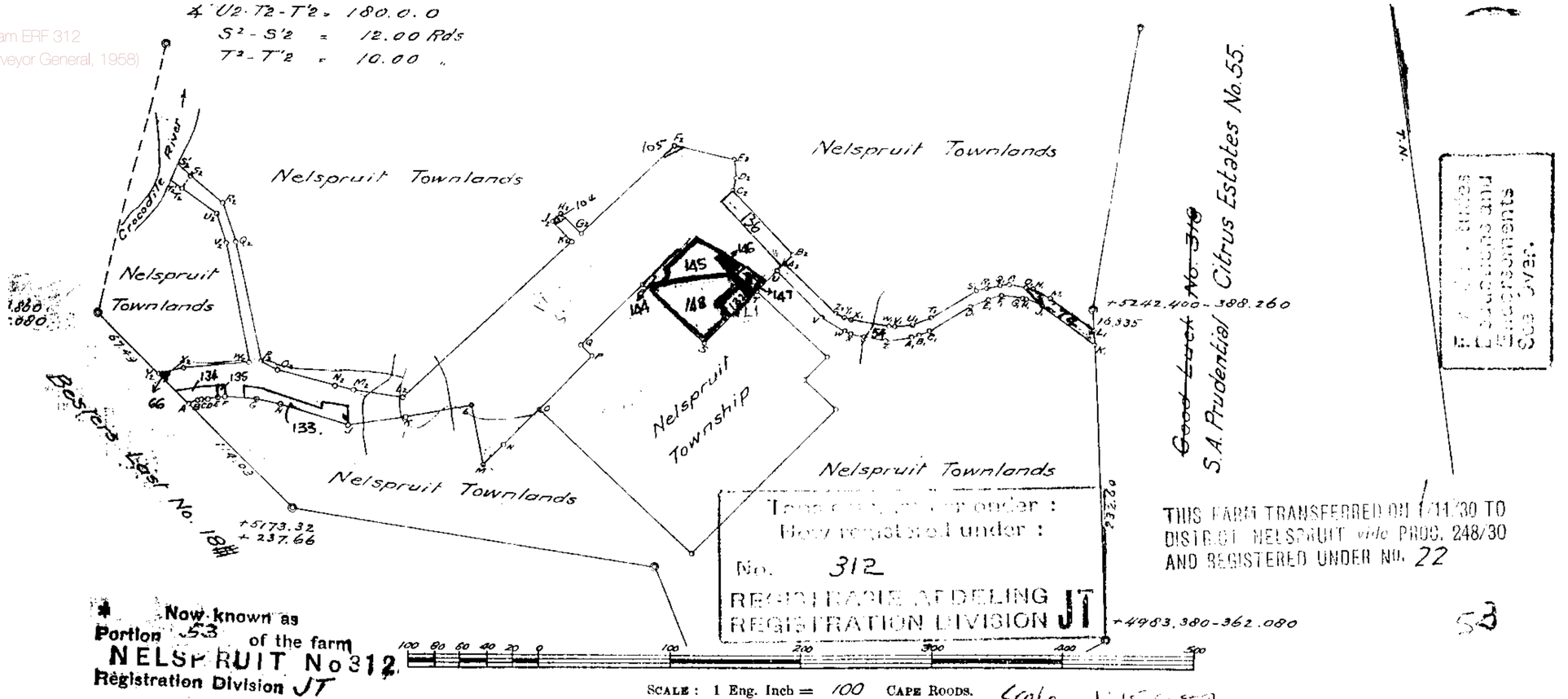


Fig 2.94
SG Diagram ERF 312
(Chief Surveyor General, 1958)

Fig 2.95
SG Diagram ERF 312
(Chief Surveyor General, 1958)



The above Figure lettered A B C D E F G H J K L M N O P Q R S T U V W X Y Z A₁ B₁ C₁ D₁ E₁ F₁ G₁ H₁ J₁ K₁ L₁ M₁ N₁ O₁ P₁ Q₁ R₁ S₁ T₁ U₁ V₁ W₁ X₁ Y₁ Z₁ A₂ B₂ C₂ D₂ E₂ F₂ G₂ H₂ J₂ K₂ L₂ M₂ N₂ O₂ P₂ Q₂ R₂ S₂ inner bank of River T₂ T₁ U₂ V₂ W₂ X₂ Y₂ represents

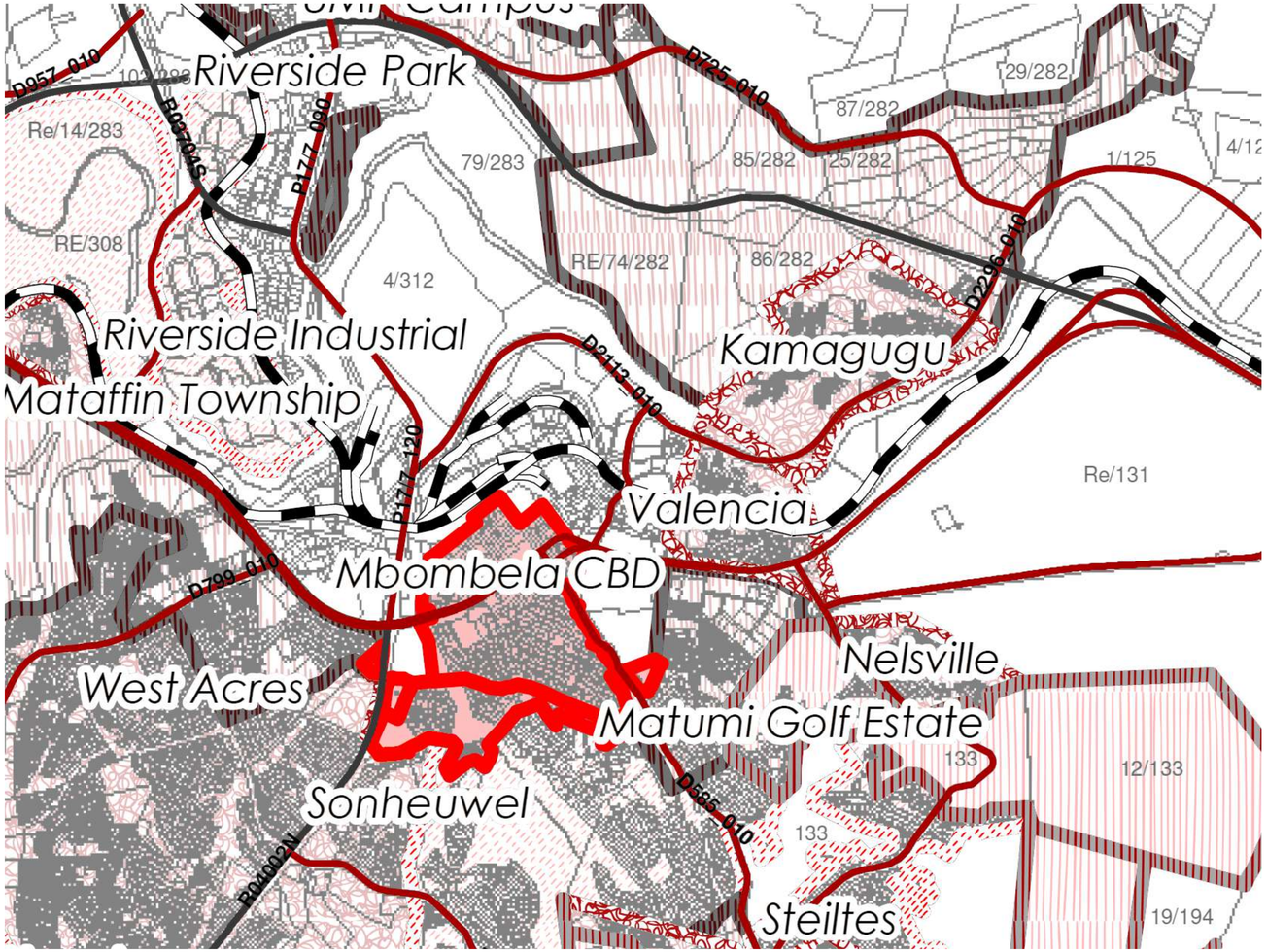
57 Morgen 526 Square Roods of Land, being * Portion 5 (Railway Reserve) of the Farm

NELSPRUIT No [redacted]

as appears on the Diagram S.G. No. A 792/07 framed by Surveyor [illegible] in

relating to Deed of No. dated made in favour of

Situate in the District of ~~Bapherton~~ Ward ~~White River~~ Nelspruit, Province of Transvaal. Bounded as indicated



Legend

- Main roads
- National routes
- Railway
- Land parcels
- Informal land parcels
- Municipal boundary
- General plan
- Proposed urban edge

Density Directives

- 1 du per 120m² or less (83+ du/ha)
- 1 du per 200-300m² (33-50 du/ha)
- 1 du per 300-500m² (20-33 du/ha)
- 1 du per 500-700m² (14-20 du/ha)
- 1 du per 1000-2000m² (5-10 du/ha)

Fig 2.96
Land Use Zoning
(Mbombela Municipality, 2024)

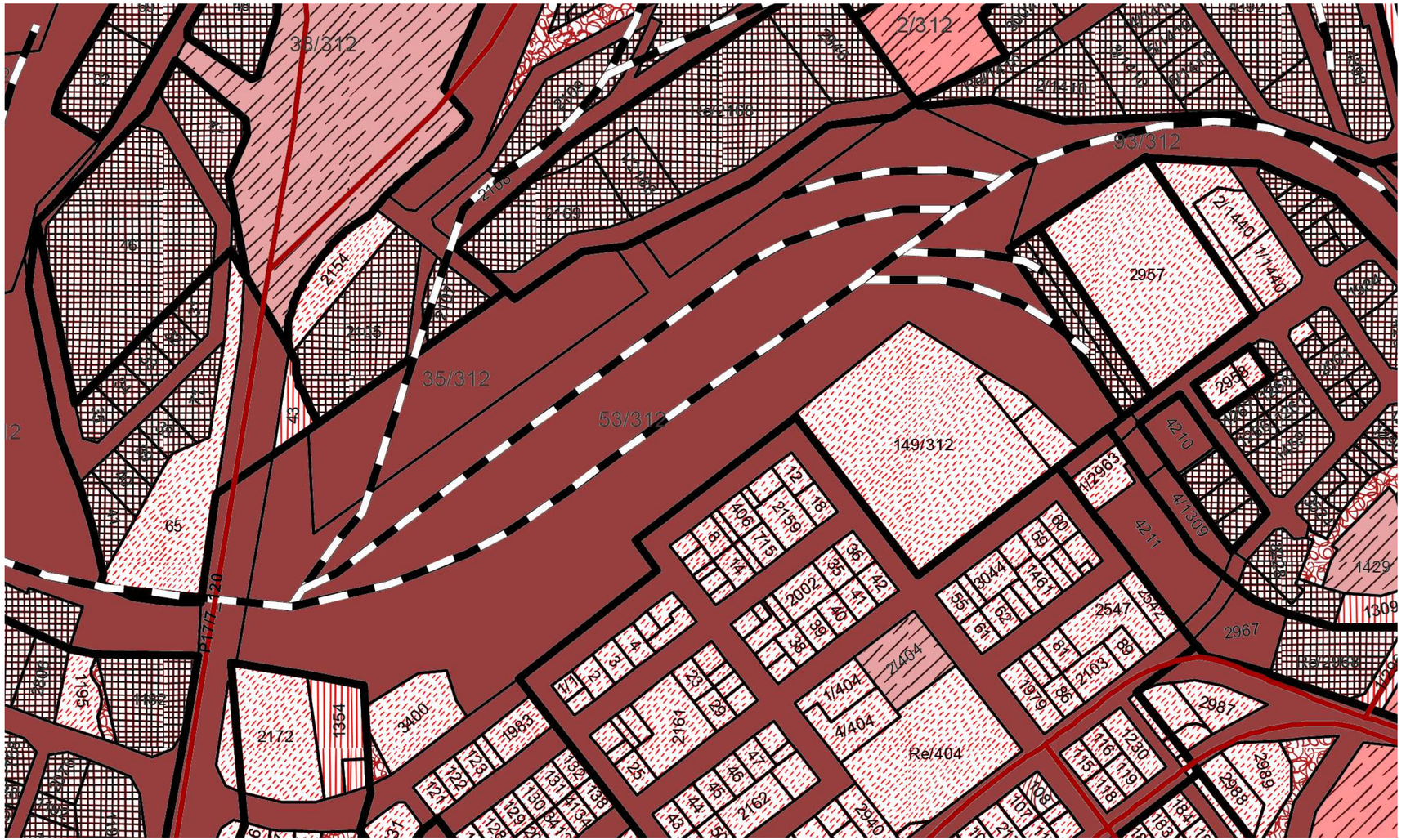


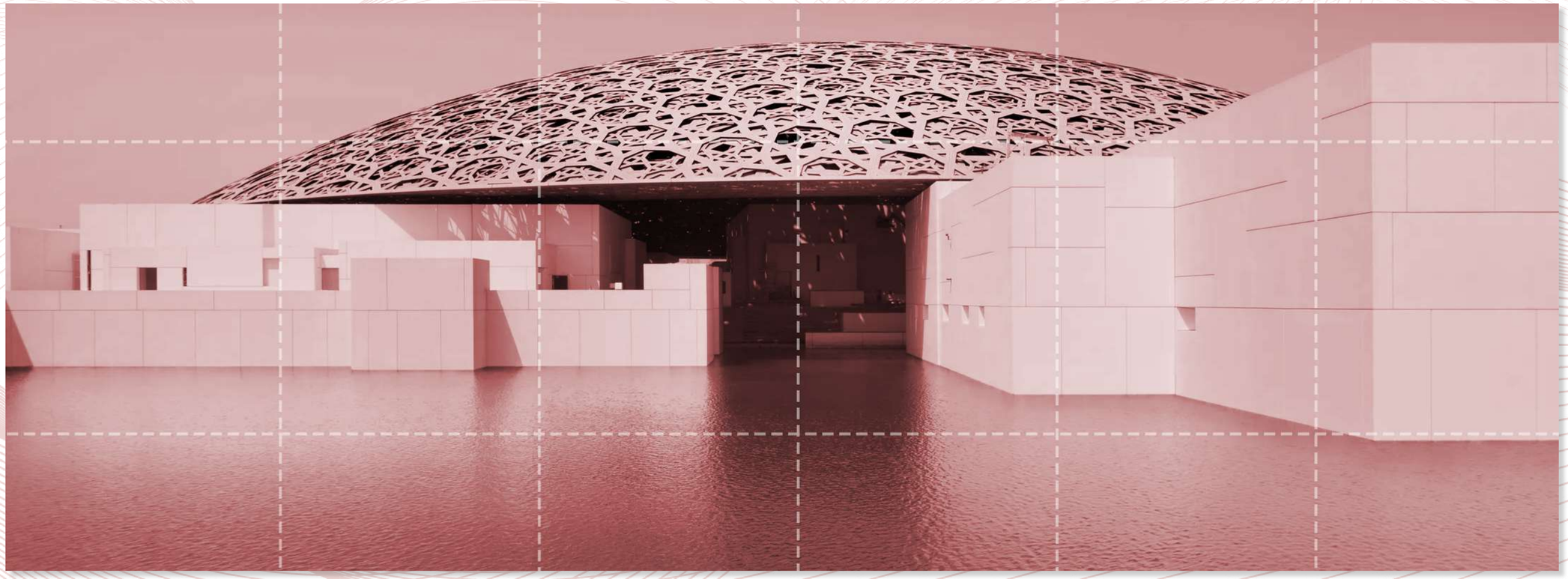
Fig 2.97
Land Use Zoning
(Mbombela Municipality, 2024)

CONCLUSION

The Nelspruit Train Station and the broader railway network in Mpumalanga, highlight the challenges and potential within South Africa's transportation infrastructure. The station's historical significance, contrasted with its current neglect, shows a pressing need for revitalisation. The decline in rail usage, due to the declining maintenance, vandalism and economic changes, further exacerbated by the COVID-19 pandemic, have left many stations, including Nelspruit, struggling to remain relevant. Nonetheless, Mbombela offers a strong argument for redevelopment thanks to its strategic location along the N4 and Eastern Line. Despite its isolated and divisive behaviour, it has the potential to become the very opposite. Its disuse highlights the station's vital role in connection, as it connects South Africa's interior to the shores of Mozambique and the rest of the world, making it an important connection for ease of access to popular tourist attractions and commercial areas.

The redevelopment of Nelspruit Station into a modern transport hub, presents an opportunity to revitalise the local economy, support tourism, and drive socio-economic growth. Achieving this objective requires a comprehensive strategy that unpacks and understands the movement of people in African cities, how to reinterpret heritage in architecture and make what was designed to be exclusive, an inclusive environment, creating sustainable and climatically responsive architecture for the building to continue to be functional and adaptable. Such a redevelopment would not only restore the station's operational capability, but also re-establish it as a versatile node within South Africa's rail network, benefiting both the community of Mbombela and the broader region.

CHAPTER 3
THEORETICAL FRAMEWORK



PARAMETRICISM AND CULTURAL SYNERGY: A MULTI-MODAL VISION FOR MBOMBELA INTER-MODAL STATION

CHAPTER GLOSSARY

CONCOURSE (Noun)

A large space or room in a public building, such as, a station or airport that people meet in or pass through.

COUNTER-MEMORIALS (Noun)

Or anti-memorials are works that generally recognise darker events, such as, the Holocaust, or the more troubling side of an event that in other times might have been glorified, such as a war. They may warn of the evils of an ideology, such as fascism or racism.

PARAMETRICISM (Noun)

Parametricism, *from parametric*, is a style of architecture the can be defined as the use of mathematical algorithms to generate forms and structures. This type of architecture is characterized by the use of complex geometric shapes, which are then assembled according to a set of parameters.

Fig 3.1
previous spread
The Louvre - Abu Dhabi
(Mohamed Somji, n.d.)

MOVING MBOMBELA

PARAMETRICISM AND CULTURAL SYNERGY: A MULTI-MODAL VISION FOR MBOMBELA INTER-MODAL STATION

The proposed design for the Mbombela Inter-modal Station represents a curated blend of architectural theories and principles with deep cultural significance, tailored to its unique context in the heart of the Mpumalanga province. These theories and principles underpinning the design, explore Parametricism, Afro-centric architecture, urban planning for multi-modal transportation, modern abstraction of monuments in architecture, heritage architecture, repurposing such buildings for modern use, anthropomorphic design theory, and juxtaposition.

Parametricism

Parametric design principles pivot on the idea that all elements of the design become variable and mutually adaptive according to certain external parameters[1]. This means that design outputs are based on computational variables that manipulate parameters and have the potential to produce endless innovative and dynamic iterations. In architecture, these variables can be solar studies, traffic volumes, climatic data, programmes and so forth. This enables architects to coordinate a complex system of variables to generate design solutions that efficiently and effectively address the considered variables.

> *"Contemporary avant-garde architecture is addressing the demand for an increased level of articulated complexity by means of retooling its methods on the basis of parametric design systems. The contemporary architectural avant-garde can be best understood as a research program based upon the parametric paradigm. We propose to call this style: Parametricism."2- Patrik Schumacher[2]*

1 *Ankitha Gattupalli, 'Parametricism- The Style of the Future', RTF | Rethinking The Future, 5 September 2020, https://www.re-thinkingthefuture.com/rtf-fresh-perspectives/a1710-parametricism-the-style-of-the-future/.*

2 'Parametricism as Style - Parametricist Manifesto', accessed 25 May 2024, https://www.patrikschumacher.com/Texts/Parametricism%20as%20Style.htm.

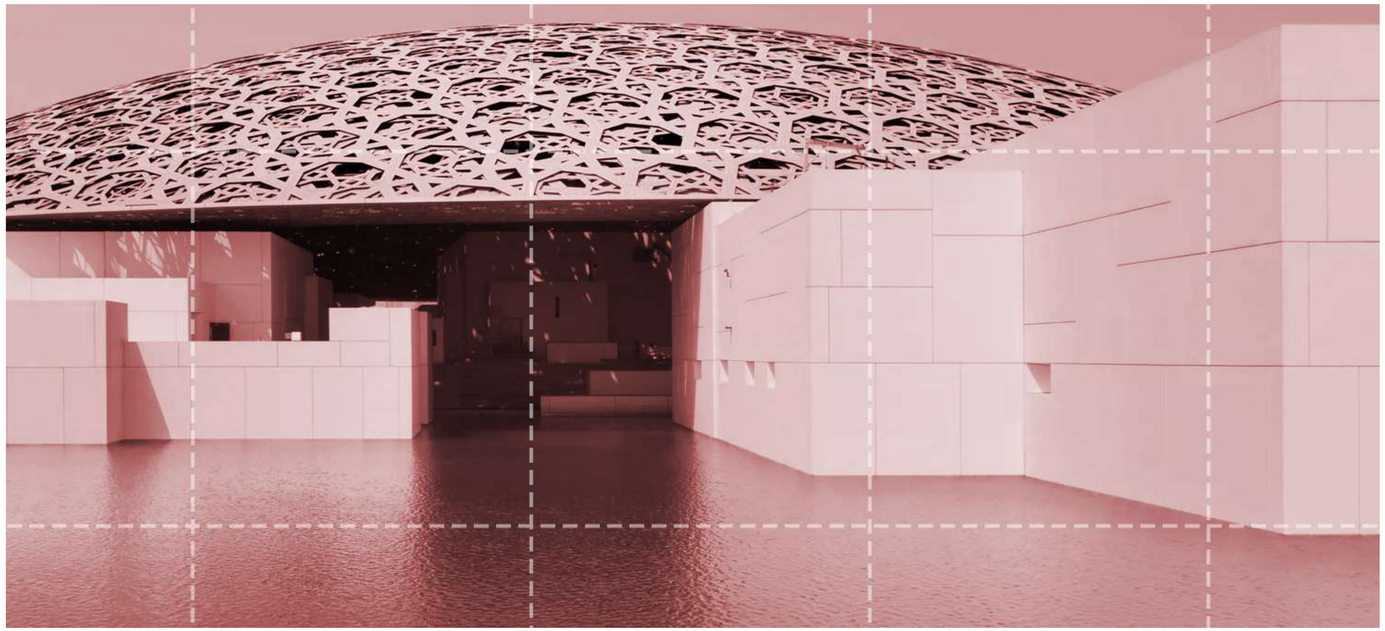


Fig 3.2
The Louvre - Abu Dhabi
(Mohamed Somji, n.d.)

In the built environment, this simulation of variable-based iterations has become a style of architecture in its own right. As stated by Patrik Schumacher (a prominent advocate of parametricism) it is an era-defining moment[3] that supersedes modernism and post-modernism, embodying a synthesis of art and technology. It is this era-defining moment because it has allowed designers to rapidly generate and evaluate different forms, ensuring optimal solutions that meet specific design criteria. It takes understanding the design further by allowing the designer to synthesize conditions to evaluate, among others, the design's efficiency in terms of energy, material use, and environmental impact. This process allows the designer to emphasize sustainability, efficiency, and harmony with nature at a level of accurate understanding that would have previously only been realised by designers once the building or object had been created.

3 *Gattupalli, 'Parametricism- The Style of the Future'.*

> *"The key issues that avant-garde architecture and urbanism should be addressing can be summarized in the slogan: organising and articulating the increased complexity of post-Fordist society. The task is to develop an architectural and urban repertoire that is geared up to create complex, polycentric urban and architectural fields which are densely layered and continuously differentiated." - Patrik Schumacher*[4]

Fordist society can be understood as one that has been fed cookie-cutter, industrialised, and standardised objects that have created a homogenised environment within society. It was adopted as a manufacturing system as it was realised it had far-reaching implications not only in transportation, but in other industries as well[5].

In the contemporary social landscape, parametricism offers a means to address complex societal needs in a heterogeneous fashion. The nature of parametricism affords designers the ability to create adaptable and responsive design forms that enhance social interaction, accessibility, and inclusivity. This is a significant improvement in the homogeneity of modernism and post-modernism as society is not homogeneous and should not be designed as such.

> *"Furniture and product design fully participates in the parametricist agenda we are pursuing. We consider furniture not in terms of isolated objects but as a preeminent space-making substance. Our design efforts need to encompass the domains of interior design, furniture design, and even product design."– Patrik Schumacher*[6]

This too relates to the political context in which parametricism can have a profound role. The design process democratises design decision-making by coordinating complex variables that are affected by the design. By facilitating more stakeholders in the design process, parametric practice enables more transparent and inclusive planning. This can also prove to be a powerful tool in the global political sphere concerning green building policies, as an emphasized variable in the parameters of the design, energy efficiency and environmental impact can be monitored and optimized to reach political goals worldwide. To that end, parametricism as a way of thinking and computing, is perhaps then an effective new tool that allows us to manage the use of the resources this



Fig 3.3
Gare Saint-Lazare
(Claude Monet, 1877)

4 'Parametricism as Style - Parametricist Manifesto'.
5 Mondli Hlatshwayo, 'The Public Transport Crisis in South Africa: Through the Eyes of the Four Revolutions', The Thinker 92 (2 September 2022): 49–60, https://doi.org/10.36615/thethinker.v92i3.1458.
6 'Parametricism as Style - Parametricist Manifesto'.

planet has to give for what we produce. With design optimisation as a core focus in parametricism, we can reduce our reliance on mechanical systems, reduce material and resource extraction and use, and take advantage of passive systems that improve design performance. As an added tool in the toolbox, it allows the built environment professional to achieve better quality buildings with greater functionality through the use of building information modelling (BIM) that can be simultaneously used and contributed to by other professionals. This reaches into the realm of construction and fabrication through CNC and mass customisation[7].

> *"If the only tool you have is a hammer, it is tempting to treat everything as if it were a nail."*
>
> *– Abraham Maslow, Law of the Instrument*

Parametric design is therefore contextual, adaptable, mass customisable and heterogeneous[8]. It is intentionally a method and a tool that allows designers to make better quality objects for contemporary use, and as such, is a way of looking at, and understanding, design problems in a more inclusive and complex manner. It liberates design to find new inspiration in nature in its complex, yet lawful order[9]. This affords the design of objects to adapt over time and respond to a variety of different variables and allows the built environment professional to become better capable of addressing complex design problems. In the context of the station, parametricism enables the creation of fluid and dynamic spaces that speak to cadences of movement and enhance the user experience. This design tool allows for the optimisation of spatial configuration, democratising the flow of movement within the station. It can accommodate the intricate demands of a multi-modal transport system, ensuring seamless transitions between different modes of transport. The forms generated will also resonate with the natural landscapes surrounding the site, creating a sense of place for an architectural expression that is intentionally different from its surrounding built environment. It makes for an example of Afro-centric architectural expressions for the future development of South Africa.

Afro-centric Architecture

Afro-centric architecture seeks to develop a modern African style that reflects the continent's cultural heritage and identity. The design of the Mbombela Inter-modal Station should draw inspiration from traditional African architectural



Fig 3.4
Draped Blooms - A Conceptual Shelter
(Author, 2024)

7 *Gudjon Erlendsson, '8 Reasons Why Parametric Design Is Changing Architecture', Thor Architects (blog), 16 October 2019, https://www.thorarchitects.com/parametric-design-is-changing-architecture/.*
8 *Erlendsson.*
9 *Gattupalli, 'Parametricism- The Style of the Future'.*

elements, such as, the use of natural materials, symbolic motifs and communal spaces. This approach not only grounds the design of the station to the contextual surroundings, but also creates a sense of belonging and pride among the local people. The station's design incorporates material elements, such as, thatch, earth tones, and patterns inspired by local African art, making it a cultural landmark. These features, I believe, make the architecture speak to an African-based architectural response that becomes an experience that is quintessentially African and is seamlessly embedded in the urban fabric.

Urban Planning

Effective urban planning is crucial for the success of a multi-modal transportation hub. The station is to be designed to integrate various modes of transportation, including trains, buses, taxis, e-hailing services, and private vehicles, ensuring comprehensive connectivity. The layout of the master plan should prioritise ease of access and fluidity of movement, with an emphasis on reducing congestion and enhancing the user experience. The objective is to facilitate economic development through accessibility and mobility in the region and beyond. These principles are also applicable to the building itself and is where Anthropomorphic design theory and the theory of movement come into play.



Fig 3.5
Calatrava Human Figure Studies
(Santiago Calatrava, n.d.)

Anthropomorphic Design

It focuses on human-centred design, as after all this space is designed for the movement of people and goods. Using human body proportions and movement as cues for architectural forms, scales, and spaces, the station's design becomes intuitive and comfortable for users[10]. The design emphasises the natural flow of human movement and plays on changes in cadence and proportion. Features, such as, seating areas, waiting zones, and circulation paths are designed to enhance comfort and usability. This focus on movement and human proportions is also important to reflect in the monument to migrant labour. Changes to these natural rhythms and proportions are used to evoke emotion in the user and pull the spatial experience into sharp focus for the user and allow them to contemplate and reflect on the monument.

Memorials And Abstraction

Monuments and their abstraction in architecture play an important role in architecture by serving as physical embodiments of collective memory and cultural identity[11]. The station incorporates a monument space dedicated to the migrant labourers who travelled through this station en route to the mines on the Rand in Johannesburg. This monument to these labourers is an integral part of the station's

10 *Frank Zollner, 'Anthropomorphism: From Vitruvius to Neufert, from Human Measurement to the Module of Fascism', 2014, chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.gkr.uni-leipzig.de/fileadmin/Fakult%C3%A4t_GKR/Kunstgeschichte/PDF/Publikationen/Frank_Z%C3%B6llner-B%C3%BCcher/unselbst%C3%A4ndige/Anthropomorphism_from-Vitruvius_to_Neufert.pdf.*

11 *Brady Wagoner and Ignacio Brescó, 'Memorials as Healing Places: A Matrix for Bridging Material Design and Visitor Experience', International Journal of Environmental Research and Public Health 19, no. 11 (31 May 2022): 6711, https://doi.org/10.3390/ijerph19116711.*

design, as their (migrant labour force) experience described in Charles van Onselen's "The Night Trains" is embodied in the name of the city – Mbombela – a lot of people in a small space. This memorial seeks to create this experience through space by abstraction of the monument.

Modern memorials have taken on abstraction as a tool to express trauma and memory. World War II events, such as, Auschwitz and Hiroshima, challenged traditional memorial practices[12], which were often symbolic and gallant. These events were so overwhelming that they seemed beyond representation. As a result, memorials began adopting abstract and non-representational forms, reflecting the difficulty in achieving consensus on historical interpretation.

These "counter-memorials"[13] encourage personal engagement and interpretation, contrasting traditional memorials that offer a singular historical narrative. Abstract designs, like those seen in the 9/11 Memorial, encourage visitors to fill in the gaps, creating a more personal connection to the site. However, the lack of a clear message can make these memorials challenging for some to understand. Figurative elements, like The Three Soldiers at the Vietnam Veterans Memorial, are sometimes added to provide a more concrete representation of loss, balancing the abstract with the tangible[14]. In the station's design, it aims to evoke the emotional weight of the experience of forced labour confined to a tight-packed freight carriage. This integration of monumentality within a functional space, underscores the station's dual role as a transit hub and a site of cultural significance.

The existing modest station structure, a late 1950s modernist building, comprises of a central ticketing hall and two administrative wings on either side, running parallel to the single platform. The building has a pitched, tiled roof with tall vertical window boxes on both the north and south elevations. This project calls for repurposing this heritage building by adapting the structure to meet contemporary needs while preserving its historical value. The Nelspruit Train Station is revitalised through thoughtful design intervention that respect its architectural integrity. By integrating modern facilities and technologies, the station is made relevant for present-day use without erasing its historical essence. The essence of the existing station lies in the central hall and the wings are deemed unnecessary for preservation, however, the preservation of its proportions is paramount. This central hall is integrated with the new design to ensure its continued relevance and sustainability, bridging the past with the present.

Sustainability is a vital principle for the design of the new station. The material selection prioritises local, sustainable materials, such as, timber, from sustainable plantations in the surrounding areas, recycled steel, and natural stone, such as, granite sourced locally are key materials used in the construction. These material choices reduce the carbon footprint of the building associated with manufacturing and transportation. Additionally, the design incorporates renewable energy systems like solar panels to take advantage of the sunny climate of the area. Passive cooling and thermal mass are also an integral part of the building's passive systems to reduce energy consumption and maximise its environmental responsibility and therefore become a precedent for architecture in the region.



Fig 3.6
Holocaust memorial in Berlin
(Toby Axelrod, 2012)

12 *Wagoner and Brescó.*
13 *Wagoner and Brescó.*
14 *Wagoner and Brescó.*



Fig 3.7
The Bundeswehr Museum of Military History
(The Bundeswehr Museum of Military History, n.d.)

Juxtaposition

Materiality also plays an important role in juxtaposition principles in the design. Juxtaposition in architecture involves the deliberate contrast of materials, programme, space and light to create dynamic and engaging spaces. This is used to highlight the interplay between old and new[15], movement and reflection. A combination of natural materials and manufactured ones, generous spaces and confined ones, and open and closed spaces highlight the station's dual purpose as a historical landmark and a forward-looking, yet reflective multi-modal transportation hub.

15 *'Juxtaposition | Sheila Lee Davies Architecture', Archello, accessed 4 September 2024, https://archello.com/project/juxtaposition.*

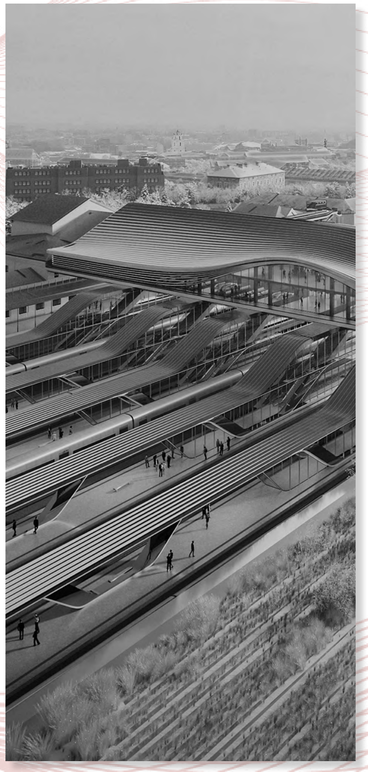
CONCLUSION

The design of the multi-modal transportation hub is rooted in an inclusive and complex selection of architectural theories that address context, function, form and cultural significance. By integrating these important principles of parametricism, afro-centric architecture, monuments in architecture, and effective urban planning, the design creates a space that is both functional and meaningful. The challenge is to give ownership of the station to the people to ensure its survival by making the building a monument to its place and its people. With an emphasis on contextual materials, human-based design, sustainability and cultural relevance, the station stands as a potential model solution for modern African architecture, capable of resonating with local identities while offering universal applications. It pushes the station as something more than a transit point - it evolves into a place of remembrance and cultural pride that embodies the spirit of its community.

CHAPTER 4
CASE STUDIES



PARKSTATION



VILNIUS



LYON-SAINT EXUPERY



KYOTO STATION



KMI AIRPORT

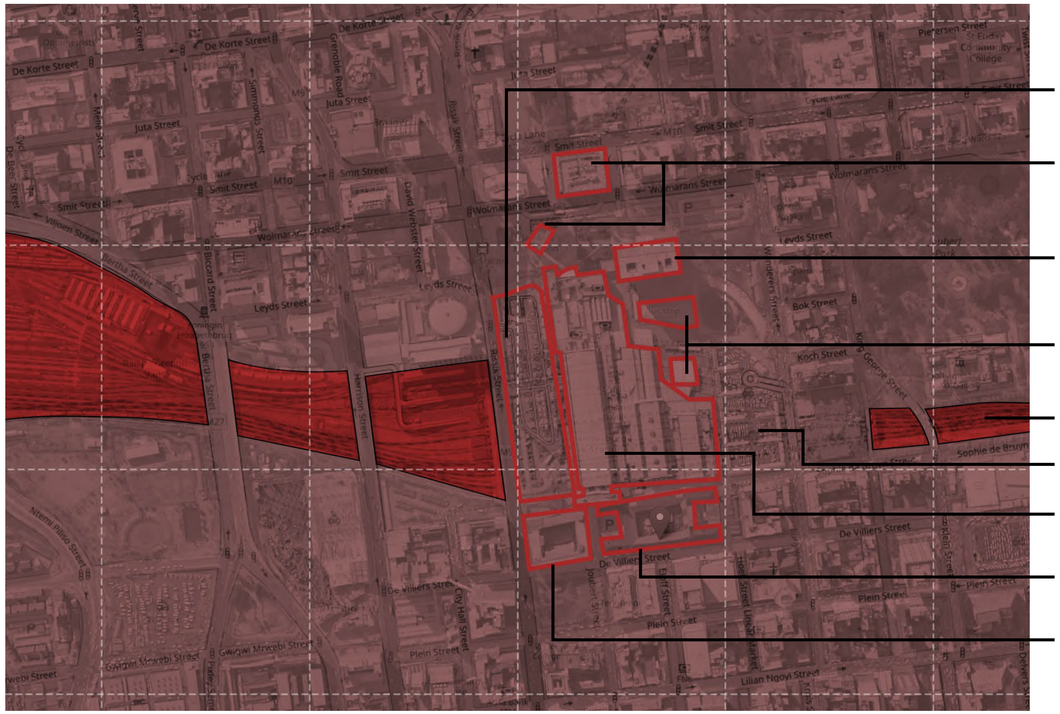
Fig 4.1
previous spread (far left)
New Park Station Main Hall
(Lekkeslaap, n.d.)

Fig 4.2
previous spread (left)
Vilnius Railway Station - Zaha Hadid Architects
(Zaha Hadid Architects, 2024)

Fig 4.3
previous spread (middle)
Lyon-Saint Exupéry Airport Railway Station
(Oliver Schuh, n.d.)

Fig 4.4
previous spread (right)
Kyoto Station
(Chuck LaChiusa, 2013)

Fig 4.5
previous spread (far right)
KMI Airport Entrance
(OrtiaSpotter, 2022)



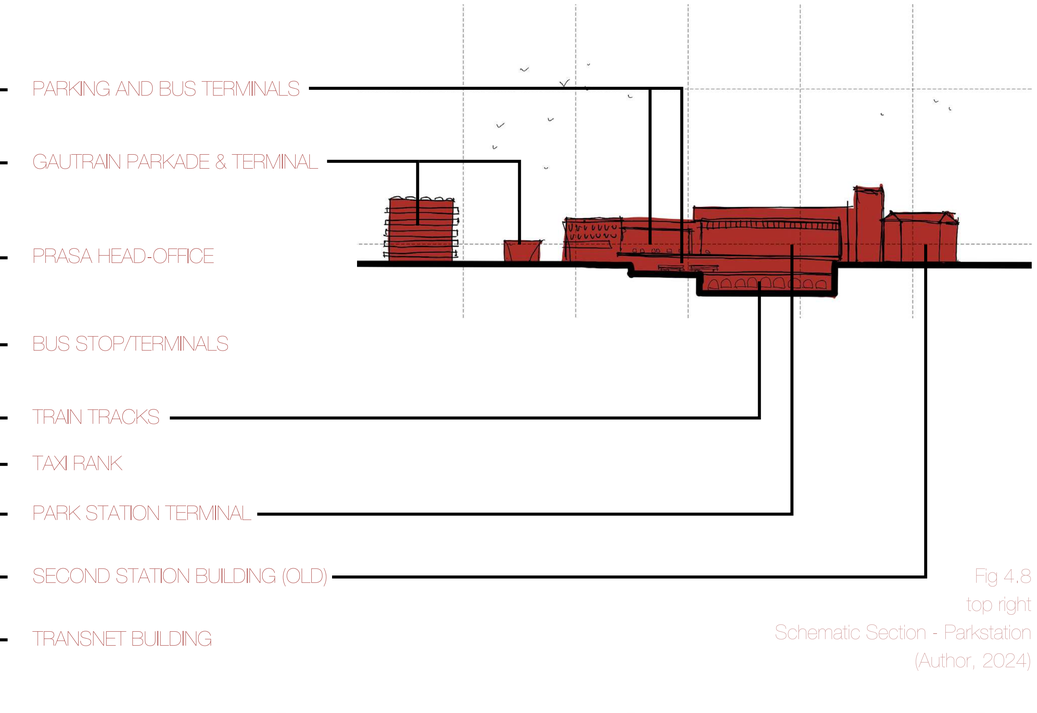


Fig 4.8
top right
Schematic Section - Parkstation
(Author, 2024)

PARKSTATION
JOHANNESBURG, SOUTH AFRICA

Park Station is located in Johannesburg CBD, South Africa. It is a major transportation hub in the city that services commuters with transport modes like trains, buses, taxi's and e-hailing services. The Gautrain is a 'high-speed' rail network that operates separately to PRASA's Metro Rail. Gautrain however has a terminal at Park Station that has a bus stop and car parkade. The main station features terminals for buses and trains, along with commerce and office space for Transnet and PRASA.

The layout consists of a station building that bridges the tracks, with terminals and access to the bus stops, the train tracks and the commercial modules.

Fig 4.6
top left
Park Station : Second Main Station Map
(Artefacts, n.d.)

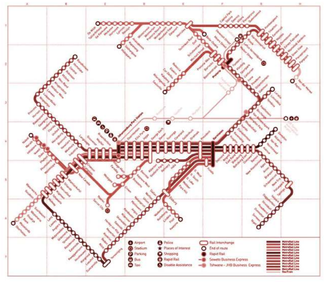


Fig 4.7
bottom left
Transit Maps: Official Map: Gauteng Metrorail, South Africa
(Metro Line Network, 2013)



Fig 4.9
bottom right
Interior of Parkstation
(Johannesburg Park Station, n.d.)

VILNIUS RAILWAY STATION
VILNIUS, LITHUANIA

Designed by Patrik Schumacher (Zaha Hadid Architects), the Vilnius railway station complex located in Lithuania is a redevelopment scheme that seeks to generate an integrated transportation hub. The project, at a conceptual level, aims to prioritise pedestrians and cyclists, while creating a bridge that connects the Naujininkai district to the southern Vilnius old town[1].

The development looks at incorporating a contemporary concourse bridge that connects to the existing neoclassical original station and spans across the tracks – the new bridge. The project proposes a relocated parking basement, a public square and park, as well as, a bus terminal that is integrated into the public space.[2]

The elements that resonate with my design project is the connection to an existing station building and how one designs to pay homage to the past. The use of the bridge that is the concourse provides clues as to how the station becomes a linking element, rather than allow the tracks to divide the city.

> "existing rail infrastructure from being a barrier that divides the city into a connector that unites Vilnius and serves as a transport hub for national and local rail services in addition to the new Rail Baltic line that links with Europe's high-speed network".

1 *'Zaha Hadid Architects' "Green Connect" Proposal Selected First in Competition to Transform Vilnius Railway Station', ArchDaily, 24 September 2021, https://www.archdaily.com/969075/zaha-hadid-architects-green-connect-proposal-selected-first-in-competition-to-transform-vilnius-railway-station.*

2 *'Zaha Hadid Architects' "Green Connect" Proposal Selected First in Competition to Transform Vilnius Railway Station'.*



Fig 4.10
Vilnius Station Interior Render 1
(Zaha Hadid Architects, 2021)



Fig 4.11
Vilnius Station Bird's Eye View
(Zaha Hadid Architects, 2021)



Fig 4.12
Vilnius Station Interior Render 2
(Zaha Hadid Architects, 2021)

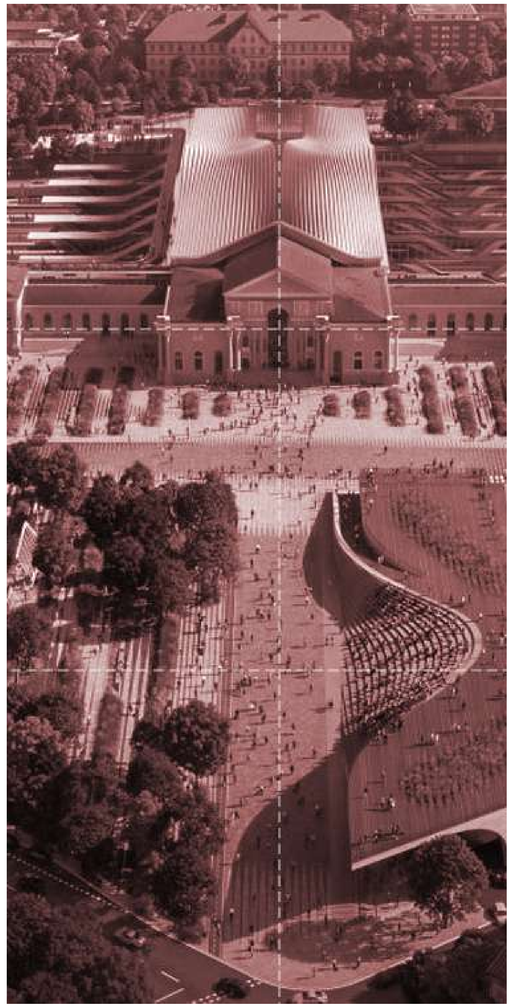


Fig 4.13
Vilnius Station Public Forum Render
(Zaha Hadid Architects, 2021)

LYON-SAINT EXUPERY AIRPORT RAILWAY STATION
VILNIUS, LITHUANIA

As one of Santiago Calatrava's best-known works, the Lyon-Saint Exupéry Airport Railway Station has furnished me with very inspirational ideas for my project. The form is best described as a bird in flight, but the building's design is actually birthed from a sculpture Calatrava sculpted. The 5600 square meter facility is a building that spans across the tracks and connects to the airport. The main hall spans 53 meters and features six arch structures that support the 1300-ton roof. The roof measures 100 x 120 meters, with a maximum height of 40 meters[1]. "The progressive narrowing of the supports and ceiling of the station lends to its dynamic feeling. Whether or not the soaring space specifically evokes a bird or not, movement is certainly one of its sources of inspiration" [2].

Calatrava (an engineer, architect, and artist) believes that train stations are a public space that should allow for people to move freely and the architecture is required to give something back to the commuters. His layout for the halls in his train stations give two things, a vast space for movement as well as a notion of time through a central clock – in the same fashion as Grand Central Station in New York City[3].

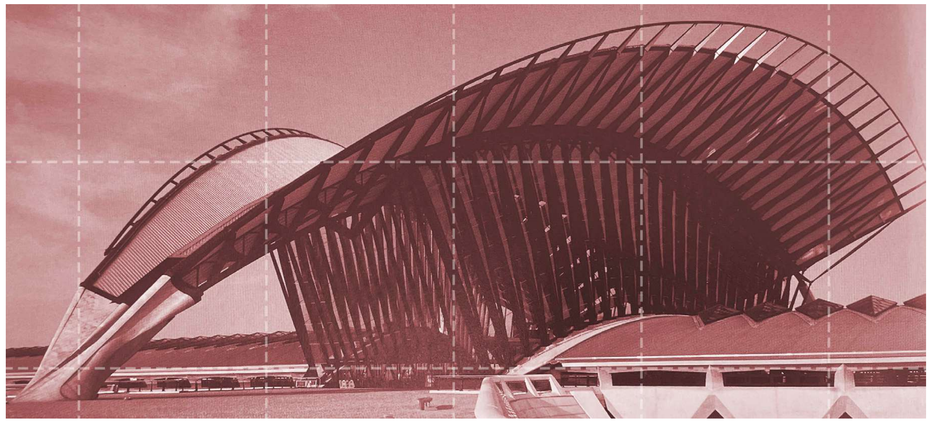


Fig 4.14
above
Lyon-Saint Exupery Airport Railway Station
(Jodidio, 2009)

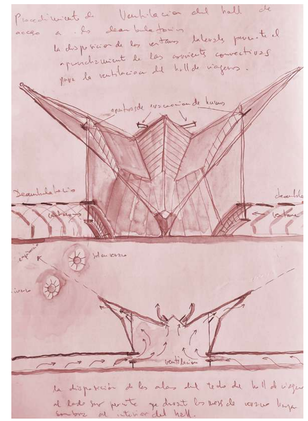


Fig 4.15
Calatrava's Concept Sketch 1
(Jodidio, 2009)

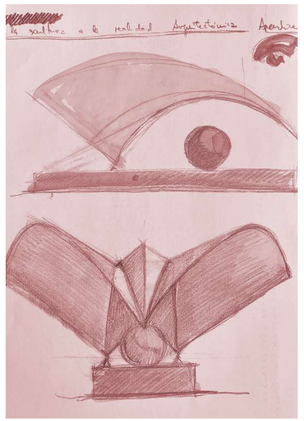


Fig 4.16
Calatrava's Concept Sketch 2
(Jodidio, 2009)

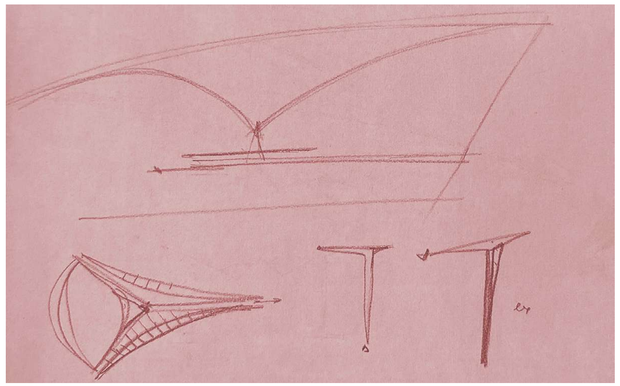
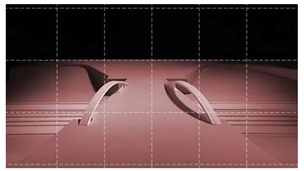
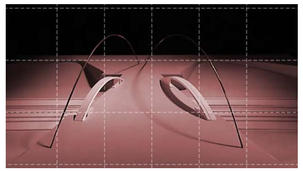
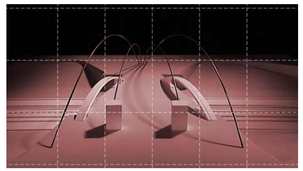
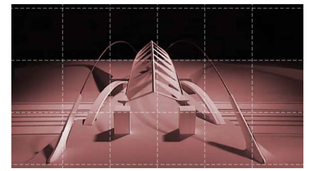


Fig 4.17
left
Calatrava's Concept Sketch 3
(Jodidio, 2009)









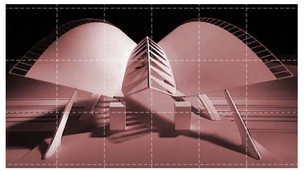


Fig 4.18 - 4.22
bottom series
Structure of LSE Airport Railway Station
(Calatrava Official, 2019)

1 *Philip Jodidio, Calatrava (Taschen, 2009).*
2 *Jodidio.*
3 *Lyon-Saint Exupéry Airport Railway Station, 2019, https://www.youtube.com/watch?v=Uh4ruvcEaSk.*

KYOTO TRAIN STATION
KYOTO, JAPAN

Kyoto Train Station, the second largest train station in Japan, was completed in 1997. Designed by Hiroshi Hara, this glass and steel building was designed to commemorate the city's 1200th anniversary. The 15-storey station houses a hotel, a shopping mall and a cinema, government offices and the platforms for multiple rail lines including the "bullet train", Shinkansen[1].

The deconstructivism-inspired design met a lot a criticism as many felt it was at odds with the ancient city that surrounded it. The cavernous concourse is accessible at 171 steps below the entrance point and the programming is positioned along the journey down to the trains[2].

1 *'Kyoto Station Designed as "Geographical Valley" Says Video Blogger Martin van Der Linden', Dezeen, 18 April 2020, https://www.dezeen.com/2020/04/18/kyoto-station-one-minute-architecture-video/.*
2 *'Kyoto Station Designed as "Geographical Valley" Says Video Blogger Martin van Der Linden'.*

"The juxtaposition of function, scale, and historical time in contemporary culture is not a negative phenomenon but belongs to the logic of a new urban society."

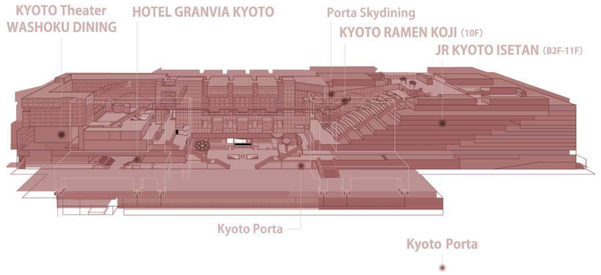


Fig 4.23
bottom left
Kyoto Train Station Floor Guide
(JR Kyoto Station, n.d.)

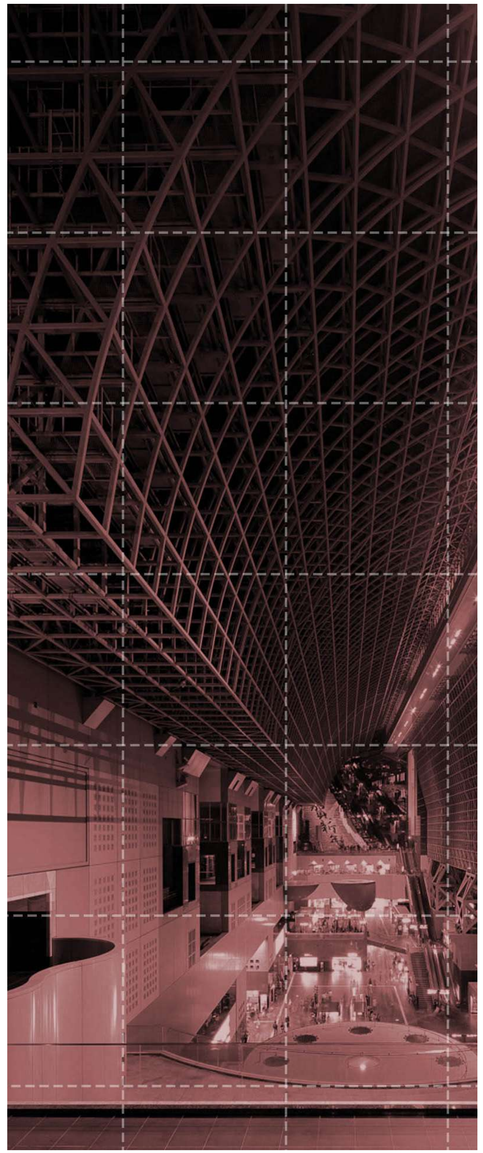


Fig 4.24
middle
Kyoto Atrium Space 1
(JR Kyoto Station, 2014)

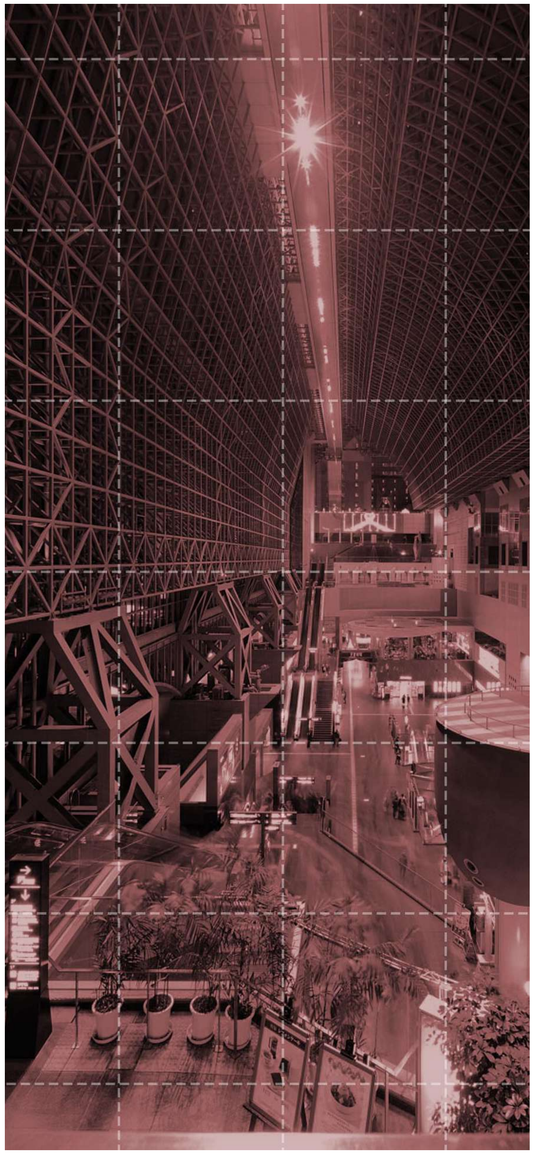


Fig 4.25
Right
Kyoto Atrium Space 2
(JR Kyoto Station, 2014)

KRUGER MPUMALANGA INT. AIRPORT
MPUMALANGA, SOUTH AFRICA

Located to the north-east of Mbombela (RSA), Kruger Mpumalanga International Airport is the largest thatched structure in Africa, covering over 7300 square meters and is the largest thatched airport in the world[1]. The airport was constructed in 2001and opened its doors in October 2002. The airport serves as an international gateway to the prestigious Kruger National Park and surrounding reserves and lodges, ferrying approximately a quarter of a million people every year but has the capacity to accommodate over 600 000 people per year.

The airport facilities include Customs and Immigration, Border Police, Lounges, Conference facilities, Training facilities, secure parking, Bank and exchange services and a food court with other shops.

KMI Airport is the official international port of entry into Mpumalanga which offers expanded opportunities to the tourism and business industries of the province[2].

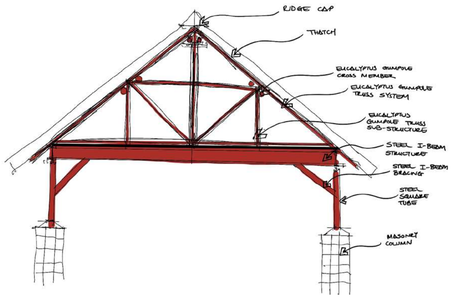


Fig 4.26
right
Kruger Mpumalanga International Airport(KMIA)
(KMIA, n.d.)



Fig 4.27
bottom left
Thatch Structure at KMIA
(Author,2024)



Fig 4.28
below
KMIA Entrance
(OrtiaSpotter,2022)



Fig 4.29
bottom middle
KMIA Public Interface
(KMIA, n.d.)

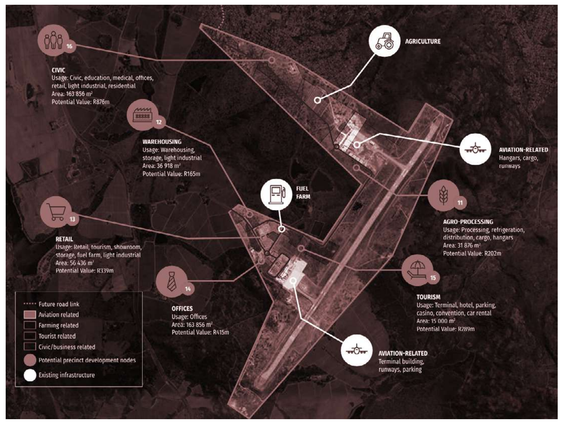


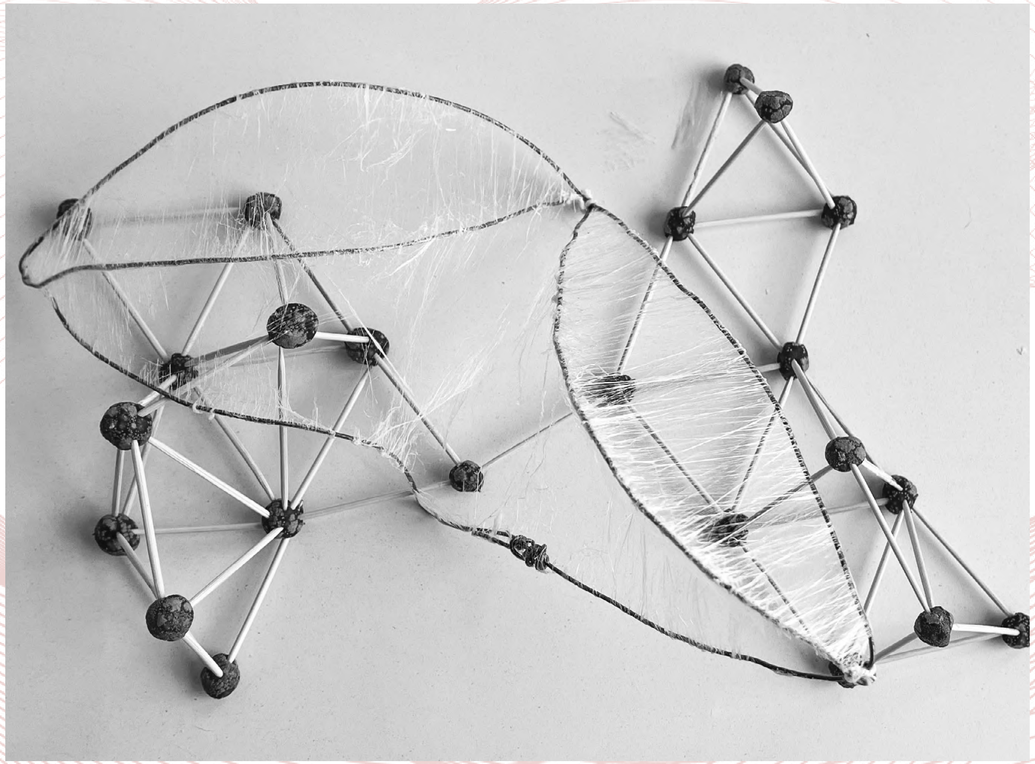
Fig 4.30
bottom right
KMI Airport at a glance
(KMI Airport, 2021)

1 *hendrik_admin, 'Our Airport', KMI Airport (blog), accessed 15 August 2024, https://www.kmiairport.co.za/our-airport.html.*
2 *hendrik_admin.*

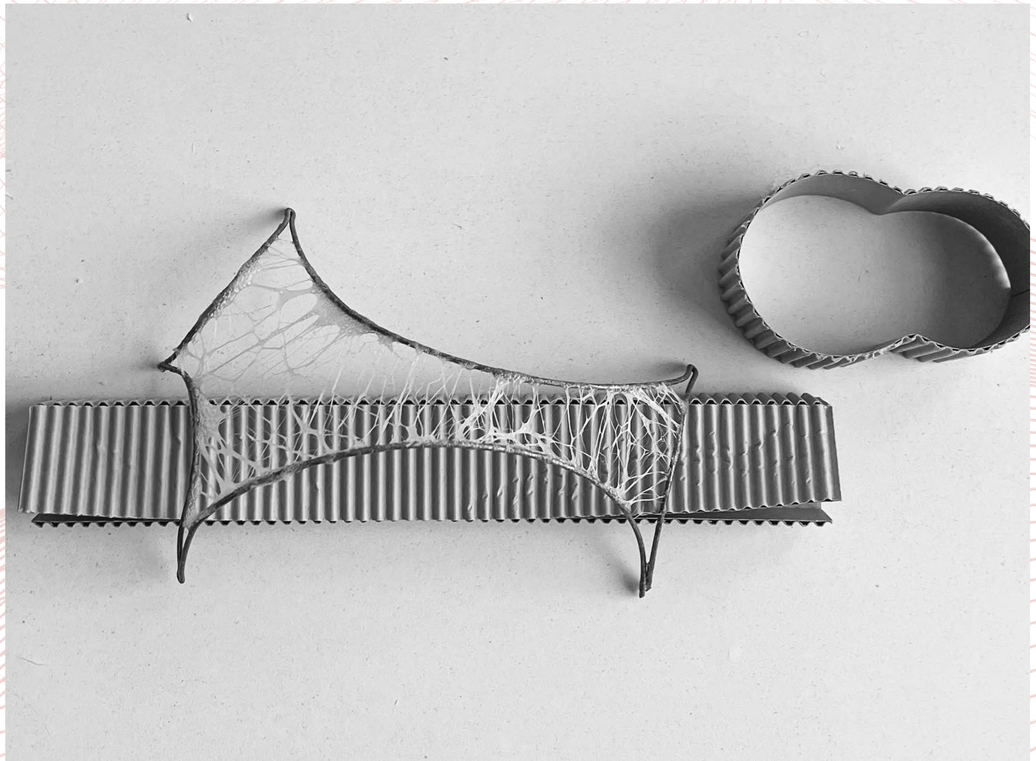
CONCLUSION

These architectural precedents offer valuable insight into the design of transport hubs, stressing the importance of integrating old and new elements, exploring spatial dynamics, and using alternative materials in architectural expression. Park Station in Johannesburg reveals the complex role of a transportation hub in a bustling African urban centre, where multiple modes of transit converge. Similar to Johannesburg's Park Station, the Vilnius Railway Station's redevelopment scheme illustrates the integration of a historic station with contemporary architecture, creating a cohesive link between different urban areas, enhancing pedestrian connectivity. The Lyon-Saint Exupéry Airport Railway Station and Kyoto Station further explore using dynamic, atypical architectural forms to create memorable public spaces that prioritise movement and flow. These structures do not only serve as transit points, but also as architectural statements that add value to the urban fabric. KMI Airport illustrates the traditional, yet innovative use of materials, such as, thatch and steel together in commercial buildings, merging traditional aesthetics with modern functionality. Collectively, these examples emphasize the potential for transport hubs to be both functional and transformative, while serving as vital connectors in both physical and cultural contexts.

CHAPTER 5
FORM, MATERIALITY & PROGRAMME



FUNCTION & PROGRAMME

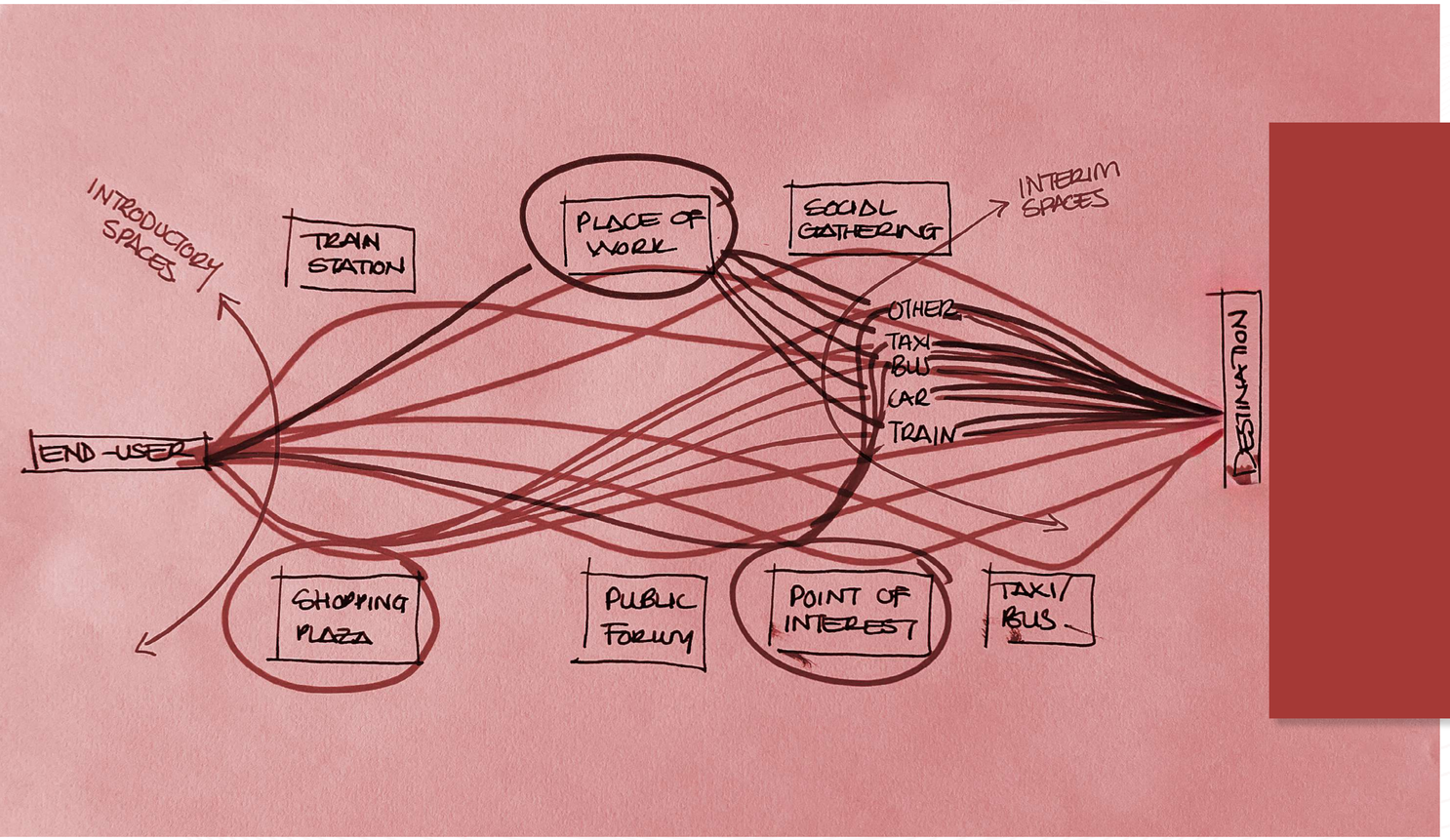


FORM & MATERIALITY



Fig 5.1
previous spread (left)
Massing Model
(Author, 2024)

Fig 5.2
previous spread (right)
Massing Model
(Author, 2024)



FUNCTION & PROGRAMME

Fig 5.3
Programming Exploration Sketch
(Author,2024)

ROVOS RAIL - FUNCTION AND PROGRAMME

When deciding on who to talk to about railway infrastructure, station design and all this in the South African context, Rohan Vos from the luxury train, Rovos Rail, was an obvious choice. His knowledge and experience of South African railways for over thirty years, makes his insight and opinion on a modern station invaluable.

Rohan Vos founded Rovos Rail in 1989. His journey began after purchasing a book titled *Railway Dining Cars of South Africa* from the museum at the old Johannesburg Station. He went on to restore steam locomotives for a club in Witbank and gradually acquired carriages. Before long, he established Rovos Rail, and the rest is history.

Rohan noted that when he started, there were very few infrastructure issues; running trains were a pleasure as, all stations had station masters, the signals worked, and so did the points. It wasn't until 2000 that he began to notice derelict and unmanned stations, a problem that has only worsened. He mentioned that COVID-19 had dealt a severe blow to the rail network due to theft and vandalism.

When asked about his vision for a new train station in Mbombela, he referenced Pretoria, Johannesburg, and Paddington in the United Kingdom.

> "The ideal station is what you have at Paddington—one of those major stations in London. Your requirements, of course, change with each station. For Nelspruit, yes, it is somewhat of a hub, but the station is a mess!"[1]

He warned against underground facilities, which risk becoming grimy spaces like Park Station. He suggested considering factors, such as, the number of trains using the station and the passenger volume. The design should include a large waiting hall, ticketing, toilets, retail modules, level areas for trolleys, and so forth. The station's design should also consider its location—whether at an end, a junction, or along a line. He mentioned there would be 101 questions to consider before designing the station.

When his train arrives at Nelspruit Station, he says they avoid the station building whenever possible. Passengers often leave reviews commenting on the station's condition, which impacts the quality of the tour he offers—one of grandeur and elegance. Unkempt platforms with piles of rubbish and weeds, are hardly a destination his clientele would appreciate. They frequently have to navigate around the station buildings because they are either vandalised or closed most of the time. It would be ideal if the stations were functional and tidy, providing a pleasant stop.

Service at stations is also crucial, although due to the decline in railway services over the years, Rovos Rail mostly relies on their own service

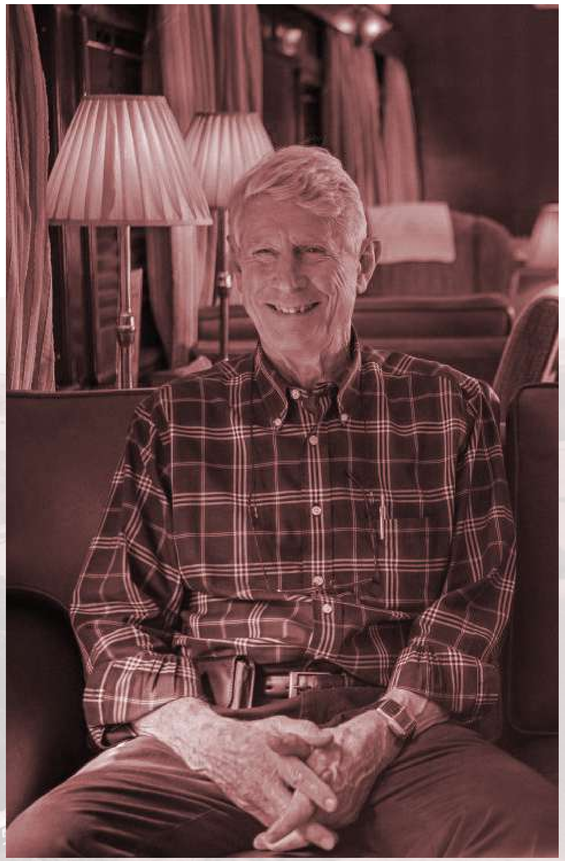


Fig 5.4
Photograph of Rohan Vos
(SATSA, 2024)

1 *Rohan Vos, Rovos Rail, Recorded, 30 July 2024.*

when arriving at a station. Tasks, such as, moving the train onto and off the platform, servicing the train, removing rubbish, and refuelling, are all part of what is required when entering a station.

His own station in Pretoria has become a highly sought-after experience by his passengers because of the exceptional service and experience it offers. He says:

> "I find the visit to this station to be very important—it never used to be. I never thought of it that way, but I started doing one or two tours for interested people and then thought, we might as well get these earphones and jackets for everybody. So I tried it once or twice, and the whole lot—fifty to sixty people would come. After I finished my tour, which I made more personal and filled with stories to illustrate things, people came up to me afterwards saying thank you very much and how wonderful it was, especially women, and if there were any petrol-heads or experienced railway enthusiasts among the guests, they really let loose. I realised it was hugely important for them."[2]

He agrees that educational facilities like museums and workshops provide an additional layer to the experience that seems inconsequential, but it is invaluable. His journey of Rovos Rail may never have started were it not for the book he found in the museum that he wondered into at the old Johannesburg Station.

> "The old Johannesburg Station is one of the reasons I started this business. We had lunch in the Blue Room, so I wondered into the museum and I found a book that was called 'Railway Dining Cars of South Africa'. And I thought to myself, who would want to buy a thing like that? And why would someone even think of writing a book like this? So I thought, hang on a second, there must be something to this and so I opened it and read through it, and eventually thought it might be fun."

Rohan Vos
2024
Interview with Author

2 *Rohan Vos.*

TAXI RANK - A CASE STUDY
CENTANE, SOUTH AFRICA

Centane is a small, rural town in the Eastern Cape province of South Africa surrounded by a cluster of over twenty villages. It's the central transport node for these villages. The transport hub, as so called by the municipality, came with a R6.8 million price tag and no one can point out where the money was spent on the facility. Chair of the Border Taxi Association in Centane, Xolani Somana, was interviewed on Carte Blanch in early 2024 to describe the challenges they face with the structure the municipality had provided.



Fig 5.5
Centane Transport Hub
(Author, 2024)

"First of all, they made it small. That is the first thing. It does not fit the cars that are available in Centane. So, the challenge we have is that, even when it rains, the cars can't all fit underneath the shelter. They don't fit there and there's water leaking everywhere... When it rains, people's belongings get wet. It floods. Yes, because we load passengers outside, not underneath the shelter. People have no place to relieve themselves. When they need the loo, they have to use the bush. It's a problem. And you work such long hours. We, the people who work here also suffer because we live in the villages. Here, when you need the loo, it is difficult. When you're at home, you don't have this problem. But we have no choice but to be here at the taxi rank...It could never be that amount. Even though I don't know much about these things, it could never be that amount. This rank that I see before me was built with less money. Because we've built our own houses that are much bigger than these offices. So, we know the costs"[1].



Fig 5.8
left
Centane Transport Hub Site Plan
(Author, 2024)

1 *Eastern Cape: Broken Promises | Carte Blanche | M-Net, 2024, https://www.youtube.com/watch?v=6w91_FuyEpE.*

Fig 5.6
below
Centane Transport Hub
Services Buildings
(Carte Blanche, 2024)

Fig 5.7
bottom
Centane Transport Hub
Taxi Stop
(Carte Blanche, 2024)





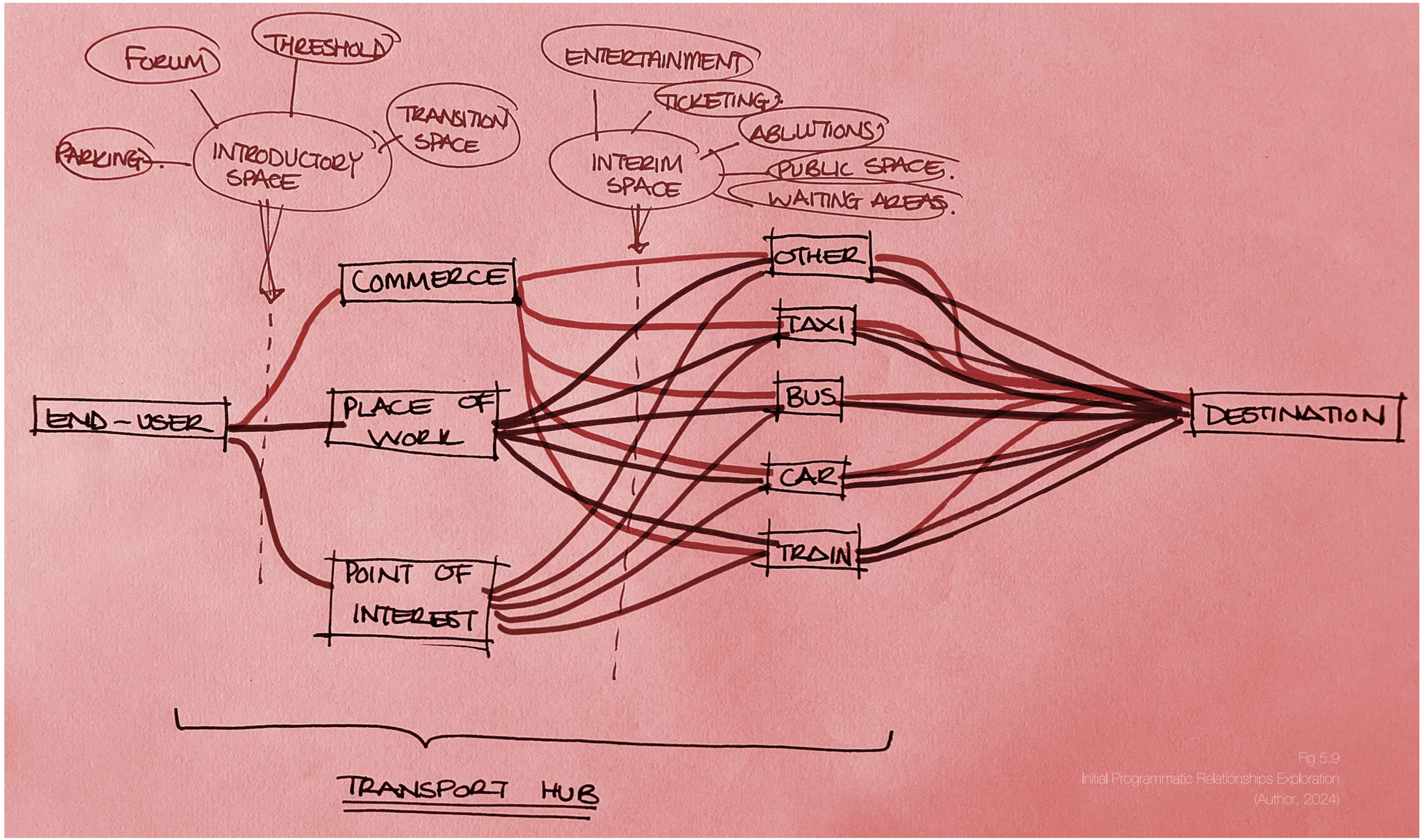


Fig 5.9
Initial Programmatic Relationships Exploration
(Author, 2024)

PROGRAMMING STUDY
AN INITIAL OUTLINE

Terminal Buildings:

Main structures for passenger arrivals, departures, and transfers.
- Arrivals terminal
- Departures terminal
- Transfers terminal

Waiting Areas:

Comfortable spaces for passengers awaiting their transportation.
- Comfortable and ergonomic waiting spaces
- Nearby ablutions
- Plug points and hot desk spaces
- Convenience store nearby

Ticketing and Information Counters:

Stations for purchasing tickets and obtaining travel information.
- Language options
- Clear signage and directions - colour coded directions/signs
- Logical position - central and accessible.

Vehicle Platforms:

Designated areas for buses, taxis, e-hailing services, and private vehicles to pick up and drop off passengers.
- Sequential terminals that are marked and easily identifiable
- Safe waiting areas that are protected from the elements
- Convenient positioning that allows seamless transition between different modes of transport

Pedestrian Walkways:

Safe pathways for pedestrians to navigate within the facility.
- Level, raised, paved walkways
- Rest points and benches that are shaded
- Information boards with schedules and updating times
- Natural barriers that protect the pedestrian from the vehicles

Parking & Charging Stations:

Parking facilities and support for the transition to electric vehicles in time.
- Parking bays for commuters - long and short term
- Parking for staff
- Electric vehicle bays, with the potential for installing more over time

Green Spaces:

Incorporation of landscaping and greenery to enhance aesthetics and environmental sustainability.
- Shaded walkways
- Water features that cool the building passively and also muffle other noise
- Grass and indigenous plant gardens to rewild the urban fabric

Retail and Amenities:

Shops, cafés, and other amenities for passengers and visitors.
- Anchor tenant space like Woolworths/Checkers/Dischem etc
- Coffee shops and restaurants - cater to all hours of the day
- Book store/Curio shop/Clothing stores/Tech Store

Restrooms:

Sanitary facilities for passengers and staff.
- Male/Female/Unisex/Disabled/Baby
- Space for luggage (lockers)
- Shower facilities
- Staff ablutions

Administration Offices:

Spaces for managing operations and logistics.
- Open plan office space
- Small offices
- Tea room
- Archive/Server Room

Security and Surveillance Areas:

Facilities for monitoring and ensuring the safety of passengers and property.
- Surveillance office
- Luggage search rooms

- Meeting rooms
- Strong Room
- Server room

Community Spaces:

Areas for events, gatherings, or cultural activities to foster community engagement.
- Amphitheatre/Performing space
- Conference space

Multi-modal Connectivity:

Integration with other modes of transportation such as trains, ferries, or airports.
- Nearby drop-off zones
- Paved, covered walkways
- Ticketing offices
- Information boards (digital)
- Colour-coded and sequential transport bays
- Covered waiting areas

Waste Management Facilities:

Proper disposal and recycling facilities to manage waste generated within the hub.
- Refuse and recycling area
- Loading area
- Tools store
- Staff Change rooms

Emergency Services:

Designated areas for emergency response and medical assistance.
- Emergency parking bays
- Infirmary

Technology Integration:

Implementation of digital signage, Wi-Fi, and other technological advancements to improve user experience and efficiency.

Flexible Spaces:

Adaptable areas that can accommodate future changes in transportation trends or user needs.

Design for Climate Resilience:

Consideration of climate change impacts and resilient design principles to mitigate risks such as flooding or extreme weather events.

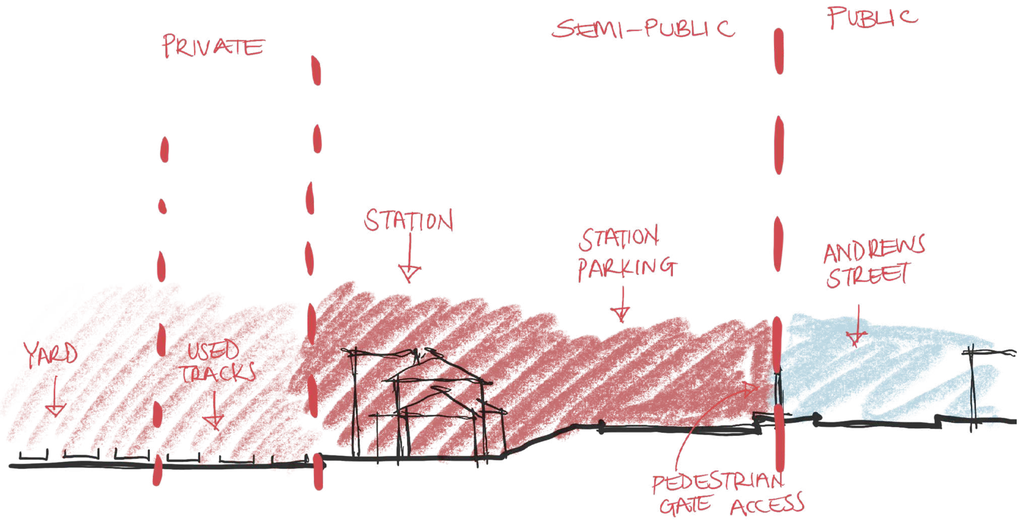


Fig 5.10
above
Schematic Section of Site
(Author, 2024)

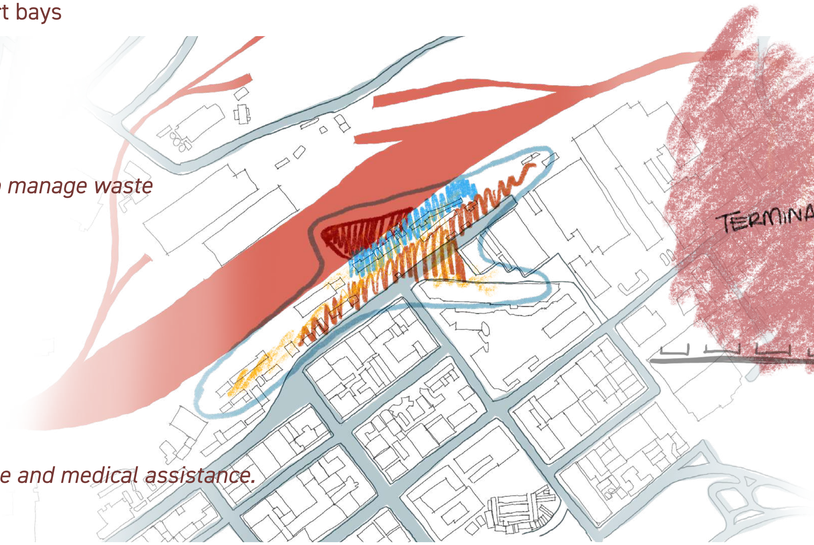


Fig 5.11
left
Schematic Master Plan Scope of Works
(Author, 2024)

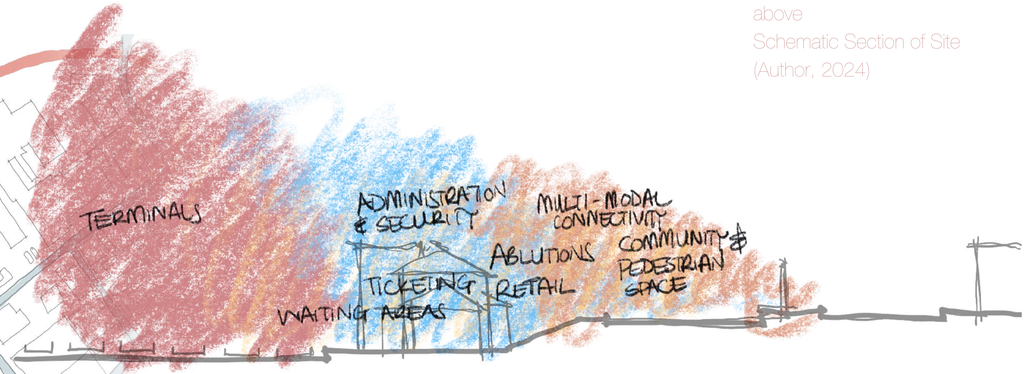
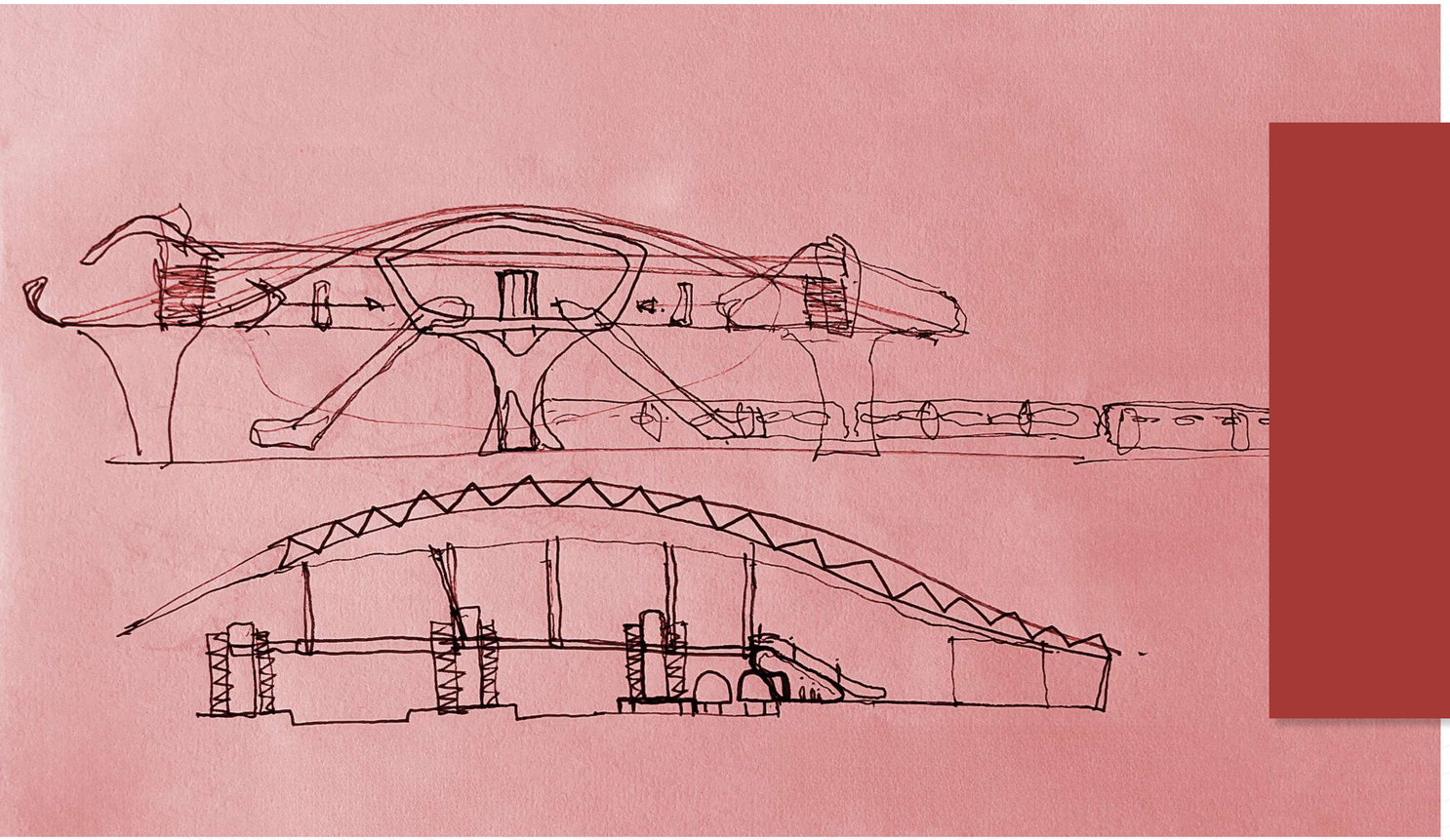


Fig 5.12
above
Schematic Section Planning
(Author, 2024)



FORM & MATERIALITY

Fig 5.13
Initial Form & Construction Materiality Exploration
(Author, 2024)

SABIE POLES - FORM AND MATERIALITY

Marina and Peter Daniel, of Sabie Poles, provided expert insight into the use of timber for thatch roof designs and the logistics of transporting timber in the Lowveld. This report looks at their recommendations and observations based on extensive industry experience.[1]

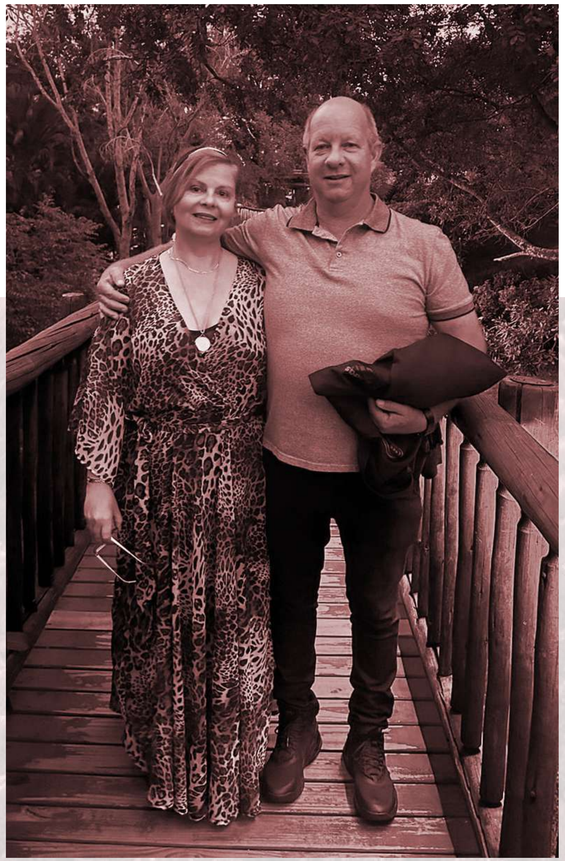


Fig 5.14
Photograph of Marina & Peter Daniel
(Marina Daniel, 2024)

Timber Selection for Thatch Roof Design

For thatch roof designs, the preferred timber types are eucalyptus or gum poles, as this timber has demonstrated its effectiveness and durability, and has been successfully used on thousands of roofs, that can withstand the elements, and when maintained, can last a very long time, which makes them ideal for this application.

Recommendations for Roof Structure

When designing a thatch roof structure, several factors need consideration:

1. *Pole Length and Diameter: A minimum of a 7.2-metre pole is recommended, with a diameter of 100-125mm on the thinner end. The poles typically taper by 7mm per metre and it is the industry standard to place the smaller diameter end at the top (ridge) and the thicker end at the base for optimal support.*
2. *Weight Considerations: The weight of thatching grass, especially when wet, needs to be accounted for. Therefore, poles with a diameter between 125-149mm are ideal to ensure the structure can bear the additional weight without compromising stability.*
3. *Roof Angle: Thatch roofs are typically constructed at a 45-degree angle to ensure proper water runoff and reduce the weight load on the timber structure. The 90-degree angle at the ridge ensures a strong structural form for the thatch roof.*

1 *Marina Daniel and Peter Daniel, Sabie Poles, interview by Keagan Doyle, Recorded, 28 July 2024.*

Joinery and Connection to Main Superstructure

For connecting the timber members to a steel superstructure, a steel bracket technology is commonly used. This involves using a pipe or tube over the ends of the pole, extending 200-300mm, with a bolt inserted through the middle. The use of stainless steel or galvanised steel bolts or threaded rods ensures stability and longevity. Because the poles are treated, shrinkage or expansion of the timber is not a concern with the joinery. A common industry practice includes using untreated 12mm threaded rods for joining poles, which has proven effective in inland thatch roof constructions.

Best Method for Capping the Ridge of Thatch Roofs

Cement is often used for capping the ridge of thatch roofs but is advised to avoid it due to its tendency to crack from structural movement caused by wind. Instead, a fibreglass ridge cap is preferred, offering both durability and aesthetic appeal. Concrete has to be knocked out and recast when doing maintenance on the thatch, whereas fibreglass is just cut out in sections and replaced where needed.

Additional Considerations for Thatch Roof Design

Several other factors should be taken into account when designing a thatch roof with timber members:

- Pest Control: CCA-treated poles placed under a roof require no further pest treatment. However, annual applications of a product called CTX108 is used to deter spiders and termites from nesting in the thatch itself.

- Fire Safety: Fire is the main concern for timber and thatch. To mitigate this risk, what are called “fire bombs” are used to detect heat and release fire retardant. These are installed at the top of the poles within the roof. Additionally (although not commonly used in residential thatch roofs), hoses with sprayers are embedded within the thatch to wet it with water when smoke or heat is detected. The system covers the area along the ridge and approximately 500mm down from it.

Evaluation of Freight Rail Network in the Lowveld

Historically, the rail network was essential for transporting mining timber, especially in the forestry sector of Sabie. Timber transport by rail was cost-effective and efficient, with large payloads ensuring uninterrupted operations for mines. However, due to the removal of certain rail sections over the past 20 years by thieves and vandals, this option is no longer viable, forcing a shift to road transport. This change has significantly reduced the volume of timber that can be transported in a single trip.

Current Transport Methods and Challenges

At Sabie Poles, trucks are primarily used for transporting freight. However, this method poses several challenges:

- Roadblocks and Protests: Frequent roadblocks and protests cause delays and increased costs due to re-routing and additional time on the road.

- Security Risks: There is a high risk of theft, with fuel, tyres, and rims commonly stolen from trucks during transport.

- Increased Costs: The need for security systems such as Car-track and the rising cost of diesel add to the financial burden of road transport.

Impact on Network Infrastructure

The shift from rail to road transport has led to increased wear on road infrastructure and higher transportation costs. Moreover, the decreased use of rail due to theft and vandalism has contributed to its degradation and loss of efficiency.

Potential Benefits of a Functioning Rail Network

A fully functional rail network could significantly benefit timber transportation, provided the logistics align with current business needs. Unless there are sidings at both the supplier’s and customer’s locations, handling and the risk of damage make it infeasible for high-end product distribution by rail. Supporting or secondary services would have to be efficient and cost-effective for this to be considered. Modern technology, including surveillance, drones, and tracking systems, could enhance cargo security and detect any infrastructure theft.

Suggestions for Improving Rail Network Viability

Expanding the rail network to include tourism could provide additional revenue streams and make better use of existing lines. That said though, new infrastructure is essential since firstly, there is not much left of the infrastructure, and secondly, infrastructure needs to accommodate modern trains and their speeds. Some scenic routes and destinations that are inaccessible by road could attract tourists, similar to how cruise ships operate, offering an integrated travel and sightseeing experience. A more efficient rail network could also streamline cross-border travel to destinations like Maputo, provided improvements in passport control and border management are implemented on the trains.

CCA GUM POLES

Diameter	Length
32-49mm	1.2 - 3.0m
50-74mm	1.2 - 8.4m
75-99mm	1.2 - 10.0m
100-124mm	1.2 - 15.0m
125-149mm	1.2 - 15.0m
150-174mm	1.2 - 15.0m
175-199mm	1.2 - 15.0m
200-224mm	1.2 - 15.0m

CCA DROPPERS

Diameter	Length
32-49mm	1.2m
	1.5m
	1.8m
	2.1m
	2.4m
	2.7m
	3.0m

TREATMENT

Tanalised CCA Treatment (Pressure Treated) & Untreated

Classes:

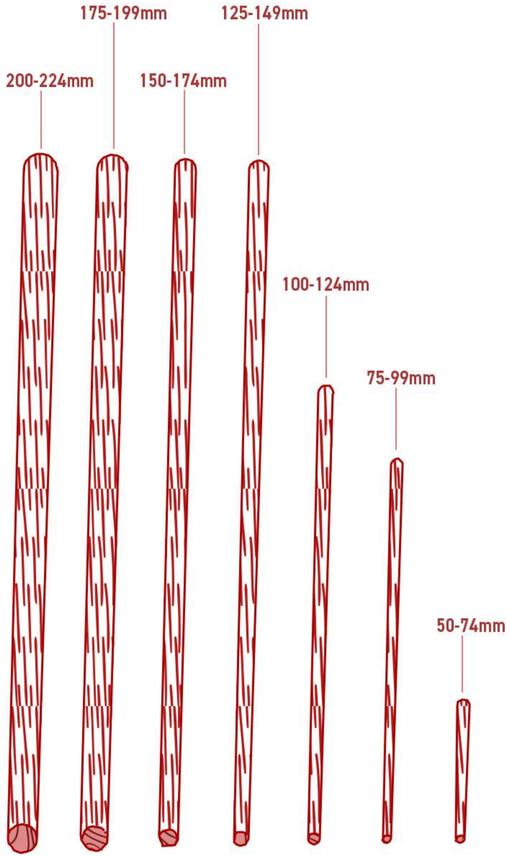
H2 - Internal Applications
H3 - External Above Ground Applications
H4 - In-Ground Contact
H5 - Wet Soils or In-Water
H6 - For Application in Sea Water

SEALING PRODUCTS

UltraSeal & UltraDeck
Khuni Sealer
CTX 108
Indeg
Timbrite

S5 CONSTRUCTION

Size	Length
38x76mm	3.6m, 6.0m, 6.6m
38x114mm	3.6m, 6.0m, 6.6m
38x152mm	3.6m, 6.0m, 6.6m
38x228mm	3.6m, 6.0m, 6.6m
50x76mm	3.6m, 6.0m, 6.6m
50x152mm	6.6m
50x228mm	6.6m



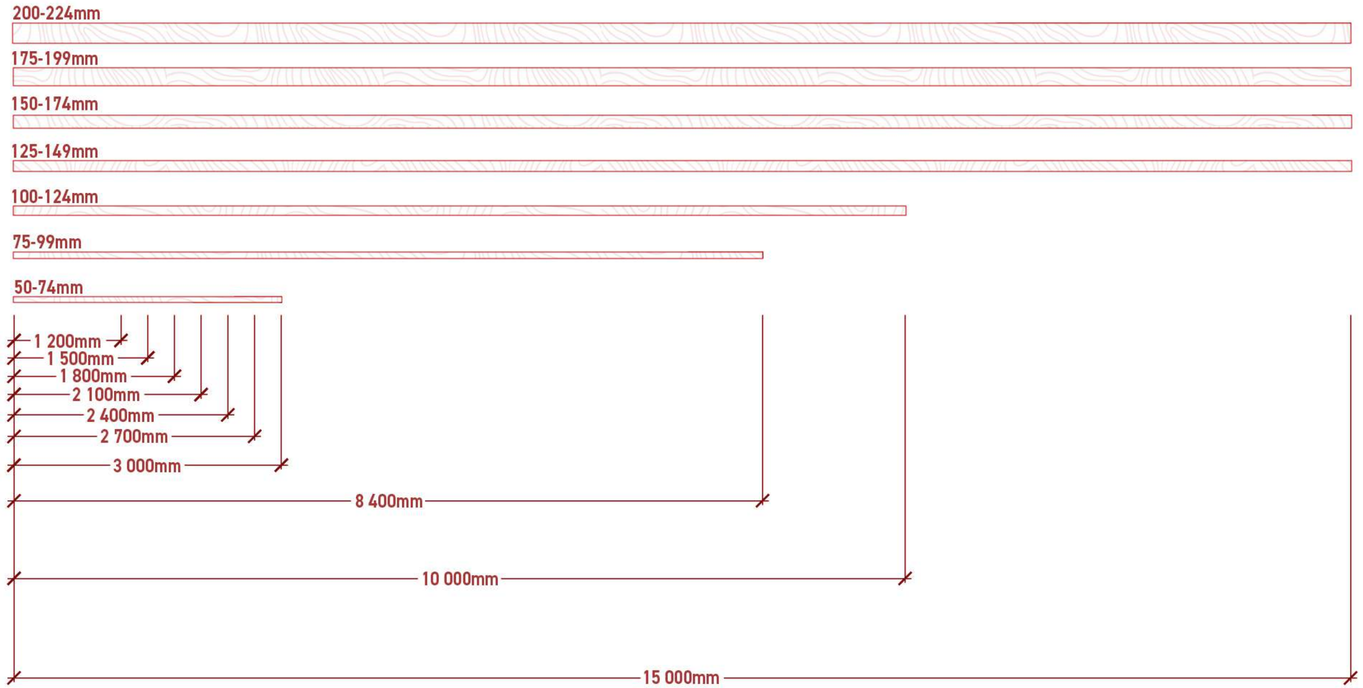
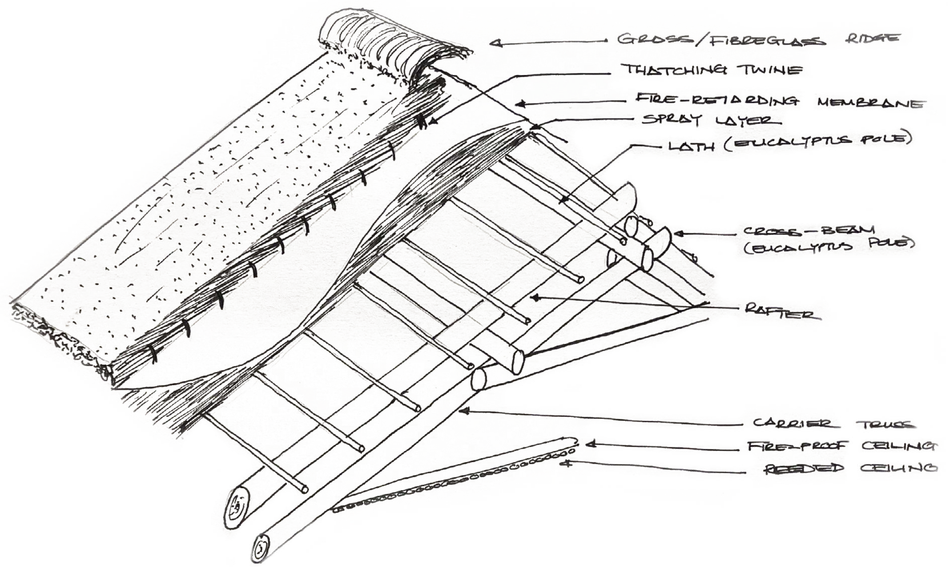


Fig 5.15
CCA Pole Dimension Diagrams
(Author,2024)

MATERIALS
THATCH



Thatch: A Sustainable and Iconic Roofing Choice

IN THE REGION

Thatch is a traditional roofing material extensively used throughout South Africa, particularly in the Lowveld, where it is a defining feature of lodges and nature reserves. From rest camps in the Kruger National Park, to Kruger Mpumalanga International Airport, thatch has become synonymous with safari experiences, tourist attractions, and homes. Its use in my design is both fitting and practical, as it is locally sourced and sustainable. Additionally, the ability to incorporate patterns and shapes into the finish, adds a unique level of detail, enhancing the overall aesthetic of the design.

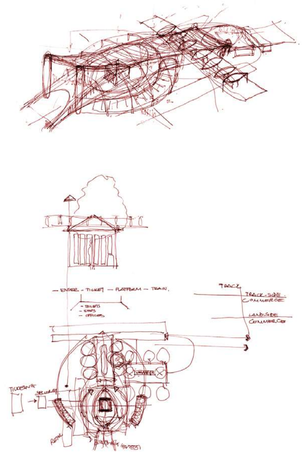


Fig 5.16
Typical Thatch Roof Construction
(Author, 2024)

Fig 5.17
Conceptual Sketches Exploring Organic Roofs
(Author, 2024)

MATERIALS
SPACE FRAME

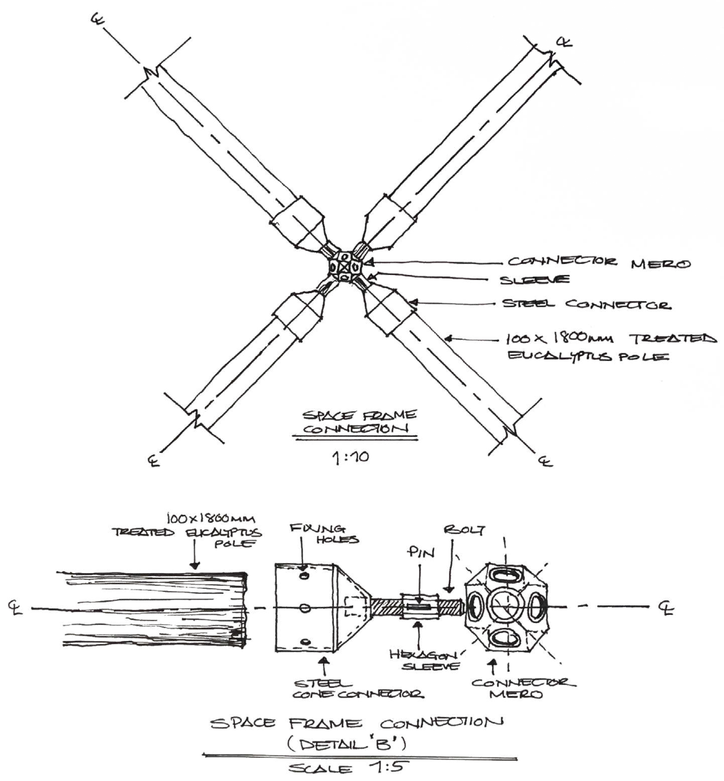


Fig 5.18
Space Frame Connection Detail
(Author, 2024)

Sustainable Space Frame Structures: Integrating Gum Poles in Modern Architecture

REINTERPRETING THE LAPA CONSTRUCTION METHODOLOGY

Space frame technology in architecture provides a lightweight and structurally efficient solution for large-span buildings. Using eucalyptus gum poles as cross members instead of steel, makes the structure more sustainable in terms of material sourcing and reinterprets the traditional thatch roof design. The inherent strength and flexibility of gum poles support this alternative method, while creating a familiar exposed structure that blends seamlessly with the natural surroundings, making it an ideal choice for minimizing a building's environmental impact.

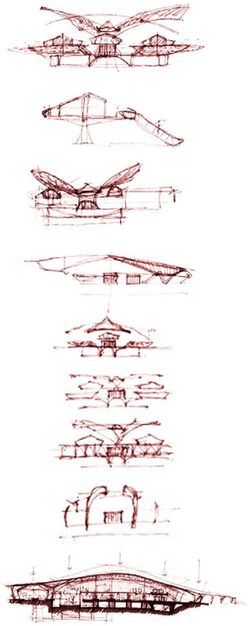


Fig 5.19
Conceptual Sketches Exploring Structure
(Author, 2024)

MATERIALS
COMPOSITE STRUCTURAL SYSTEM

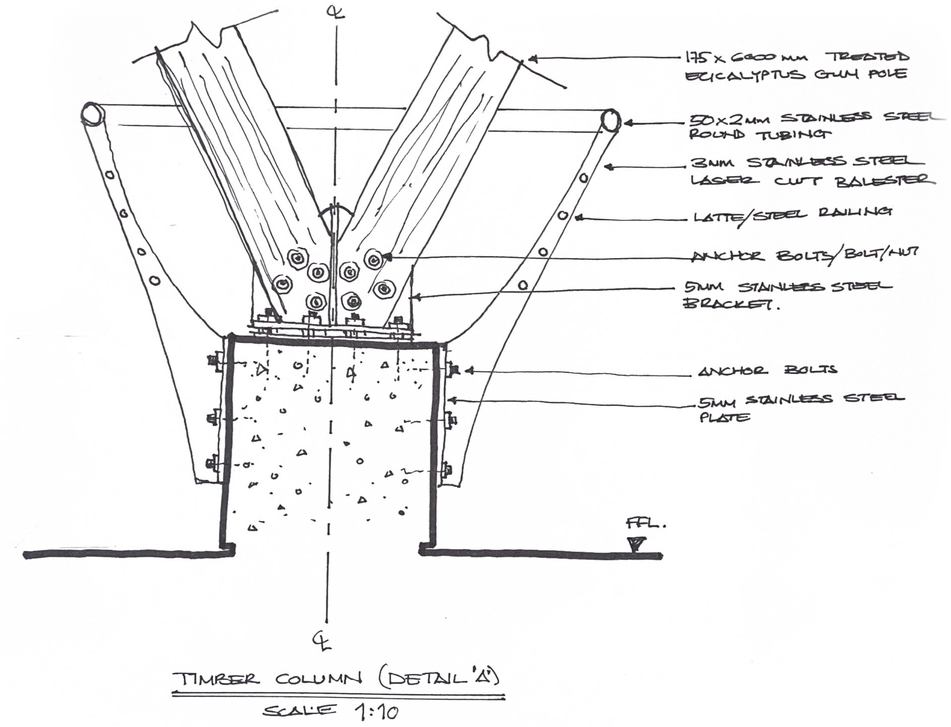


Fig 5.20
Space Frame Connection Detail
(Author, 2024)

Highlighting Composite Structural Systems in Design

COMPOSITE STRUCTURAL SYSTEM

Composite structural systems involve combining different materials to create a structural framework. In my design, I experimented with timber, concrete, and steel to achieve the desired structural form. With this in mind, I have chosen to highlight these materials and their connections, ensuring that the structural system is visible and that the details of these junctions are celebrated rather than hidden. Emphasising the structure is an aesthetic choice and a sustainable one, as it eliminates the need for additional materials to conceal it.

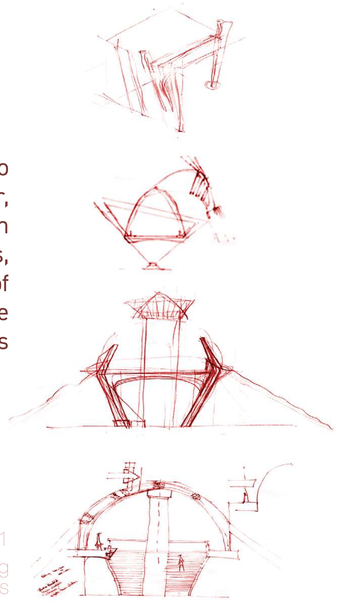


Fig 5.21
Conceptual Sketches Exploring Material Junctions and Forms
(Author, 2024)



MATERIALS
DESIGN PALETTE

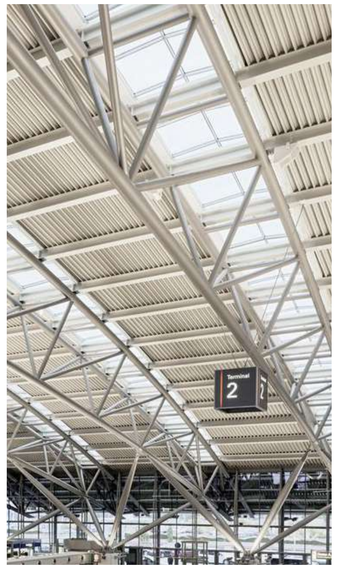














CONCRETE

A textured concrete finish with a brown tint creates a warm and tactile surface that responds to the natural context, as well as, vernacular building material tones. It also creates a visual connection with the timber used in the structure.

TIMBER

Eucalyptus Gum poles are used for structural elements in the space frame structure, as well as, column systems. Latte is used for screening and ties back to the texture and irregular patterns of thatch.

THATCH

Thatch is commonly used in commercial lodges and privates homes in the lowveld. It is a material that is synonymous with safaris and has been used for centuries as a roofing material in the region. This structure aims to reinterpret the traditional thatch roof and challenge the conventions of its application and construction.

STEEL

The use of steel in the structure is simply for spanning larger distances of the roof structure and providing junctions between the concrete and timber. Steel space frame connectors are used to join the timber members and steel brackets are used to fix the timber columns to the concrete footings.

CARVED SURFACES

An integral part of African art and sculpture, are the patterns created on otherwise simple surfaces. This idea of manipulating a material and creating patterns and textures is explored in the otherwise plain surfaces found in architecture, such as, walls, floors and other surfaces.

Fig 5.22
previous spread (far left)
Concrete Colour Swatches
(Baresque, n.d)

Fig 5.23
previous spread (left)
Gum pole
(Fotograf, n.d.)

Fig 5.24
previous spread (left)
Timber Screen Cladding
(Godsell, 2001)

Fig 5.25
previous spread (middle)
Thatch Roof
(Lindhe, 2024)

Fig 5.26
previous spread (right)
Steel Space Frame
(FloorNature, n.d.)

Fig 5.27
previous spread (far right)
Carving Timber
(Gallegos, n.d.)

EXISTING FORMS
THE STATION



Fig 5.28
above
Photograph of Northern Elevation of Nelspruit Train Station
(Author, 2024)

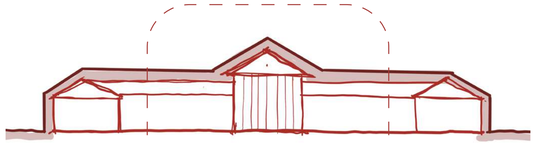


Fig 5.29
left
Proportion Diagram
(Author, 2024)

The train station consists of a main ticketing hall flanked by two administrative wings. This single-storey building, located beside the tracks, features a ticketing hall approximately eight meters tall and spans around 80 meters in width. Despite its size, the station is almost hidden from the street by tall trees lining the pavement. The symmetrical structure offers cues and opportunities for design intervention. Aligning with the existing roof line, establishes a clear datum for the intervention, creating a seamless connection between the new and existing structures.

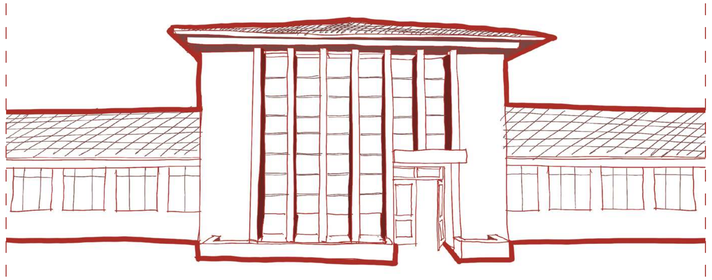


Fig 5.30
South Facade Sketch of Nelspruit Train Station
(Author, 2024)



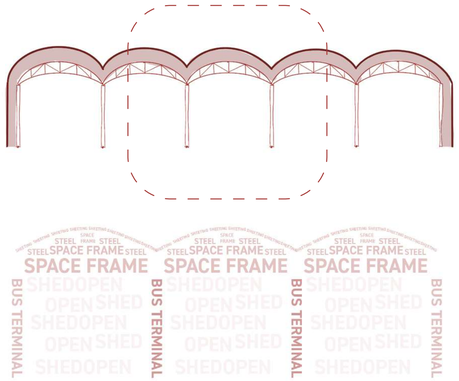
EXISTING FORMS
THE BUS TERMINALS



Fig 5.31
above
View of Mbombela Taxi Rank
(Google Street View, 2020)

Fig 5.32
right
Space Frame System Sketch
(Author, 2024)

The shed has become a familiar structure in train stations and large public transportation buildings. Bus terminals, airports, and train stations incorporate this expansive sheltered space to protect passengers from the elements while also unifying the entire programme under a single roof. In Mbombela's climate, where protection from the sun and rain is essential, the shed provides much-needed relief, creating a unified space for the building programme and the broader transportation hub precinct. It also serves as a way-finding element in both the city and within the transportation hub.



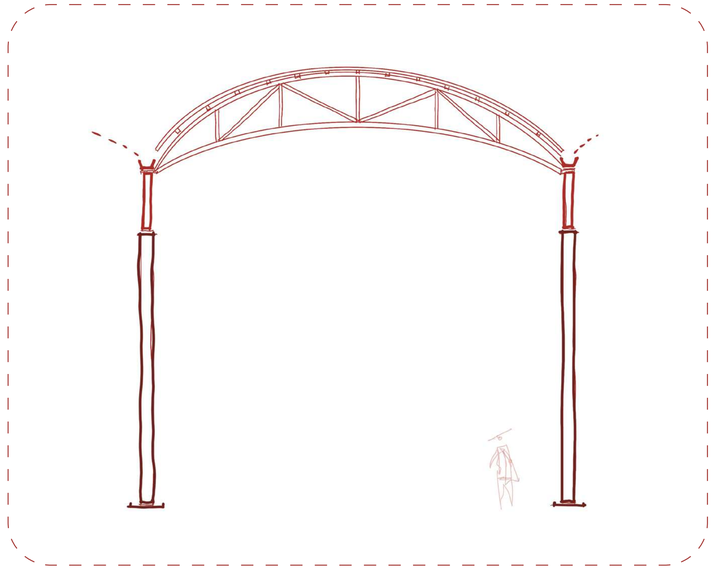


Fig 5.33
right
Space Frame Section Detail
(Author, 2024)

CONCLUSION

This chapter provides an overview of the challenges and opportunities within South Africa's transport infrastructure, focusing on the rail network and station design. Rohan Vos's experience with Rovos Rail highlights the decline in railway infrastructure and the need for well-designed, functional train stations. The discussion around the Centane transport hub further emphasizes the importance of suitable infrastructure to meet local needs. The chapter also explores and compares different architectural solutions, such as, timber use and thatch roofing with space frame technology, to create sustainable, climate-resilient buildings. Overall, it underscores the necessity of integrating thoughtful design with practical considerations to enhance the functionality and aesthetic of transportation facilities.

CHAPTER 6
VIABILITY REPORT

VIABILITY REPORT
THE SCOPE OF WORKS

The scope of works involves designing a transportation hub in Nelspruit, situated at the largest train stationin the city and adjacent to bus terminals and a shopping plaza. This hub will facilitate seamless connectivity between private e-hailing services, taxis, buses, and private vehicles, addressing the fragmented transportation system in Mpumalanga province. Its primary goal is to link commuters to workplaces, tourists to attractions, and freight to international ports. The design must prioritize efficient flow of passengers and vehicles, incorporate modern amenities, ensure accessibility for all users, and integrate sustainable transportation solutions.

QUESTIONS

WHY?

The transportation hub's design aims to address the existing fragmentation within the transportation system, predominantly reliant on road networks, by providing a centralized facility for inter-modal transportation. By facilitating seamless connections between various modes of transportation, the hub seeks to enhance accessibility within the province and promote connectivity to destinations beyond its borders. This initiative strives to create a more integrated and efficient transportation network, fostering economic growth, social mobility, and sustainable development within the region.

WHO?

The intervention is going to be designed to be used by the local city community, people from neighbouring towns and villages looking to commute for work or play, tourists who are looking for cheaper/alternative modes of travel to their destinations and students going to school. The intervention will also house commercial facilities and therefore, will also be used by shoppers and shop workers.

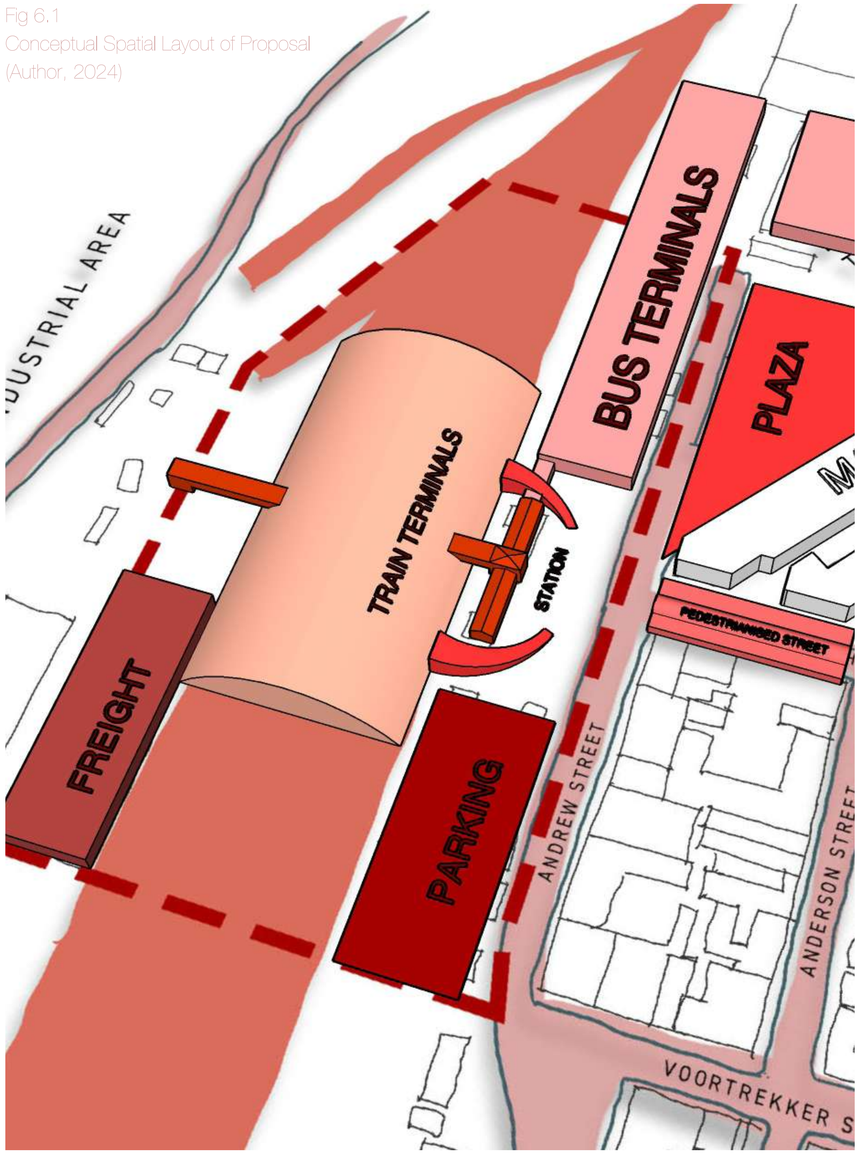
WHAT?

A mixed-use transportation hub that serves the city's transportation needs and acts as a conduit for movement and trade.

WHERE?

The hub is to be located in the centre of the city, alongside an existing taxi-rank, a shopping plaza and the current unused train station.

Fig 6.1
Conceptual Spatial Layout of Proposal
(Author, 2024)





NARRATIVE
THE TOURISTS

A young Spanish couple has come to South Africa to spend nine weeks touring South Africa. They have taken a touring bus from OR Thambo International airport and have decided to start their tour in the Kruger Park. The bus has taken them to the Mbombela Train Station for them to take the train to the Skukuza rest camp in the Kruger National Park. There, they will take a private game vehicle to tour the park.

As they arrive at the station, the unload their baggage and load it onto a luggage cart. They push their cart through the automatic doors step into the air-conditioned station, out from the hot humid climate of the Lowveld. Their English is not perfect, so they make their way to the information desk to get directions on where to go to catch their train. They have digital boarding passes and are due to check-in an hour.

The couple have travelled a long distance and are hungry. Once they have their direction, they decide to have a quick bite to eat at one of the restaurants in the station. They have their baggage with them and sit down for their meal.

They have eaten and paid their bill, and now want to use a bathroom before the hour and a half journey to Skukuza by rail. They make their way to the boarding terminal, delighted to find the ablution facility close by. They also find a baggage hold desk to keep watch of their luggage while they visit the restrooms.

Once done, they pass through the security terminal and walk towards the train. There are people waiting on comfortable benches for their train.

They board their train and make their way to the camp.

Fig 6.2
The Tourists
(Author, 2024)

NARRATIVE
JOSEPHINE

In city of Mbombela, Josephine, a South African woman in her forties, prepared herself for a journey back to her family in Bushbuckridge for Christmas.

She packed her large plastic travel bags with clothes, personal items and gifts for her two young children. She took a taxi from a nearby taxi rank in Mataffin to the train station in the city.

She was to board the new train from Mbombela to Bushbuckridge. Josephine arrived early at the station and took advantage of that to freshen up and do some shopping.

Josephine disembarked the taxi and made her way to the restrooms to freshen up. She found the facilities were very accommodating for travellers and their luggage and noted the generous space offered. Josephine then went on to do her shopping. Stepping out of the station into the heat of the summer sun, she took in the sights and sounds of the bustling plaza before her.

She meandered through the informal stalls dotted along the plaza, as well as, the larger store outlets. She decided to return to the station and enjoy a cool-drink and sit in the waiting area. She enjoyed the free WiFi and charging stations, they allowed her to recharge her phone and send messages to her family to share her whereabouts.

Her departure time soon arrived and she checked in at the counter and scanned her QR code ticket. She proceeded through the turnstile and headed toward the platforms. Following the directions on her ticket, she found herself on the tiled platform where an usher showed her to her seat on the train. She packed her luggage in the compartment overhead and settled in her seat. The train slowly began to pull out of the station head for home.



Fig 6.3
Josephine in the Plaza
(Author, 2024)

VIABILITY REPORT

EXECUTIVE SUMMARY

The viability report covers the following points pertaining to the project's viability and feasibility:
Client/ Developer
The Project Overview
Professional Team
Social Impact
Market/ Desirability
Financial
Procurement

This project proposes a multi-modal transportation hub centred around the Nelspruit Train Station and Mbombela Taxi Rank. The project aims to connect commuters, tourists and freight to the province and the rest of the country. The report lists the client, the site and the financial and social factors that influence the motivation for the proposed project

PROJECT DEFINITION

Transportation hub in the city of Mbombela, situated at the largest train station in the area and adjacent to bus terminals and a shopping plaza. This hub will facilitate seamless connectivity between rail, private e-hailing services, taxis, buses, and private vehicles, addressing the fragmented transportation system in the Mpumalanga province, as well as, South Africa at large. Its primary goal is to link commuters to workplaces, tourists to attractions, and freight to international ports. The design must prioritize the efficient flow of passengers and vehicles, incorporate modern amenities, ensure accessibility for all users, and integrate sustainable transportation solutions.

SITE SELECTION

OWNERSHIP:

The site is the Nelspruit Train Station, which belongs to the city of Mbombela and is used by state-owned parastatals Transnet and PRASA.

RIGHTS & OTHER CONSTRAINTS:

ERVEN	53/312 ; 149/312
ZONING	TRANSPORTATION
LAND USE OVERLAY	INDUSTRIAL/INDUSTRIAL GROWTH AREAS - PRIMARY USE: PUBLIC TRANSPORT RANK / RAILWAY STATION / RAILWAY LINE
COVERAGE, FAR, HEIGHT	AS APPROVED BY LOCAL MUNICIPALITY
PARKING	4,5 SPACES PER 100m² OFFICE FLOOR AREA AND 6 SPACES PER 100m² PUBLIC FLOOR
LOADING	2 SPACES PER FIRST 1000m² FLOOR AREA, OR PART THEREOF AND 1 SPACE PER EVERY 1000m² FLOOR AREA THEREAFTER
DENSITY	1 DU PER 120 SQM OR LESS (83+DU/HA)
BOUNDARY LINES	ON STREET: 8m ON REAR: 5m ON OTHER: 5m

FINANCIAL STRUCTURE

The funding is primarily sourced from public funds - funds allocated to the Department of Transport Budget (R20.6 billion for PRASA for the 2023/24 financial year) by government.

The land is owned by government and spans a large area along both sides of the tracks. The municipality can sub-divide the land to offer a commercial opportunity and collect funds to build the transportation hub. Private investment can also be encouraged to further expand public and private sector collaboration.

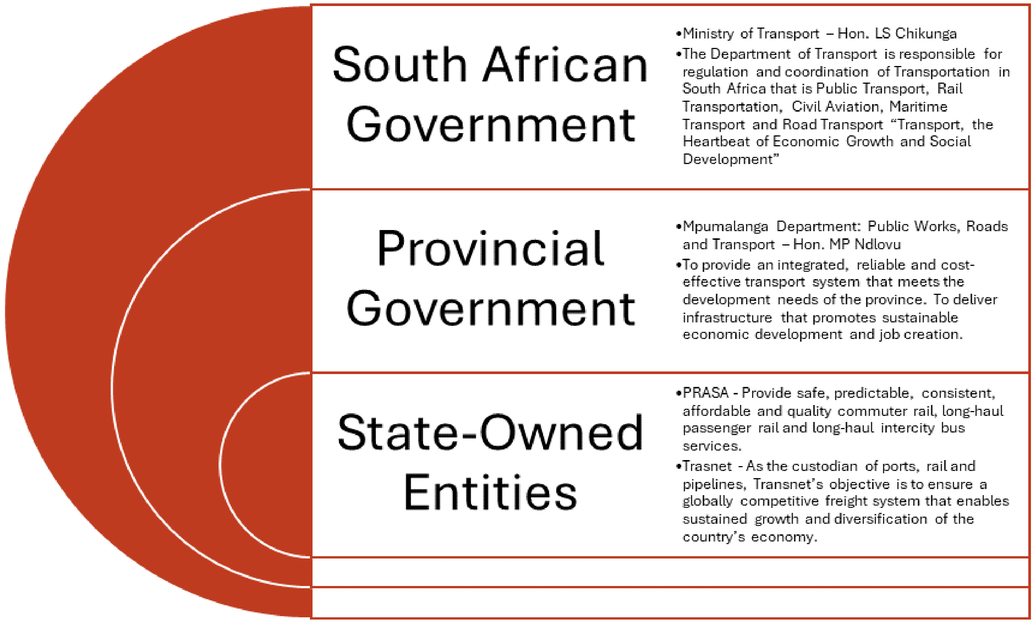
SUBSTANTIALLY PUBLICLY-FUNDED WITH ELEMENTS OF PRIVATE FUNDING

- Public funding for rail infrastructure
- Government can lease and/or make government land available for sale to carry the cost of development of the station precinct
- Surplus land can be sold to the private sector developers for relevant infrastructure redevelopment
- Fee and tax-based value capture
- Developer contributions

THE CLIENT

The client for this project would be the Department of Public Works, working closely with PRASA and Transnet, overseen by the Ministry of Transport. The Mbombela Inter-modal Transportation Hub is a facility that embodies a shared vision and strategy for all parties involved. Public transportation systems are a high priority for the ministry, and a facility that incorporates multiple modes of transportation, certainly elevates the progress of achieving that goal. The ministry has the objective to reduce carbon emissions from transportation and improve the country's carbon footprint. Their road-to-rail initiative has the potential to fast-track this objective with a facility such as this one.

ORGANISATIONAL STRUCTURE



The authorisation and initiation of the project is commissioned by the South African Government under the Department of Transport.

Under this, specialised entities, such as, PRASA and Transnet would act as representatives for the project proposal.

The existing facility is divided up by PRASA and Transnet as office space, workshops and storage facilities. The project will look at rehousing their respective administration spaces and reorganising their workshops and storage facilities.

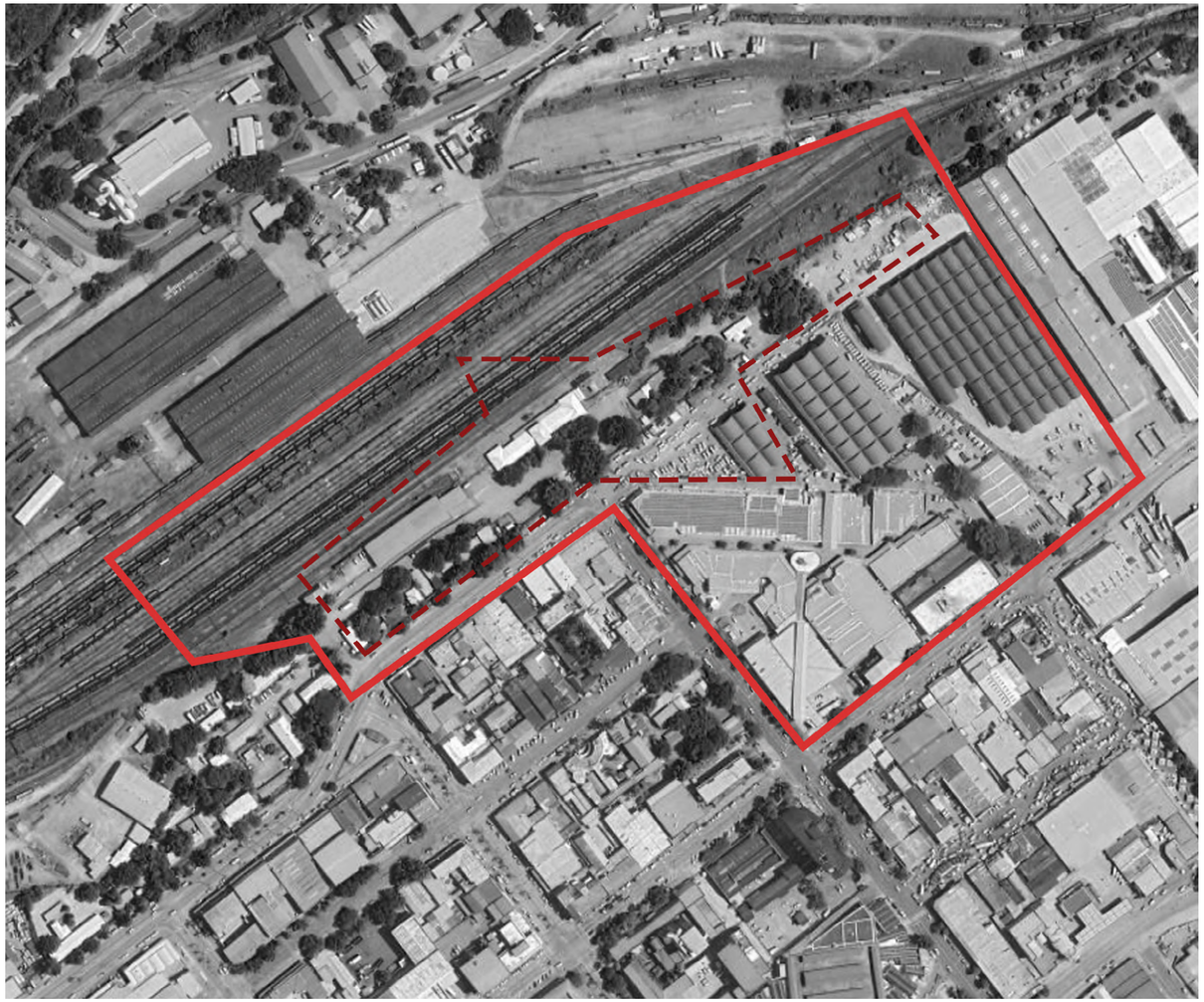


Fig 6.4
Site Extent
(Author - Derived from Google Maps 2024)

THE SITE

The site is currently used by PRASA and Transnet for administration offices and workshops. The main station building is divided up and used by both Transnet and PRASA. The station is currently unused by passengers, with the exception of private touring trains like Rovos Rail. The rest of the compound is made up of smaller office buildings and storage/workshop spaces. The intended site sits within a larger urban plan intention. The existing taxi rank and bus terminal adjacent to the shopping plaza borders the station perimeter to the south. The proposal seeks to integrate the facilities through engaging public space and pedestrianised routes.

SOCIAL IMPACT

The proposed facility would create jobs in many sectors. The following sectors are proposed as opportunities for skilled and unskilled workers:

Tourism
Passenger Rail Operations
Freight Rail Operations
Security
Maintenance and Cleaning
Retail
Informal Trade
Taxi, bus and e-hailing drivers

The project aims to enable and facilitate access to the economy for everyone. This has a profound impact on the development of the city, the economy and the country.

MARKET/DESIRABILITY

With the official unemployment rate of South Africa at 32.9% and the unemployment rate of Mpumalanga at 49.7%, there is definitely a desirability for a transport hub that facilitates movement and access to the economy. Access is what this project aims to facilitate. Mpumalanga is also responsible for the second highest share of foreign tourism, second to Gauteng. A direct and reliable mode of transportation to the province, creates an unquestionable feeding trough for the local economy's coffers. A re-established freight-by-rail system that is offered at a competitive price and turnaround time, would be desired by many industries looking to export their produce.

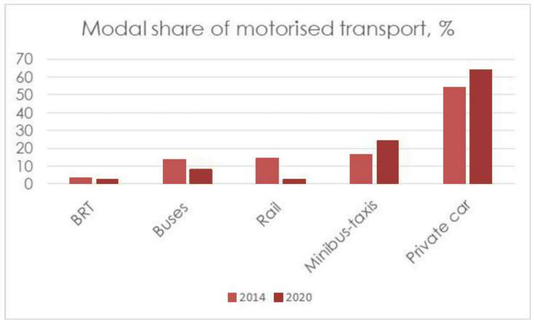


Fig 6.5
Modal Share of Motorised Transport % (CCT, 2023)

Hierarchical integration

- *Rail is not leading public transport*
- *On-demand (MBT and private car) share is increasing*
- *Share of scheduled services (BRT, bus and rail) is decreasing Shift rail to on-demand by increasing service frequency*

Operational integration

- *Multi-modal service planning account for the total time and cost of a journey for all types of users and trips*

Fare integration

- *Non-integrated fares that are inversely proportional to distance penalise transfers and discourage multi-modal integration*

INCOME AND EXPENSES

Designing, building, and operating a transportation hub in the city of Mbombela presents significant income and expense opportunities. The hub can potentially generate revenue through commercial leasing of retail spaces, advertising, ticketing fees, and parking services. The multi-modal transport system can also boost local economic activity by improving connectivity, attracting tourists, and boosting the economy by contributing to the city's GDP.

Careful financial planning and strategic partnerships are essential to balance these costs with the revenue potential, ensuring the transportation hub's economic viability and its contribution to Mbombela's urban growth.

CAPITAL COSTS

Land Ownership

Construction of Transport Hub

Zoning/Rezoning

Train Locomotives and carriages

Rail infrastructure upgrades

OPERATIONAL COSTS

Electricity

Water

Sewage

Wages & Salaries

Building Maintenance

Public Space Maintenance

Rail Maintenance

POTENTIAL INCOME SOURCES

Commercial Letting

Ticketing

Property Rental

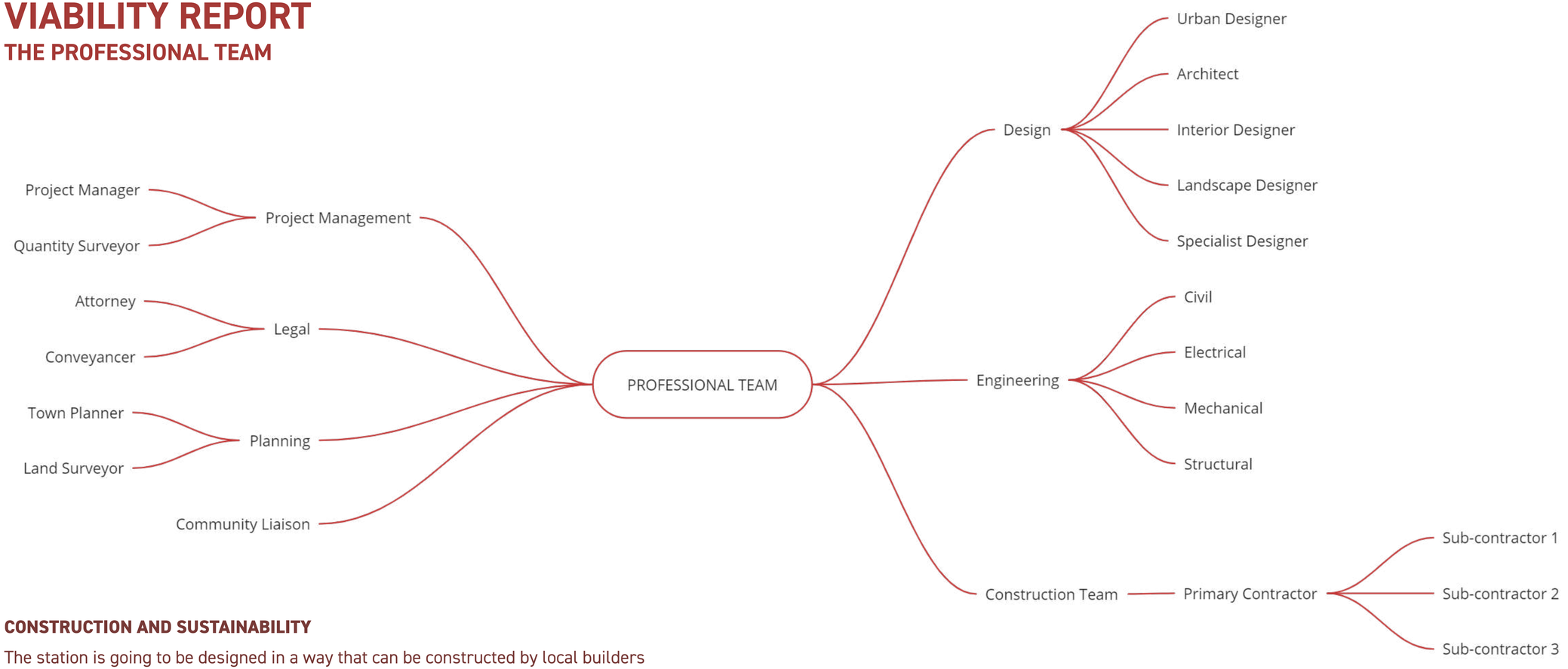
Land Sale

Advertising

Museum Tours

VIABILITY REPORT

THE PROFESSIONAL TEAM



CONSTRUCTION AND SUSTAINABILITY

The station is going to be designed in a way that can be constructed by local builders and artisans. Local building methods are woven into the parametric design theory to create architecture that is modern, functional, buildable, and evolves the vernacular.

The architecture aims to celebrate local customs, while expressing movement inter-connectivity. The facility aims to deliver public ownership and therefore encourage usage. Understanding how spaces are meant to work for intended use is important for the survival of the facility and ultimately its evolution and progression as time goes by.

CONTRACTING METHOD

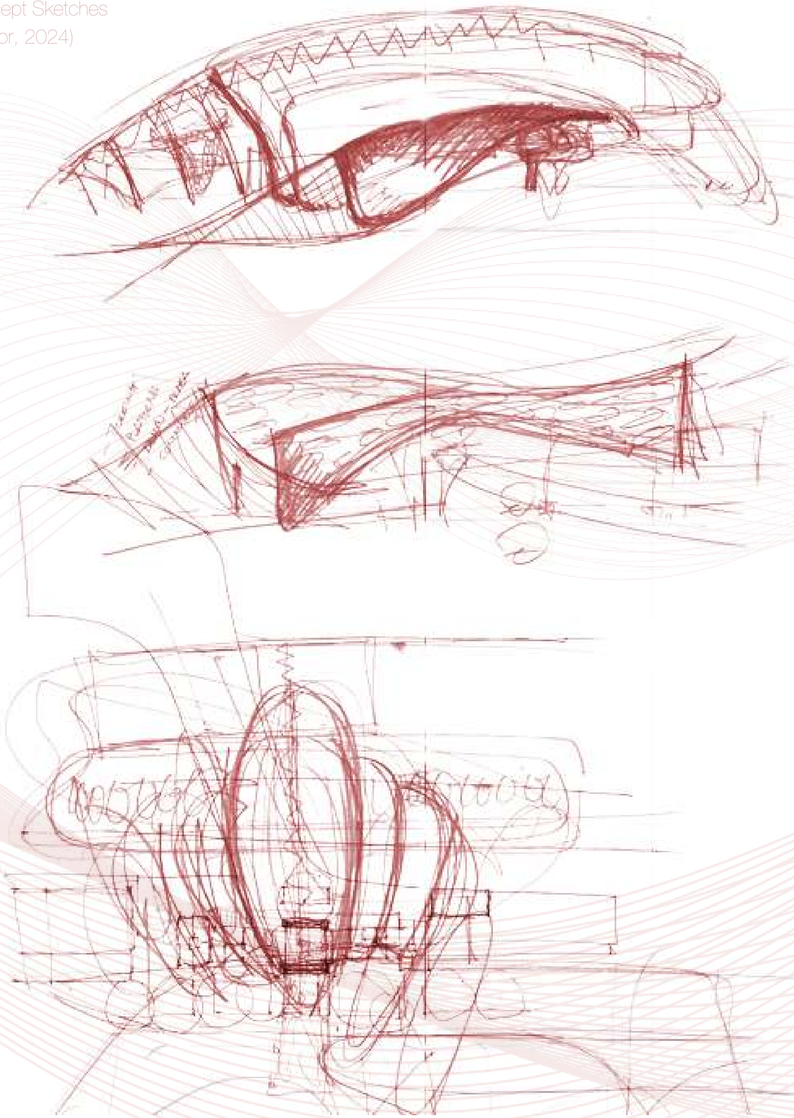
The project will be advertised as an OPEN TENDER through public media platforms.
This ensures:

- *Transparency*
- *Competitiveness*
- *The elimination of favouritism/nepotism*

VIABILITY REPORT
ESTIMATED COSTS

PROGRAMMING	AREAS	QTY	RATE	LINE TOTAL
Administration Offices	Open Plan Offices, Small Offices, Medium Offices, Large Offices, Board Rooms, Tea Room, Ablutions	500**m²**	R14 900.00/**m²**	R7 450 000.00
Community Spaces	Amphitheatre, Plaza	180**m²**	R19 500.00/**m²**	R3 510 000.00
Parking	Staff Basement, Commuters Basement, Commuters On-grade	3000m² and 200+ bays	R330 000.00 per bay	R66 000 000.00
Building Services	Fire, HVAC	13 700**m²**	R2 400.00/**m²**	R32 880 000.00
Service Roads		200m	R27 000.00/m	R5 400 000.00
Terminals	Departure Terminal, Arrival Terminal, Transfers	1700**m²**	R35 000.00/**m²**	R59 500 000.00
Retail Space	Grocery Store, Pharmacy, Book Store, Restaurants, Government Department Offices	8000	R14 150.00	R113 200 000.00
Ablutions	Male, Female, Unisex, Baby, Disabled, Staff	500	R12 500.00	R6 250 000.00
Mini-Hotel	20 Rooms, Lobby, Dining Hall, Conference Rooms	1000	R2 125 000.00 per key	R42 500 000.00
	Estimated Building Cost:			**R331 290 000.00**
	Estimated m² Cost		**@15 000m²**	**R22 234.23**

Fig 7.1
Concept Sketches
(Author, 2024)



CHAPTER 7
DESIGN DEVELOPMENT

DESIGN CHARETTE

SKETCH FORMS

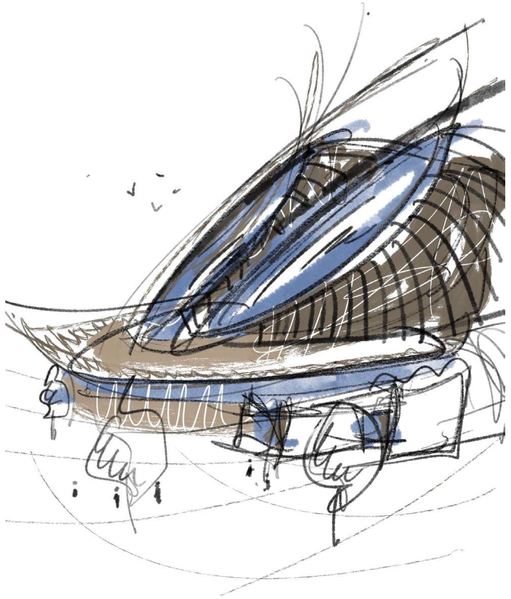


Fig 7.2
Concept Sketch 1
(Author, 2024)

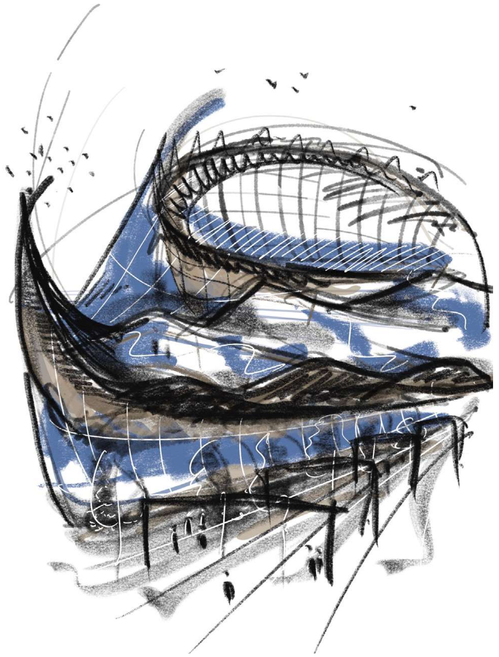


Fig 7.3
Concept Sketch 2
(Author, 2024)



Fig 7.4
Concept Sketch 3
(Author, 2024)

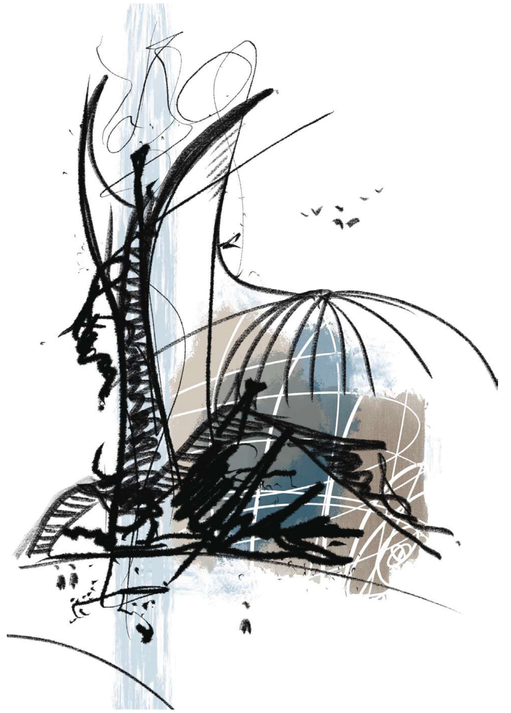


Fig 7.5
Concept Sketch 4
(Author, 2024)

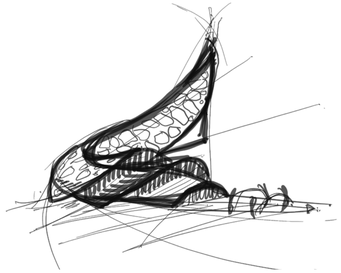


Fig 7.6
Concept Massing Sketch 1
(Author, 2024)

Fig 7.6.1-6.16
Adobe Firefly generated images
(Adobe Firefly, 2024)

DESCRIPTION TO FIREFLY AI:

(USED FOR ALL ITERATIONS)

A sleek, state-of-the-art train station situated in the heart of Mbombela. The architecture of the building is fluid, drawing inspiration from the intricate pattern of a giraffe's skin for its facade. Adjacent to the station, there is a mall with an adjoining plaza. The station building also incorporates a bridge that spans across the train tracks, serving as both a functional passageway and an extension of the office space within the building. Additionally, the bridge features viewing decks that offer panoramic vistas of the city and the bustling train tracks.



Prompts:
Architectural Concept, Realistic, Concrete, Glass, City
Reference: Fig 7.6
Composition: Fig 7.6

Prompts:
Architectural Concept, Realistic, Concrete, Glass, City
Reference: Last image of first lot of four AI generated images
Composition: Fig 7.6

Prompts:
Architectural Concept, Realistic, Concrete, Glass, City
Reference: Last image of second lot of four AI generated images
Composition: Fig 7.6

Prompts:
Architectural Concept, Realistic, Concrete, Glass, City
Reference: Last image of third lot of four AI generated images
Composition: Fig 7.6

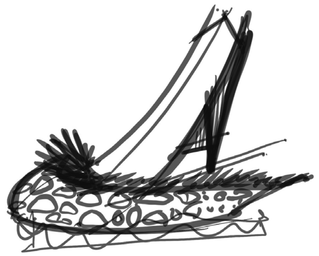


Fig 7.7
Concept Massing Sketch 2
(Author, 2024)

Fig 7.7.1-.16
Adobe Firefly generated images
(Adobe Firefly, 2024)






Prompts:
Architectural Concept, Realistic, Thatch, Traditional African Patterns,African City
Reference: Fig 7.7
Composition: Fig 7.7






Prompts:
Architectural Concept, Realistic, Thatch, Traditional African Patterns,African City
Reference: Last image of first lot of four AI generated images
Composition: Fig 7.7






Prompts:
Architectural Concept, Realistic, Thatch, Traditional African Patterns,African City
Reference: Last image of second lot of four AI generated images
Composition: Fig 7.7






Prompts:
Architectural Concept, Realistic, Thatch, Traditional African Patterns,African City
Reference: Last image of third lot of four AI generated images
Composition: Fig 7.7

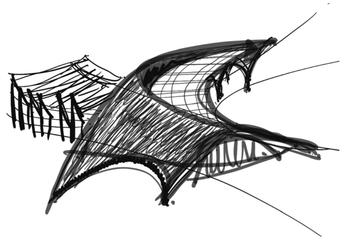


Fig 7.8
Concept Massing Sketch 2
(Author, 2024)

Fig 7.8.1-8.16
Adobe Firefly generated images
(Adobe Firefly, 2024)



Prompts:
Architectural Concept, Realistic, Thatch, Traditional African Patterns,Reed Screening, Glass, Train Station, Transport Hub
Reference: Fig 7.8
Composition: Fig 7.8

Prompts:
Architectural Concept, Realistic, Thatch, Traditional African Patterns,Reed Screening, Glass, Train Station, Transport Hub
Reference: Last image of first lot of four AI generated images
Composition: Fig 7.8

Prompts:
Architectural Concept, Realistic, Thatch, Traditional African Patterns,Reed Screening, Glass, Train Station, Transport Hub
Reference: Last image of second lot of four AI generated images
Composition: Fig 7.8

Prompts:
Architectural Concept, Realistic, Thatch, Traditional African Patterns,Reed Screening, Glass, Train Station, Transport Hub
Reference: Last image of third lot of four AI generated images
Composition: Fig 7.8

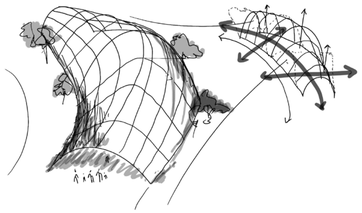


Fig 7.9
Concept Massing Sketch 2
(Author, 2024)

Fig 7.9.1-9.16
Adobe Firefly generated images
(Adobe Firefly, 2024)






Prompts:
Architectural Concept, Realistic, Sheeting, Textured Natural Material,Cladding, Glass, Train Station, Transport Hub
Reference: Fig 7.9
Composition: Fig 7.9






Prompts:
Architectural Concept, Realistic, Sheeting, Textured Natural Material,Cladding, Glass, Train Station, Transport Hub
Reference: Last image of first lot of four AI generated images
Composition: Fig 7.9






Prompts:
Architectural Concept, Realistic, Sheeting, Textured Natural Material,Cladding, Glass, Train Station, Transport Hub
Reference: Last image of second lot of four AI generated images
Composition: Fig 7.9






Prompts:
Architectural Concept, Realistic, Sheeting, Textured Natural Material,Cladding, Glass, Train Station, Transport Hub
Reference: Last image of third lot of four AI generated images
Composition: Fig 7.9

DESIGN CHARETTE

SKETCH MODELS





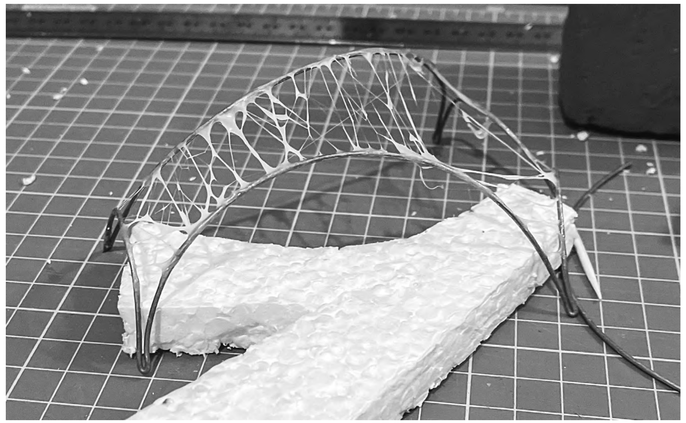


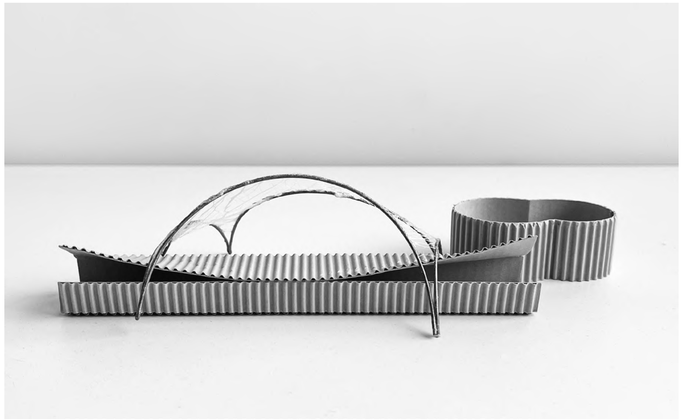
Fig 7.10-12
Concept Model 1
(Author, 2024)

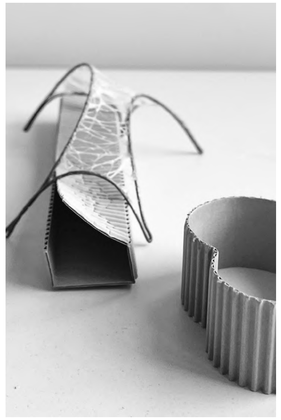
LAYERS AND MATERIAL JUXTAPOSITION

These charette models explore the layering of materials and the different spatial qualities that are developed in the folds and junctions where different materials converge. They also explore the relationship between the space and the method of making, focussing on how the space feels and looks as a consequence of the choice of material and the method of making employed.

Fig 7.13-16
Concept Model 2
(Author, 2024)







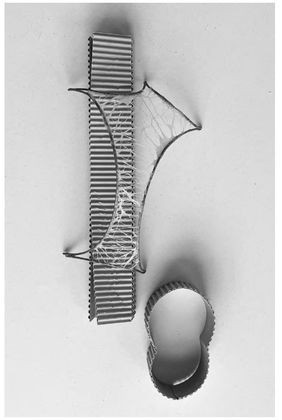


Fig 7.17
Making of Concept Model 3
(Author, 2024)

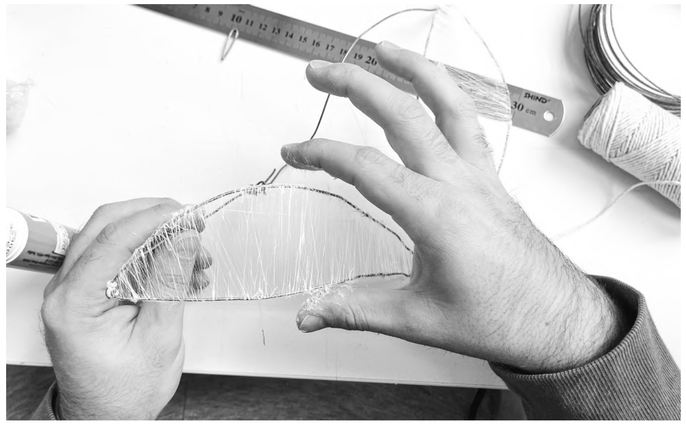
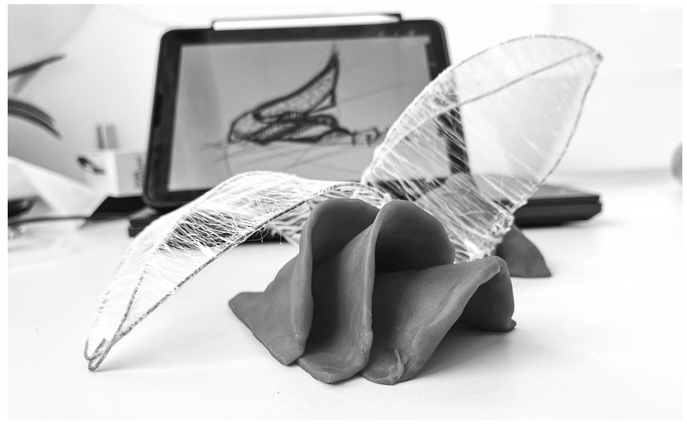


Fig 7.18-19
Concept Model 3
(Author, 2024)



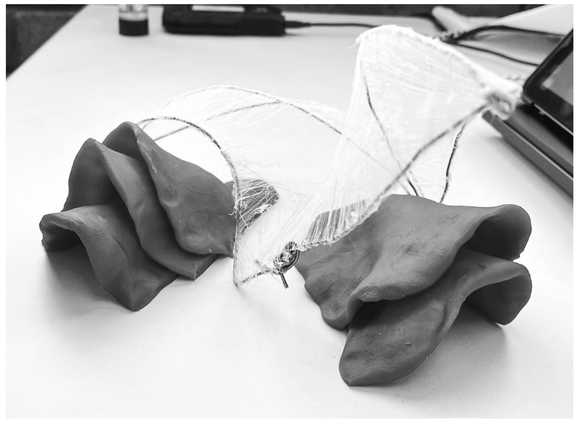
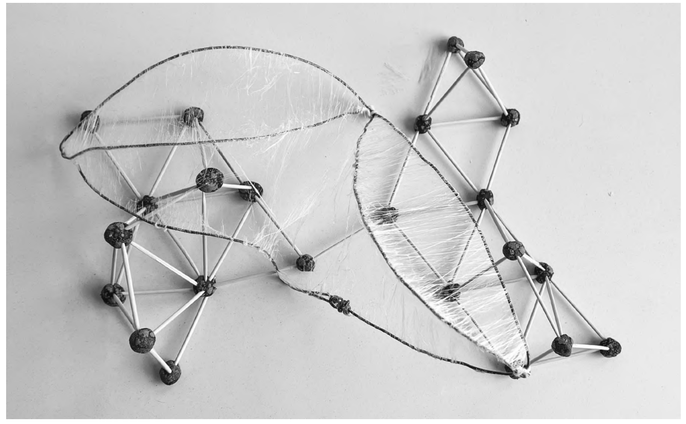
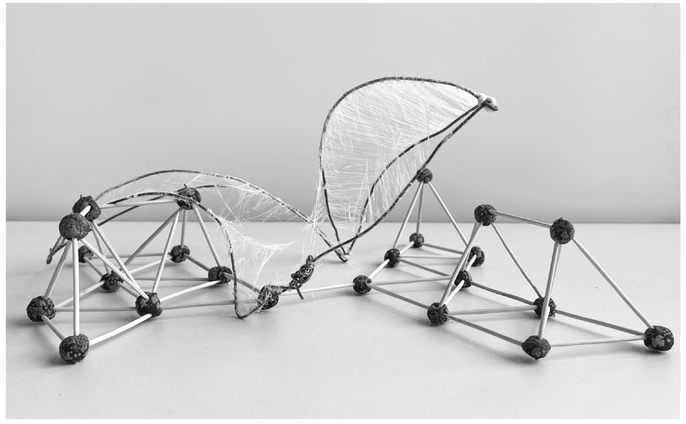
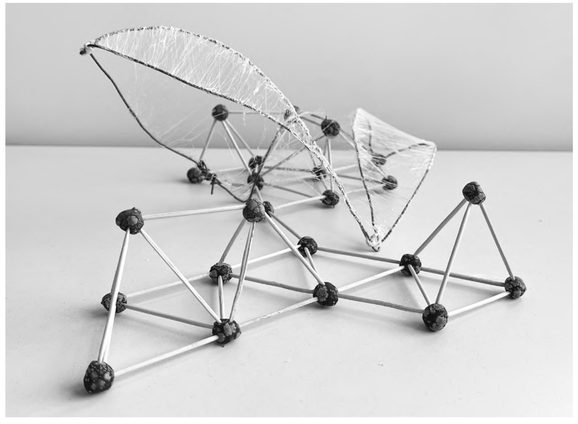
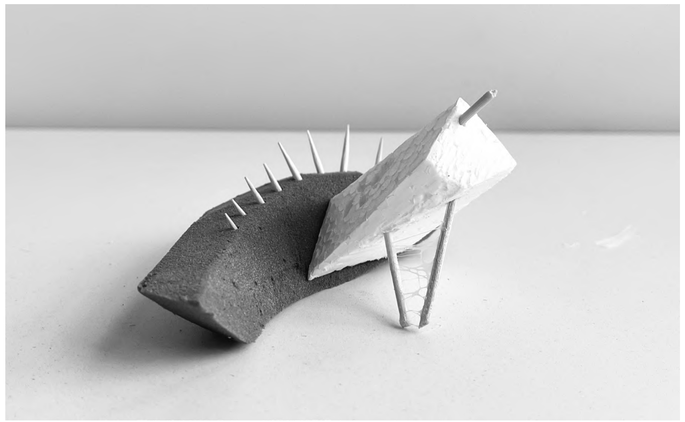


Fig 7.20-22
Concept Model 4
(Author, 2024)









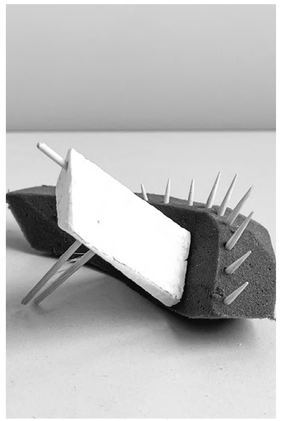




Fig 7.23-25
Concept Model 5
(Author, 2024)

AFRICAN ARCHITECTURE AND PARAMETRICISM

Parametric design principles pivot on the idea that all elements of the design become variable and mutually adaptive according to certain external parameters. Afro-centric architecture seeks to develop a modern African style that reflects the continent's cultural heritage and identity. The design of the Mbombela Inter-modal Station should draw inspiration from traditional African architectural elements, such as, the use of natural materials, symbolic motifs and communal spaces. This model exploration looks at incorporating parametricism and Afro-centric architecture.







Fig 7.26-28
Concept Model 6
(Author, 2024)



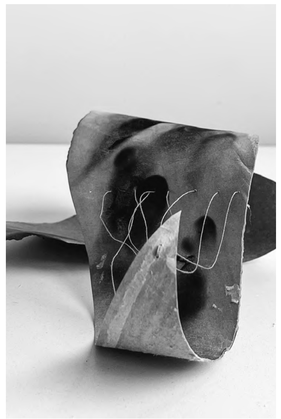


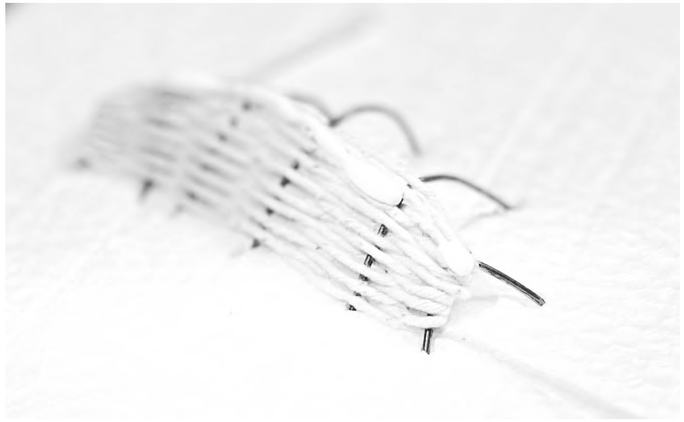


Fig 7.29-31
Concept Model 7
(Author, 2024)

AGING OF MATERIALS AND THE AESTHETIC

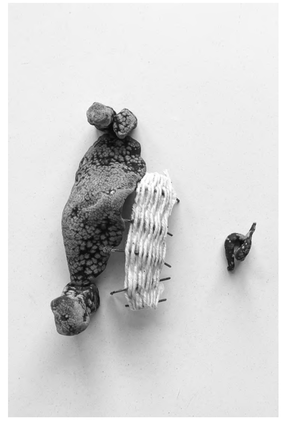
All materials undergo ageing or decay in one way or another. For instance, concrete darkens with weathering, while copper develops a green patina. Materials react to the environment and as such, need to be considered when developing a material palette for designing. These models explore this understanding of material behaviour through burning and crystallisation, revealing patterns that inform ideas about surface pattern variation and creating a layered facade with greater visual interest by leveraging the material's behaviour in its environment.

Fig 7.32-35
Concept Model 8
(Author, 2024)









INITIAL CONCEPTS

The drawings alonside describe the thought process of designing for different parts of the inter-modal transportation hub. The sketch designs explore ideas generated from Firefly AI, as well as, other ideas that respond to site. The initial sketches explore the Entrance as a journey that becomes the memorial space, through metaphoric extressions of incarceration and liberation. In addition to this, they explore the public space, as well as, the platform structure and relationship to the station and the urban fabric of the city.

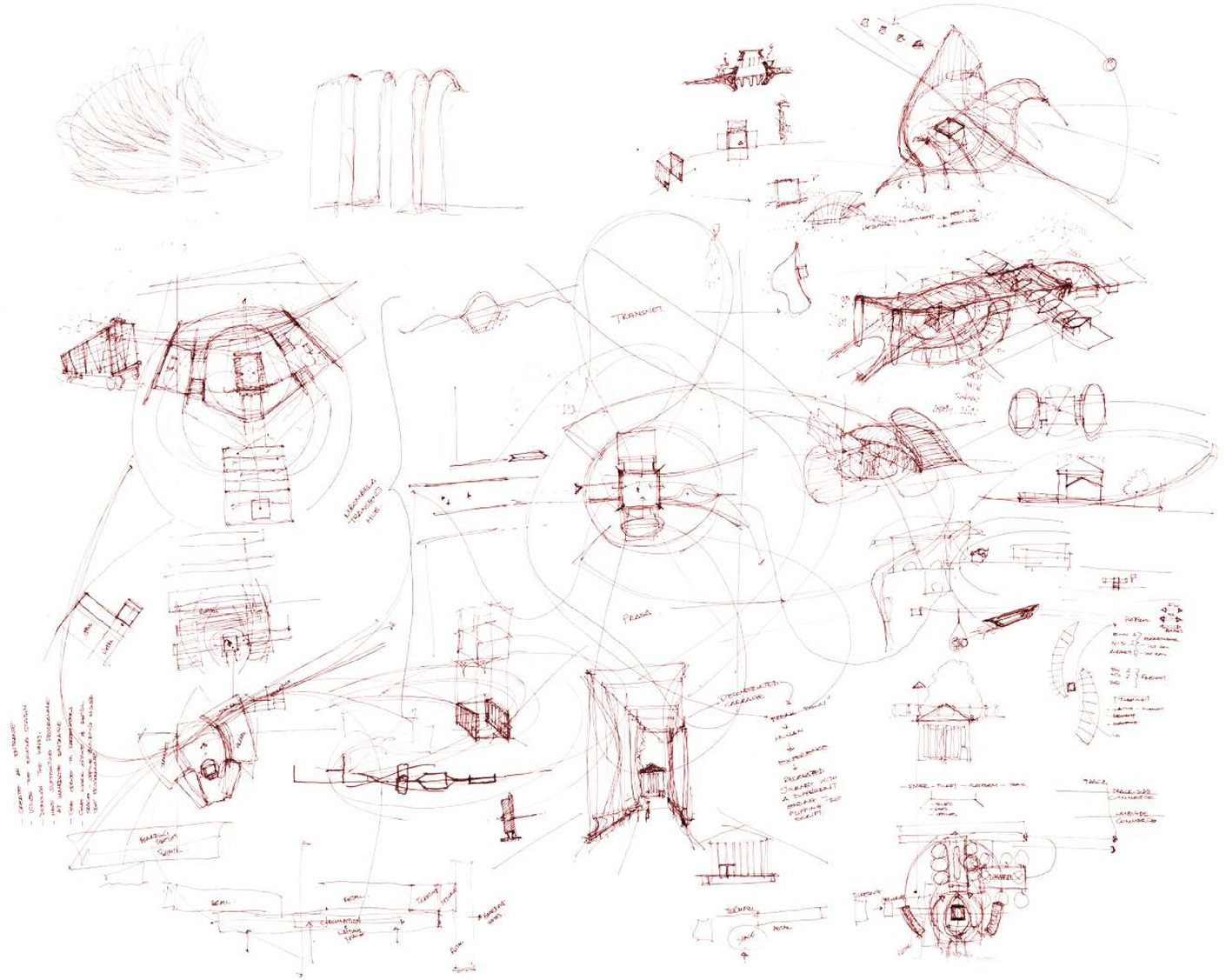
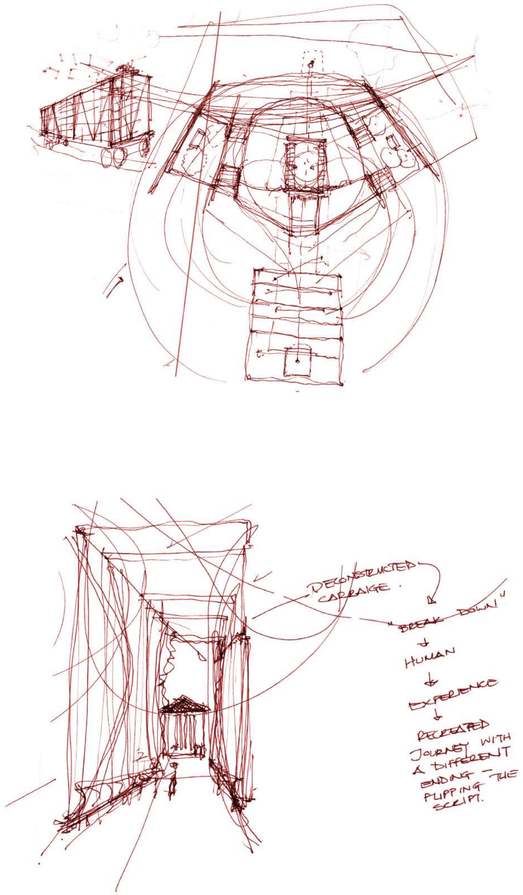
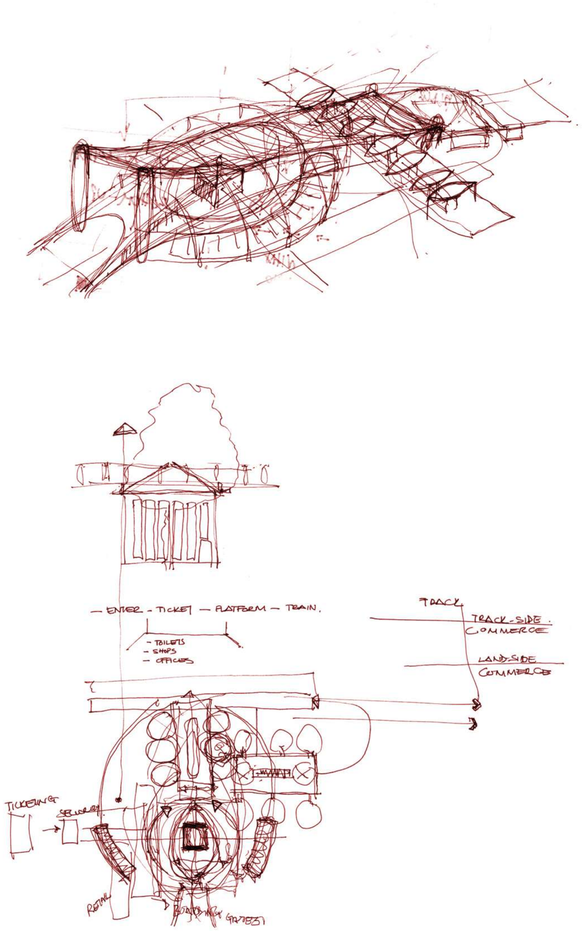


Fig 7.36
Concept Sketches
(Author, 2024)

ENTRANCE CONCEPT



PUBLIC FORUM INTERACTION



PLATFORM STRUCTURE & RELATIONSHIP

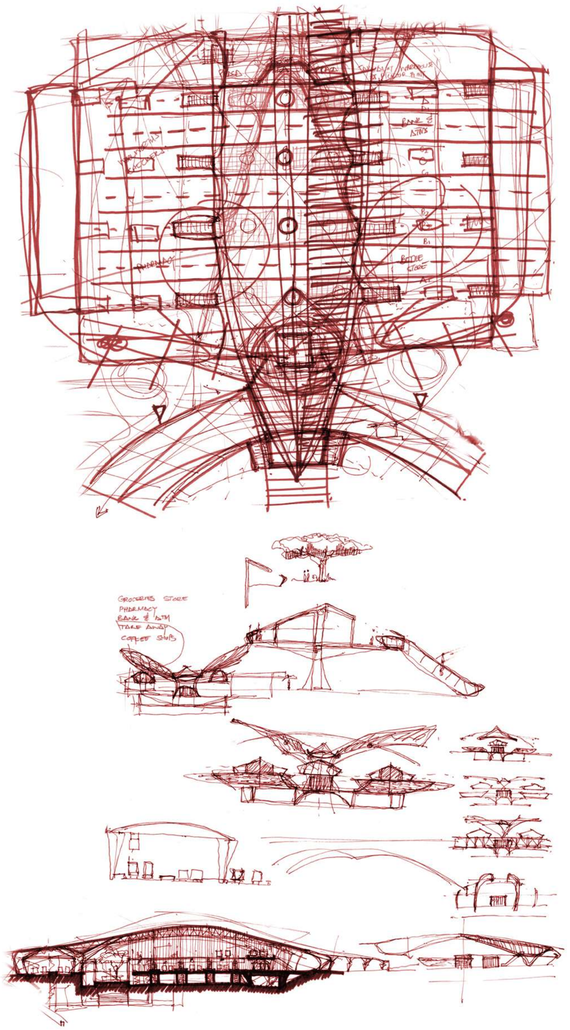
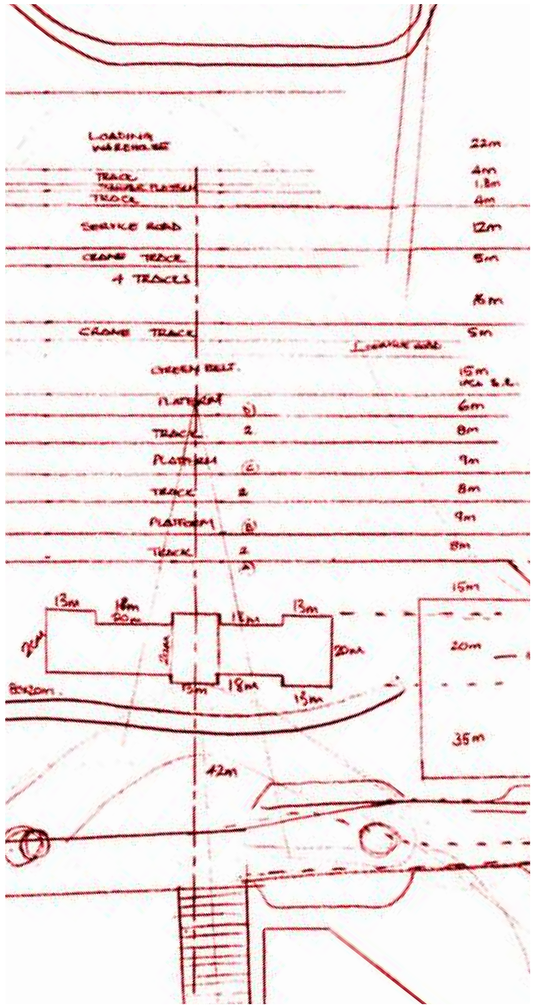
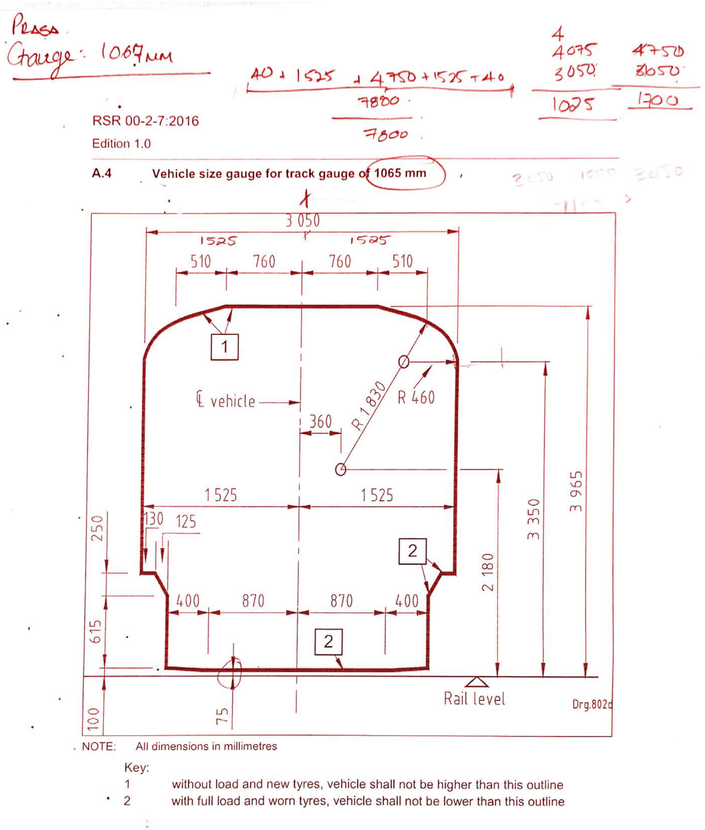


Fig 7.37-39
Concept Sketches of Entrance,Public Forum and Platforms
(Author, 2024)

TRACK GAUGE DIMENSIONS

SETTING OUT A PLATFORM SIZE





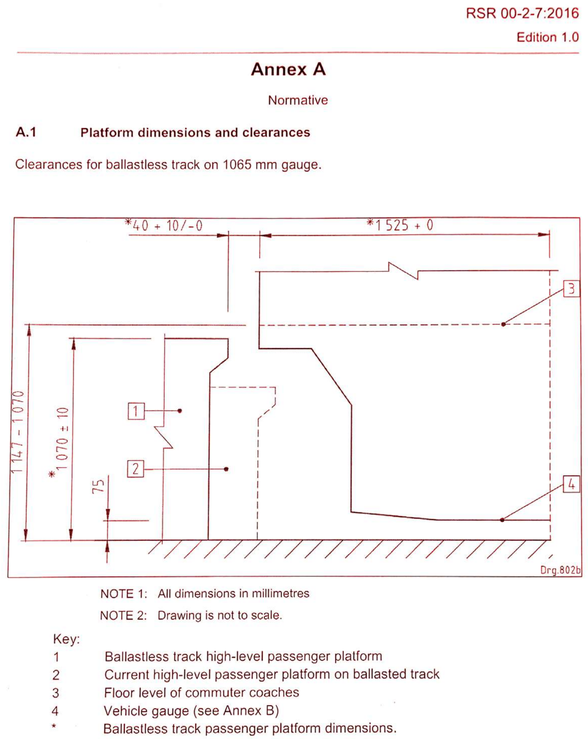


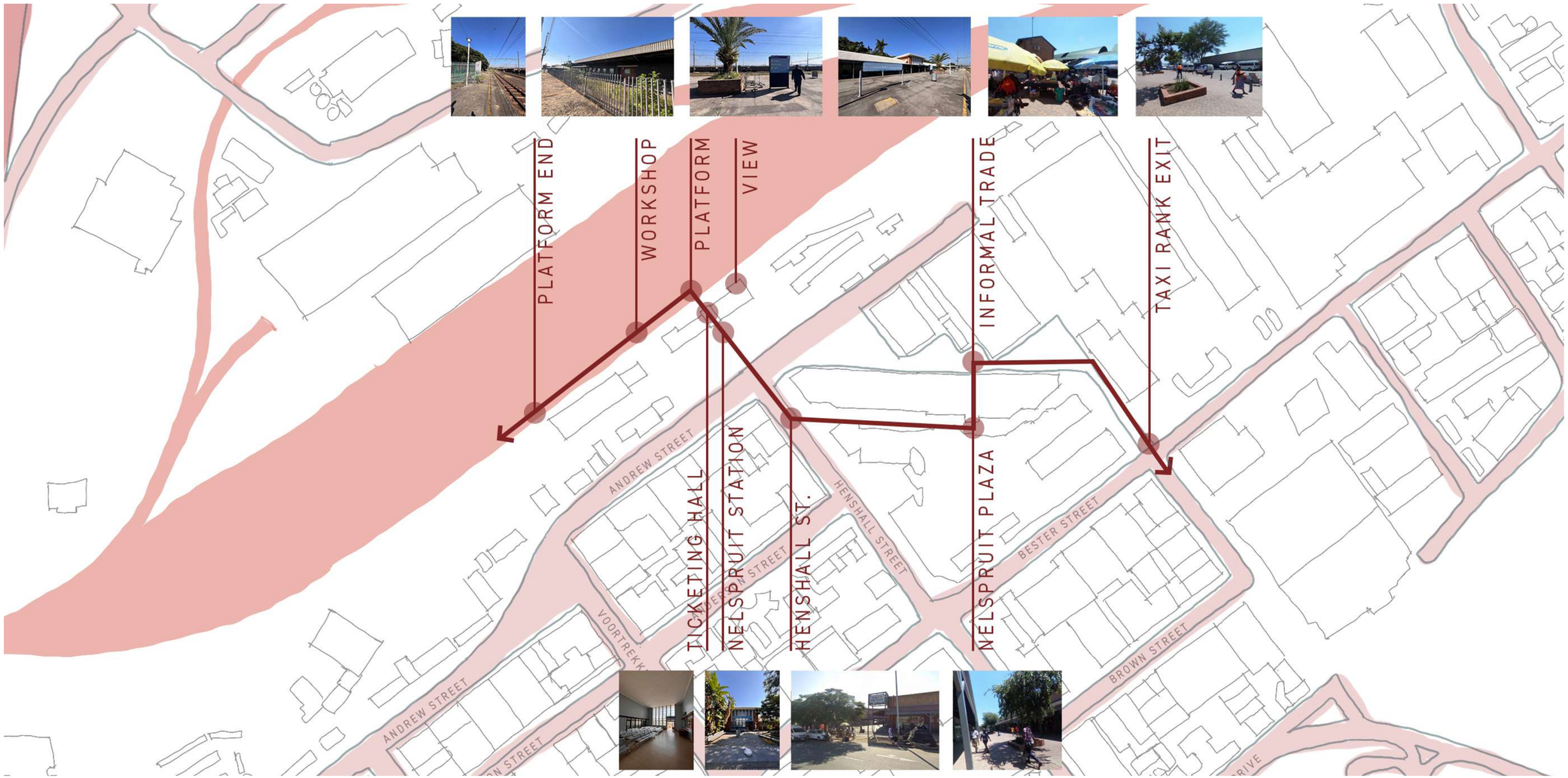
Fig 7.40
Sketch of Platform Dimensions
(Author, 2024)

Fig 7.41-42
Regulator Standard - Technical Requirements - Stations
(RSR, 2016)

SITE OVERVIEW

NELSPRUIT TRAIN STATION

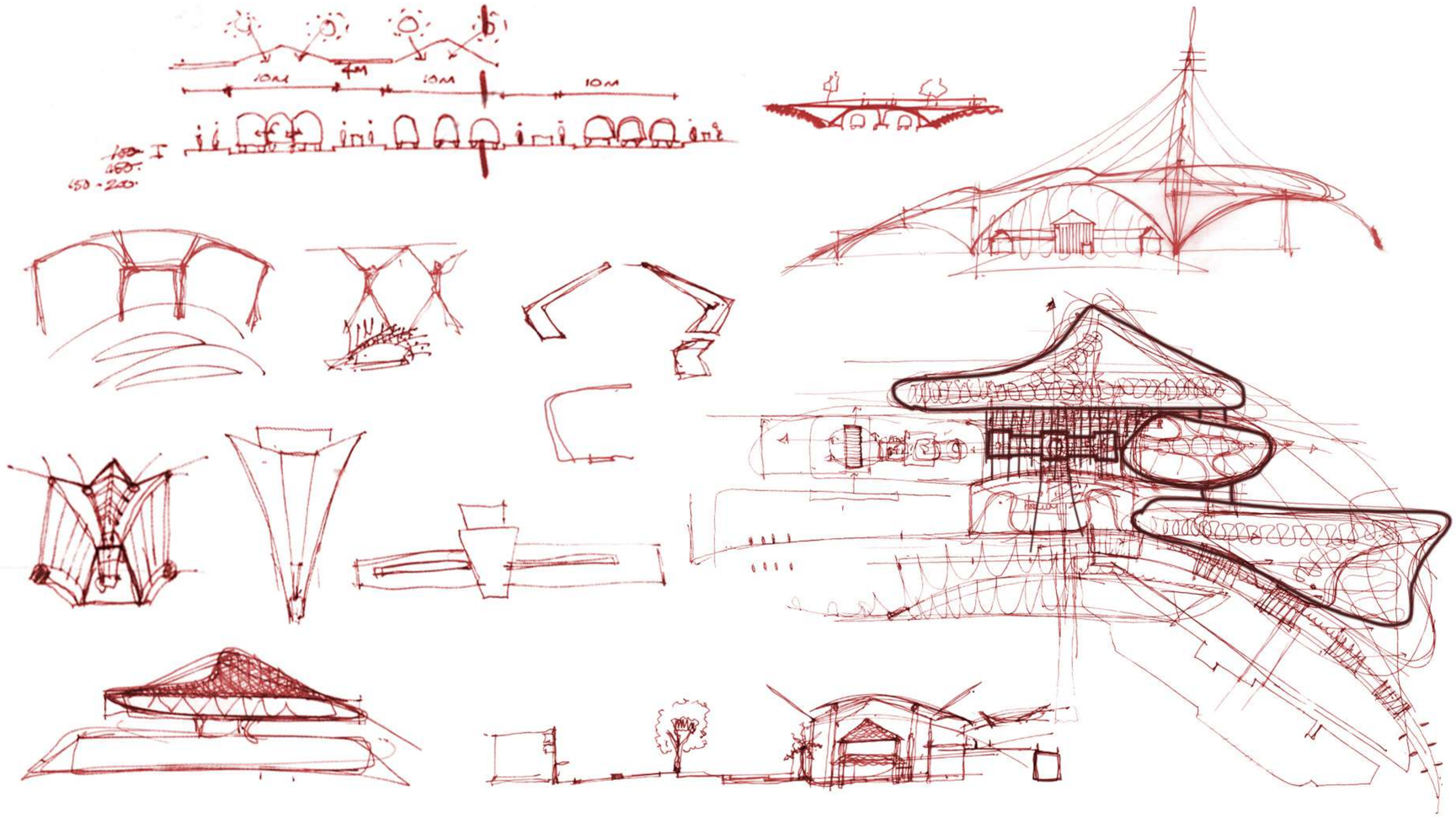
Fig 7.43
Site Overview Map
(Author, 2024)



CONCEPTUAL SKETCHES

ITERATION 1

Fig 7.44
Concept Sketches Iteration 1
(Author, 2024)



CONCEPTUAL SKETCHES

ITERATION 1

ITERATION 1 ASSESSMENT

This set of sketches explores the potential relationship between the station building and its immediate surroundings. It proposes two sheds adjacent to the station for trains and buses, with the station opening onto a forum that activates public space, connecting to the rest of the city.

Strengths:
Forum
Integration of transport services

Weaknesses:
Awkward transitional spaces
Lack of clear spatial hierarchy
Use of plaza for taxi rank

Opportunities:
Improved traffic flow
Pedestrian-friendly walkways
Space for informal trading
Basement commerce/tracks

Threats:
Disconnect between Transnet and PRASA
Junction of pedestrian route and Andrew StreetStreet

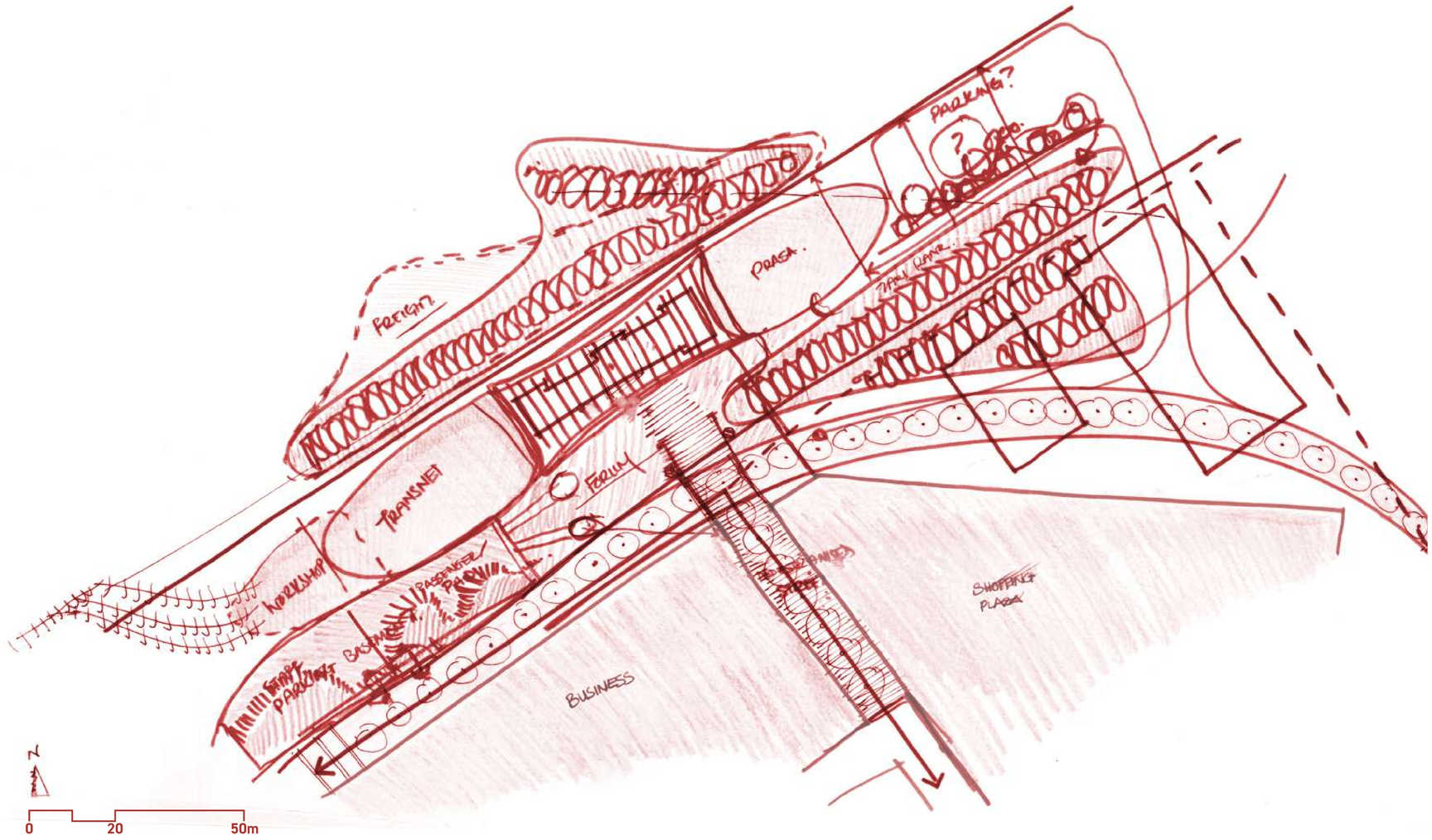


Fig 7.45
Concept Plan Iteration 1
(Author, 2024)

CONCEPTUAL SKETCHES

ITERATION 2

ITERATION 2 ASSESSMENT

These sketches explore the excavation of the site, introducing a basement to facilitate circulation to the platforms.

Strengths:
Easy access to platforms
Controlled user access through the basement, enhancing security

Weaknesses:
Limited by track width dimensions
Requires light wells for natural lighting

Opportunities:
Smaller visual impact of the structure
Roof design less dependent on other programmes

Threats:
Excavating while maintaining the existing structure poses challenges

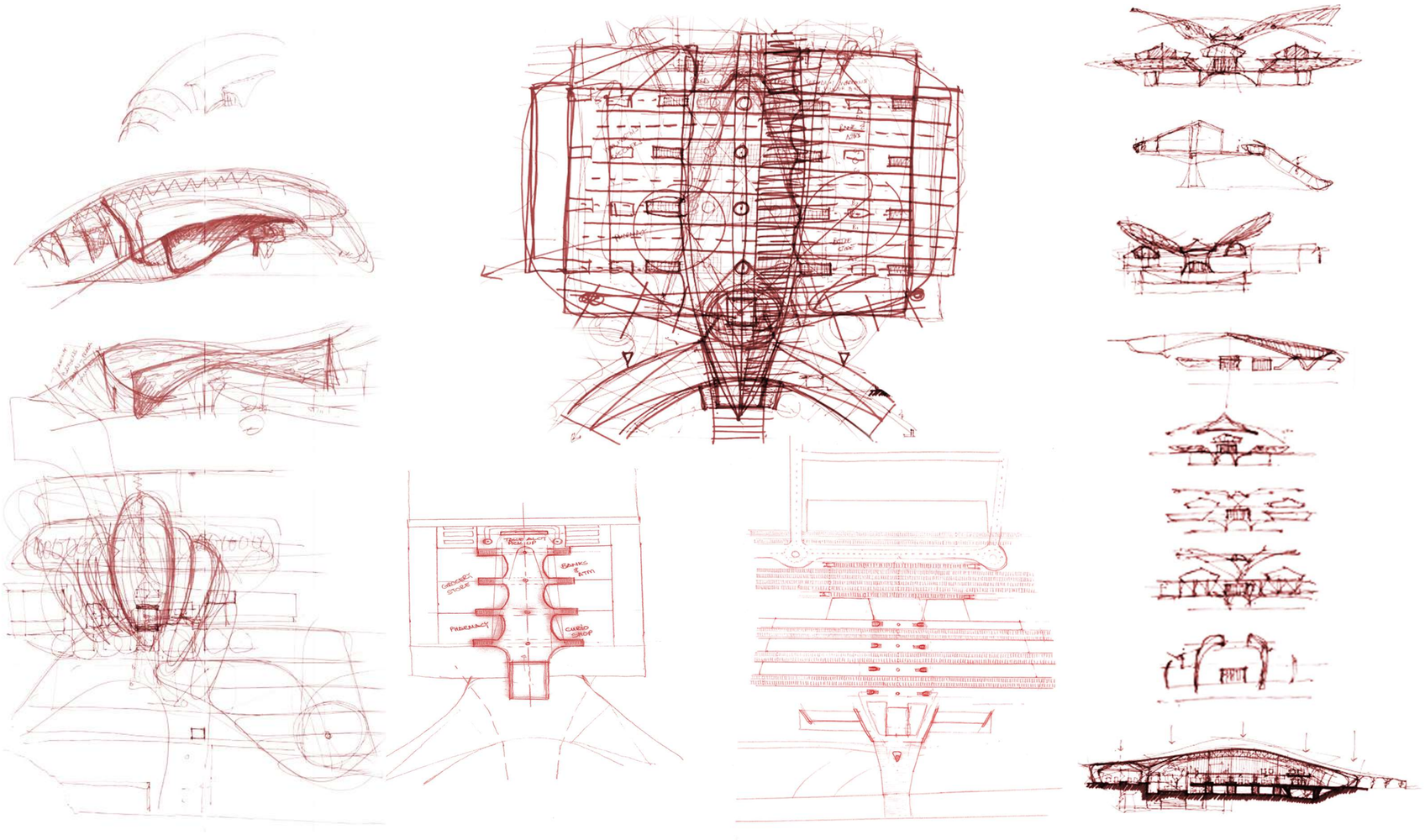


Fig 7.46
Concept Sketches Iteration 2
(Author, 2024)

CONCEPTUAL SKETCHES

ITERATION 3

ITERATION 3 RETROSPECTIVE

These sketches combine elements from the first two iterations, exploring above-ground circulation while maintaining the shed structure. A concourse level is added above the tracks for more efficient us of the site.

Strengths:
Efficient use of space
Public forums on multiple levels
Unified, cohesive structure

Weaknesses:
Symmetry does not cater to the hierarchy or varying spatial needs

Opportunities:
Improved connection to the city
Potential link to the Plaza
Material choice can express cadence and explore sustainability

Threats:
The building's scale may clash with the urban context

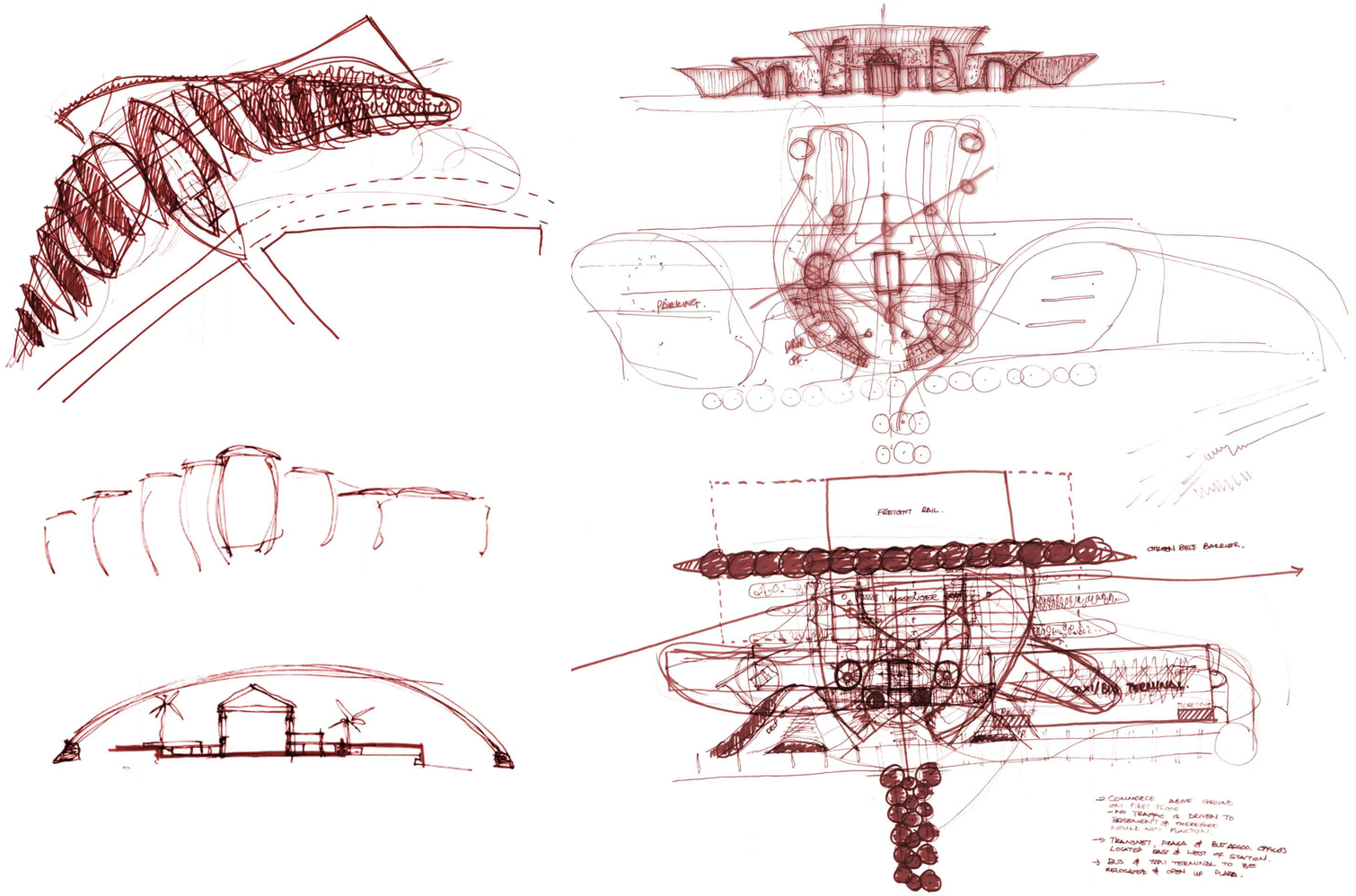


Fig.7.47
Concept Sketches Iteration 3
(Author, 2024)

CONCEPTUAL SKETCHES

ITERATION 3

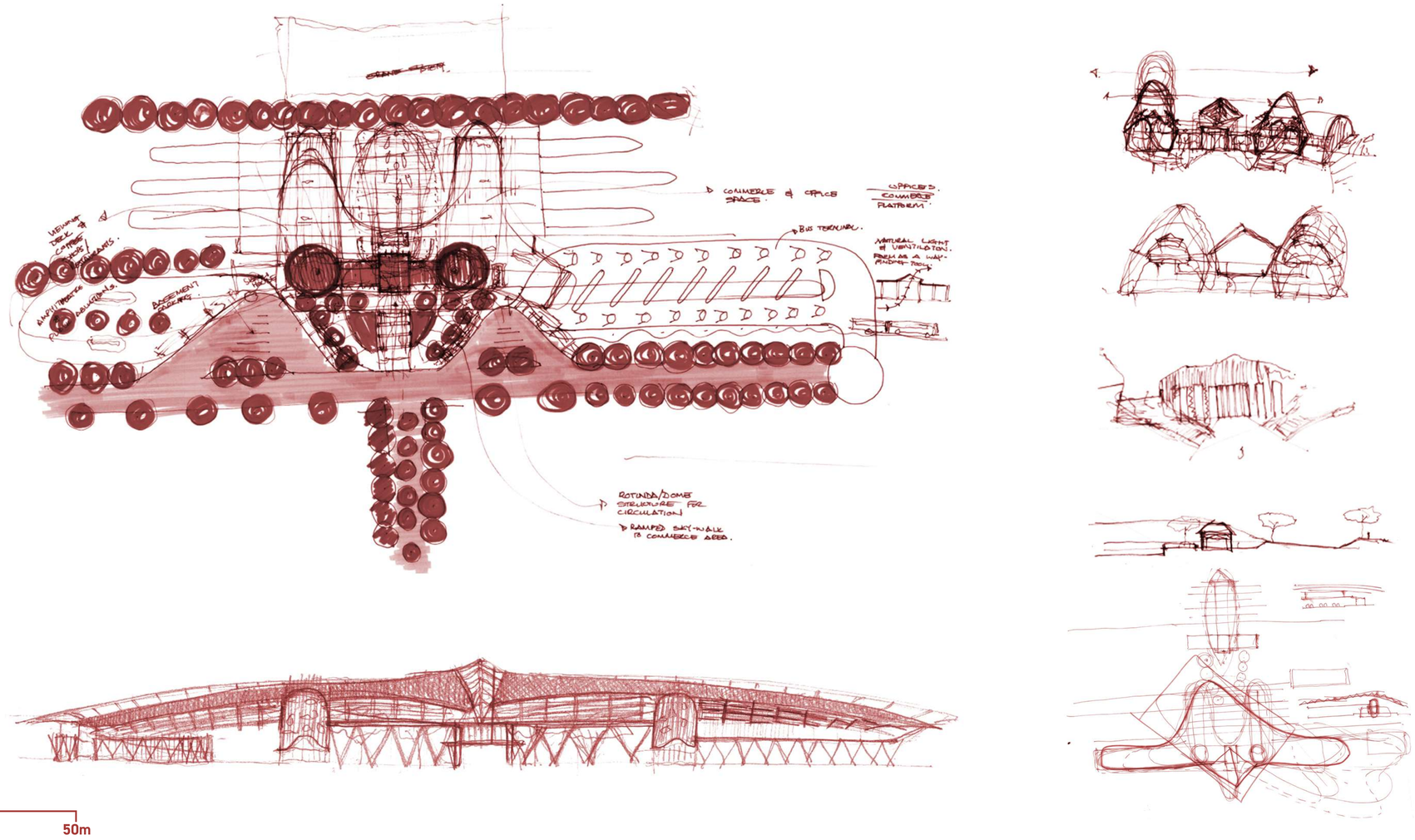


Fig 7.48
Concept Sketches Iteration 3
(Author, 2024)



Fig 7.49
Nested Food Court Perspective Sketch
(Author, 2024)

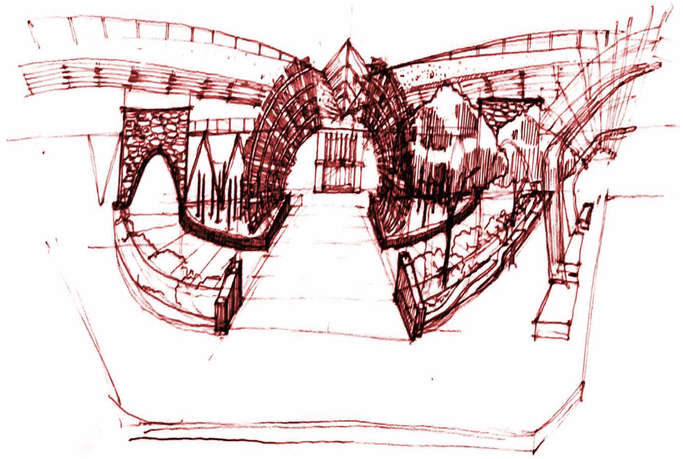


Fig 7.50
Memorial Garden Entrance Sketch
(Author, 2024)

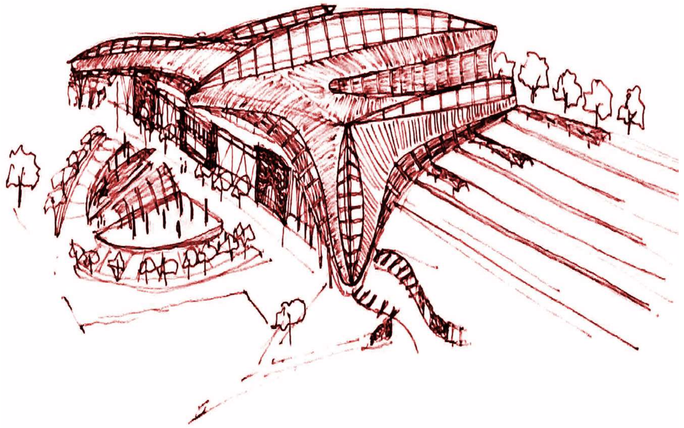


Fig 7.51
Perspective Sketch Iteration 3
(Author, 2024)

DESIGN CHARETTE

MASSING ITERATIONS

ITERATION 1

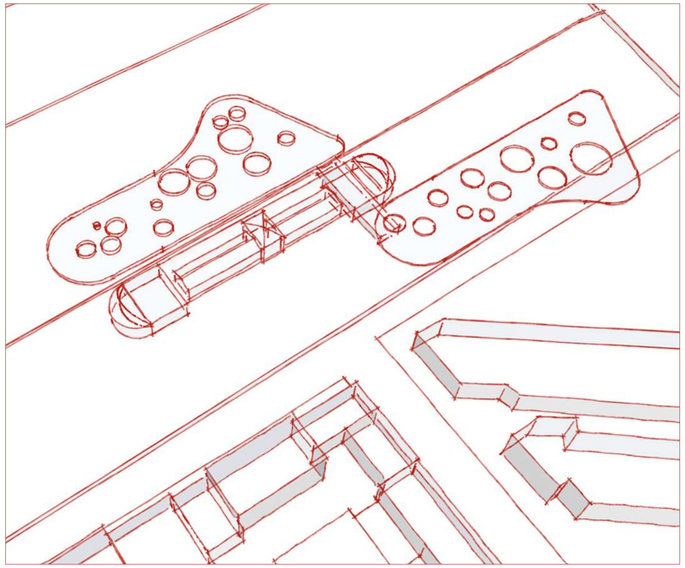


Fig 7.52
Concept Massing of Iteration 1
(Author, 2024)

ITERATION 2

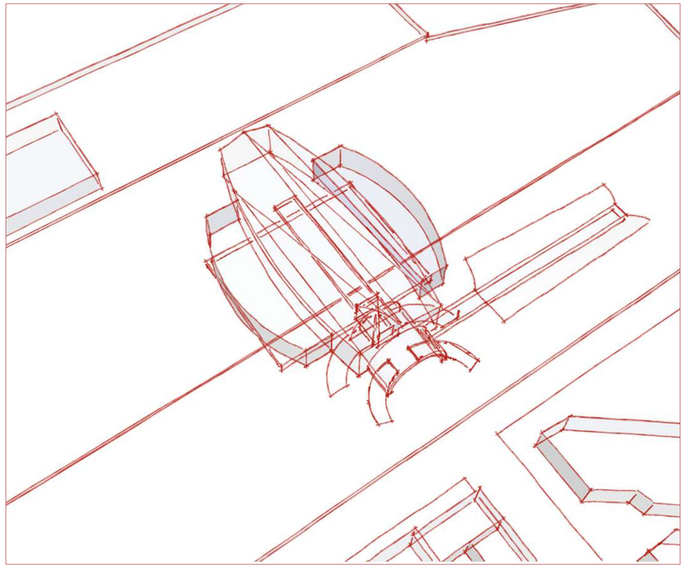


Fig 7.53
Concept Massing of Iteration 2
(Author, 2024)

ITERATION 3

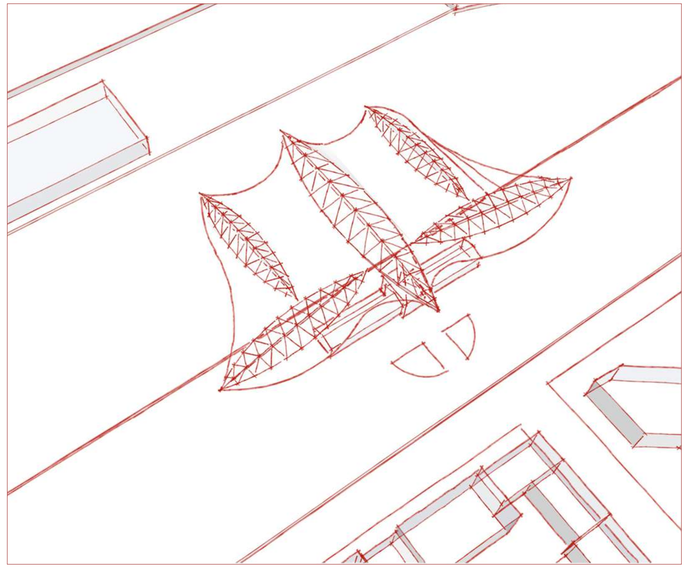


Fig 7.54
Concept Massing of Iteration 3
(Author, 2024)

DESIGN CHARETTE

CHOSEN MASSING

PROGRAMMING

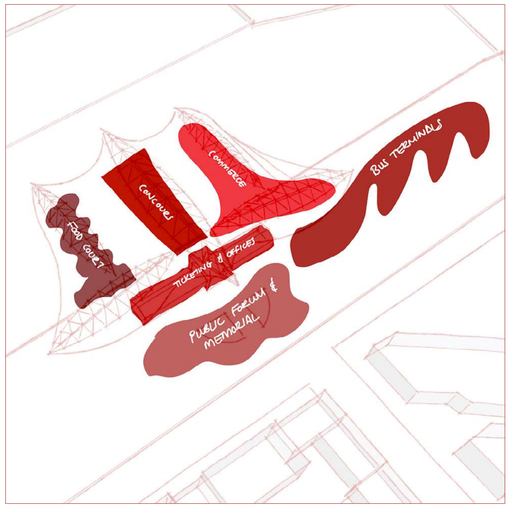


Fig 7.55
Concept Massing of Programming
(Author, 2024)

CIRCULATION

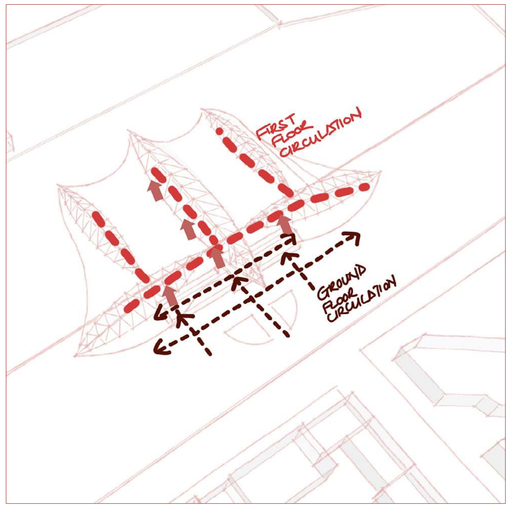


Fig 7.56
Concept Massing of Circulation
(Author, 2024)

SUN

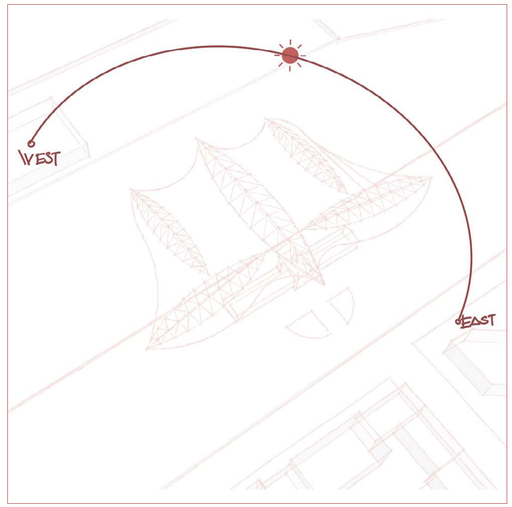


Fig 7.57
Concept Massing of Sun Path
(Author, 2024)

WIND

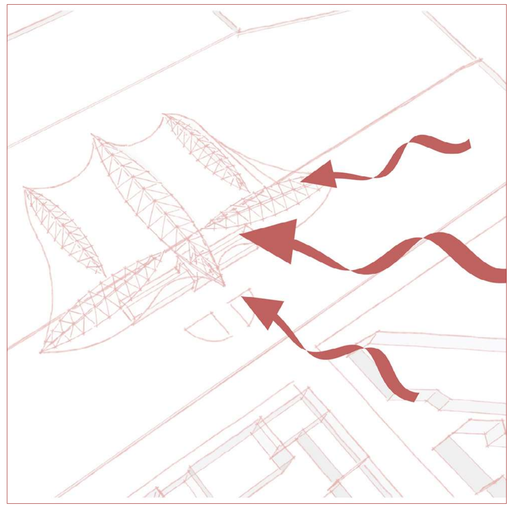
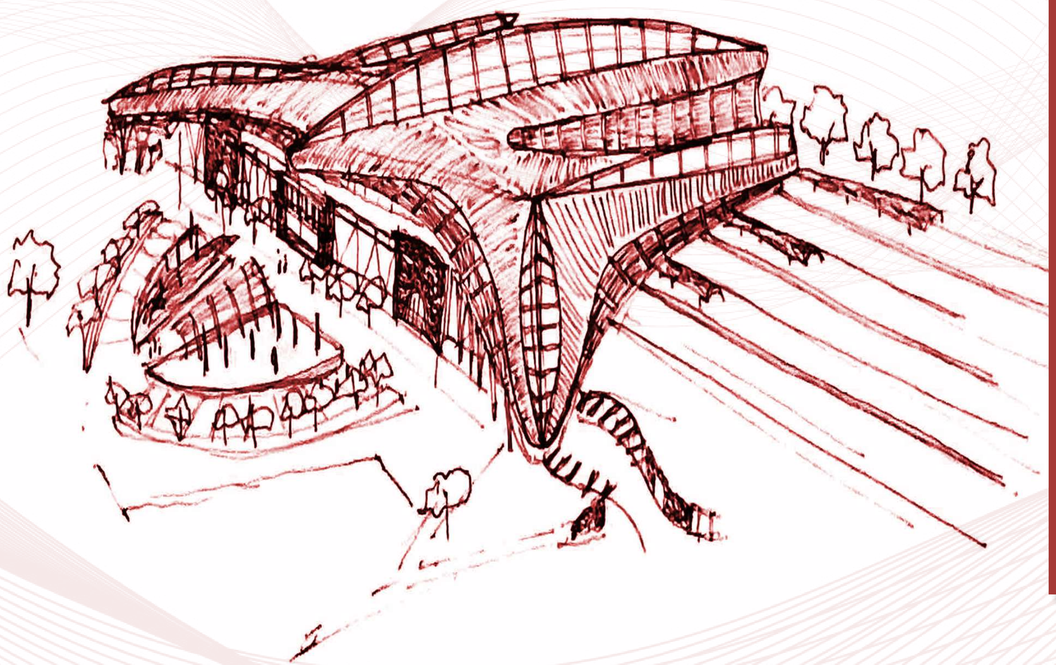


Fig 7.58
Concept Massing of Prevailing Wind
(Author, 2024)



DESIGN DRAWINGS

DESIGN DRAWINGS

JUNE REVIEW - SITE PLAN

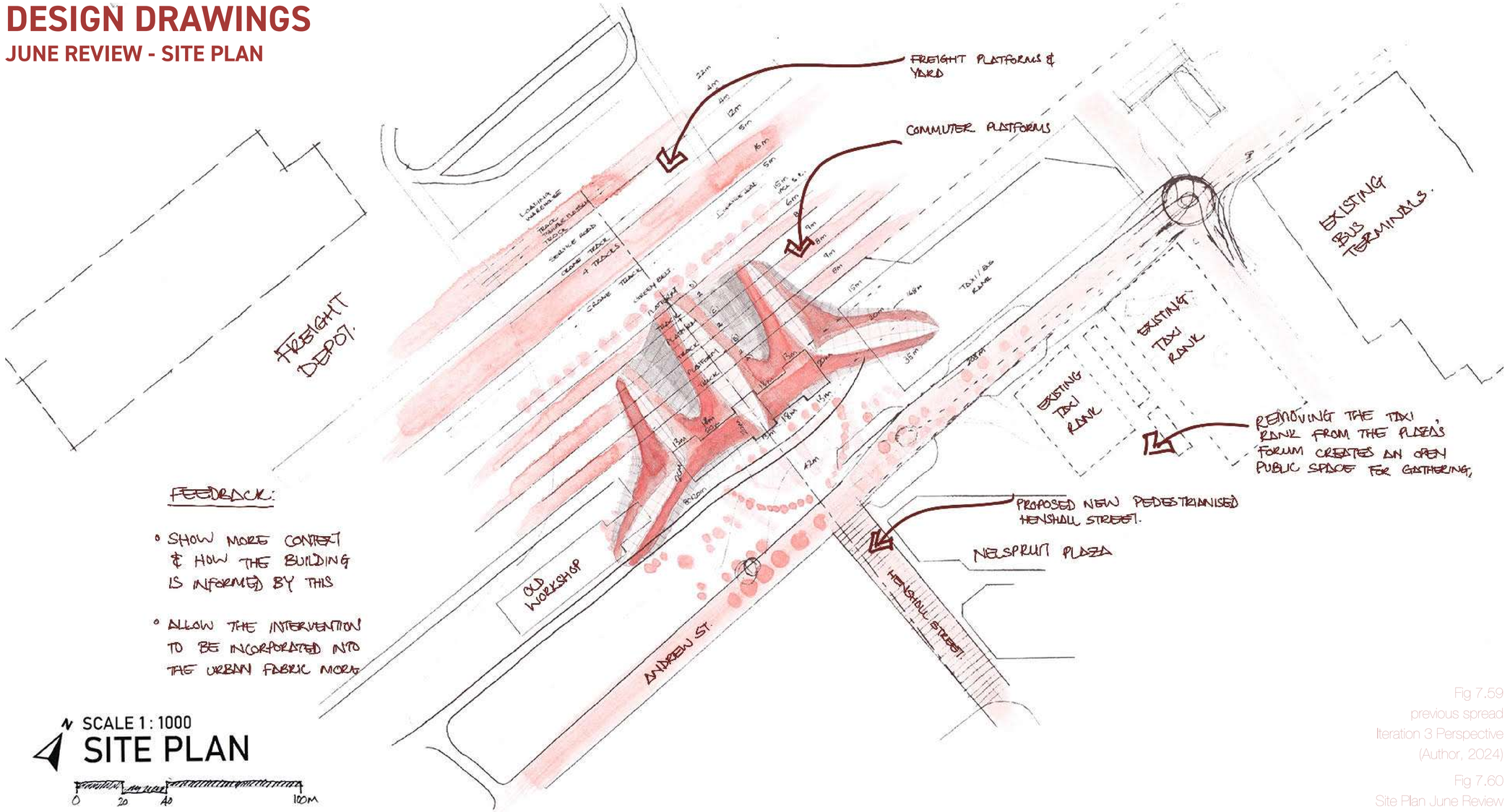


Fig 7.59
previous spread
Iteration 3 Perspective
(Author, 2024)

Fig 7.60
Site Plan June Review
(Author, 2024)

DESIGN DRAWINGS

JUNE REVIEW - GROUND FLOOR PLAN

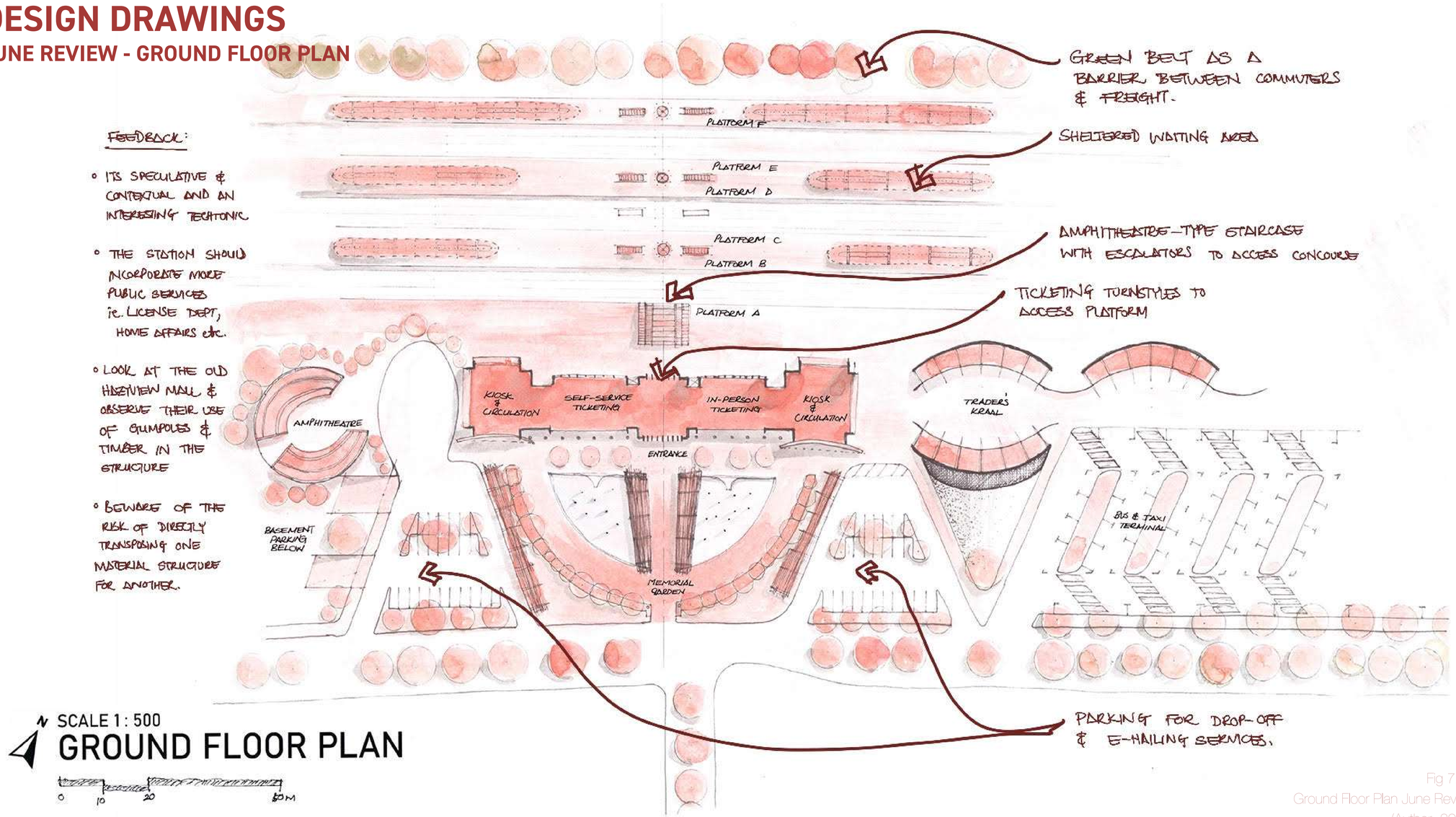


Fig 7.61
Ground Floor Plan June Review
(Author, 2024)

DESIGN DRAWINGS

JUNE REVIEW - FIRST FLOOR PLAN

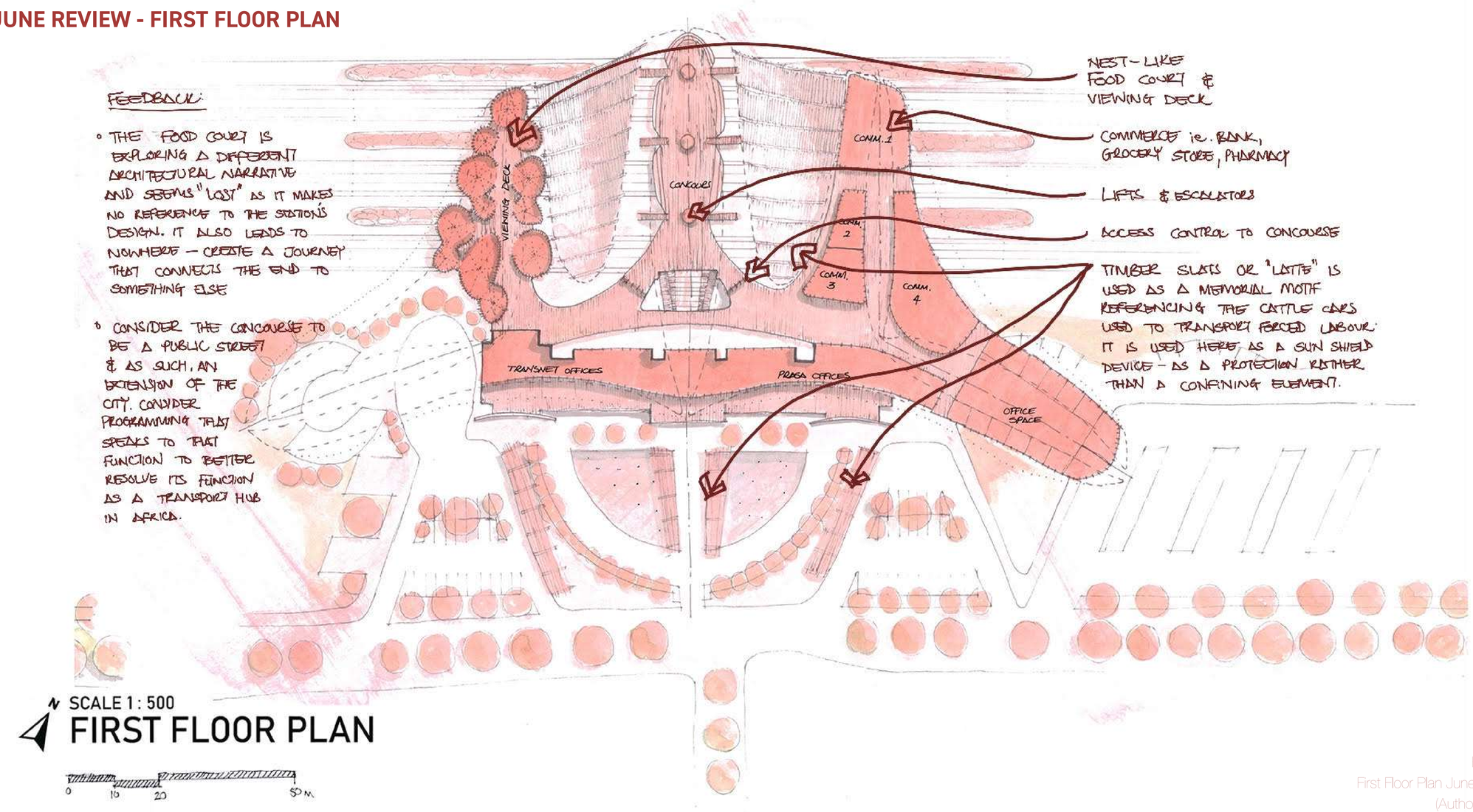


Fig 7.61
First Floor Plan June Review
(Author, 2024)

DESIGN DRAWINGS

JUNE REVIEW - ROOF PLAN

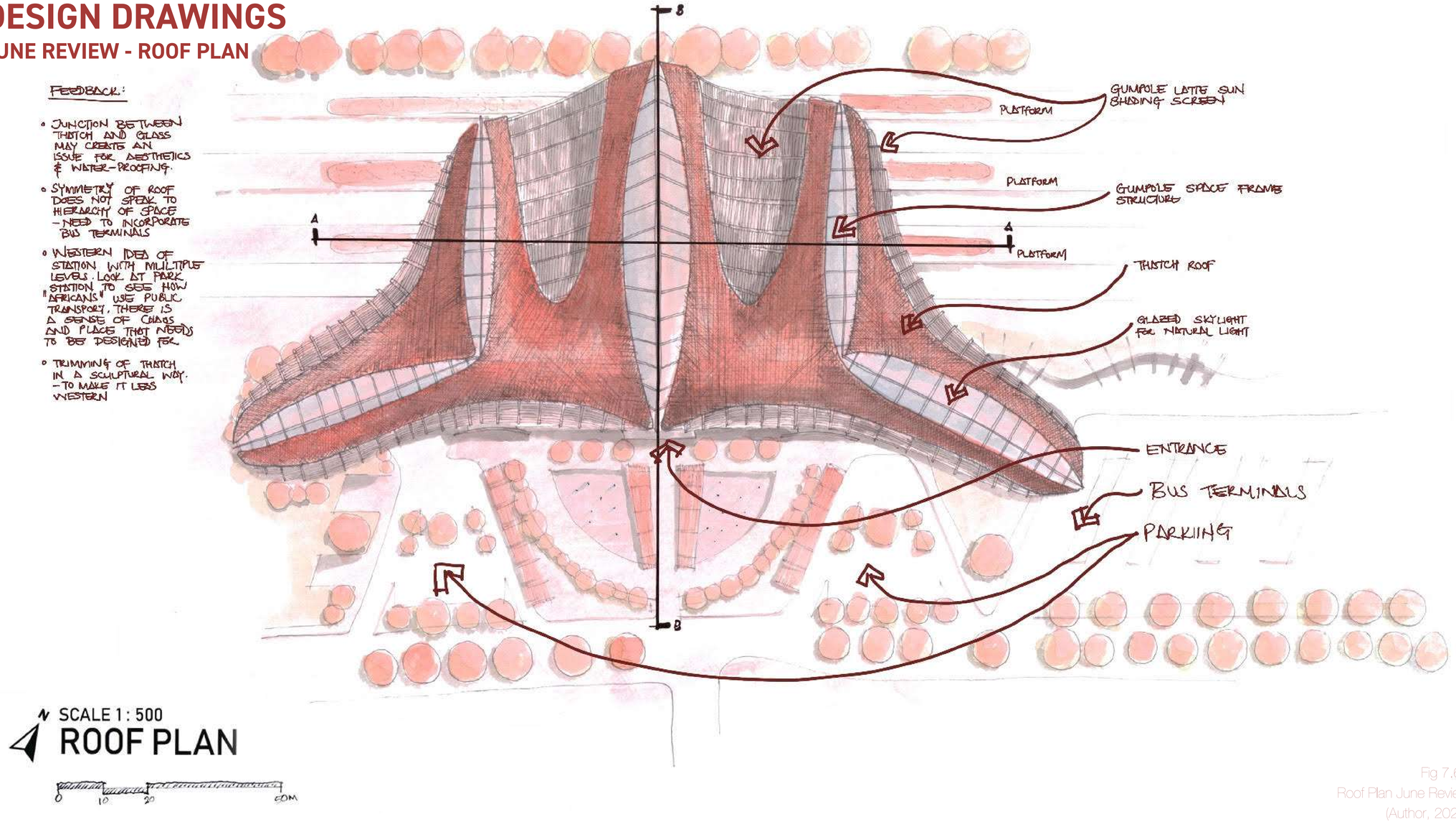


Fig 7.63
Roof Plan June Review
(Author, 2024)

DESIGN DRAWINGS

JUNE REVIEW - SECTIONS & ELEVATIONS

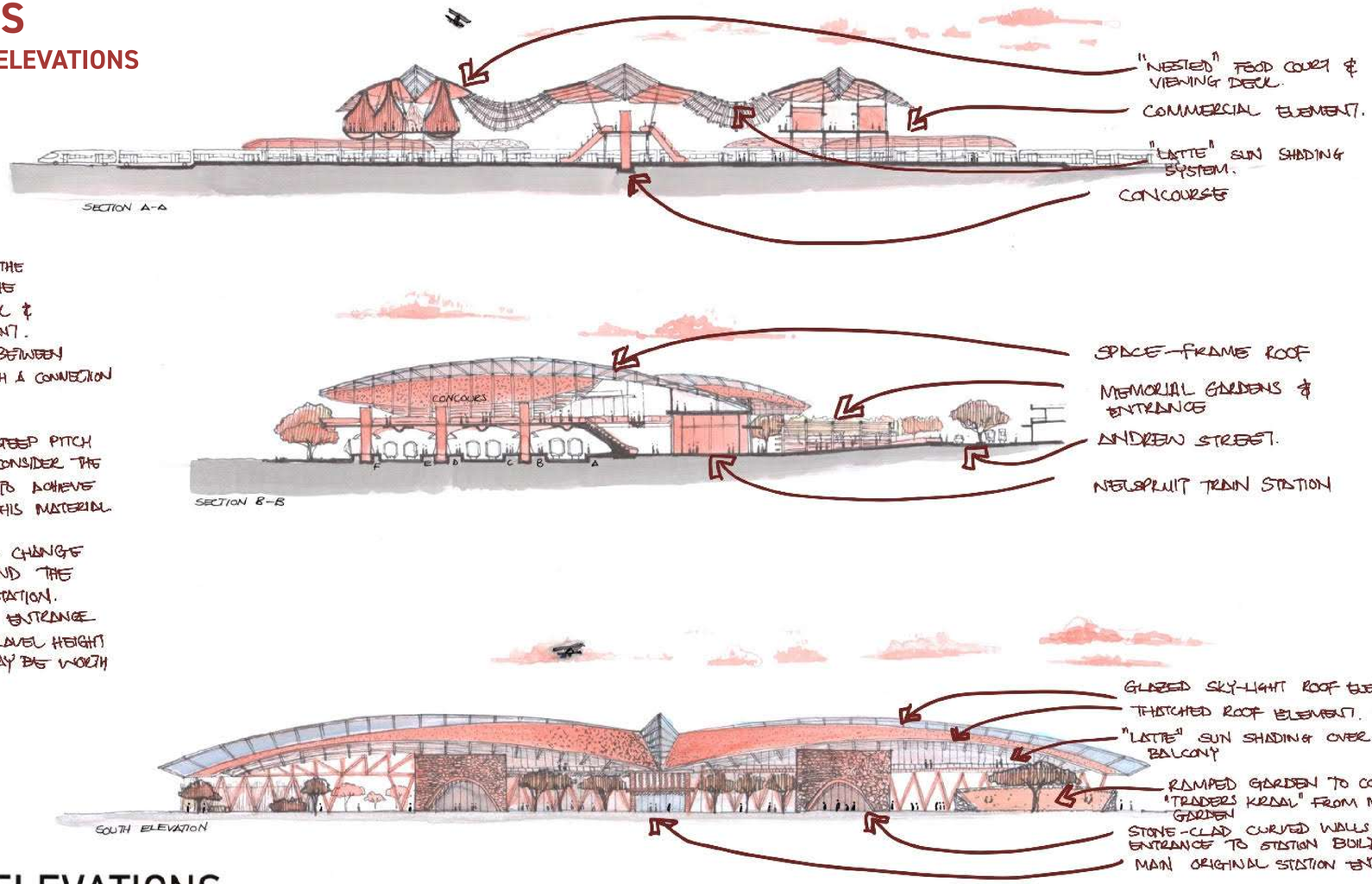
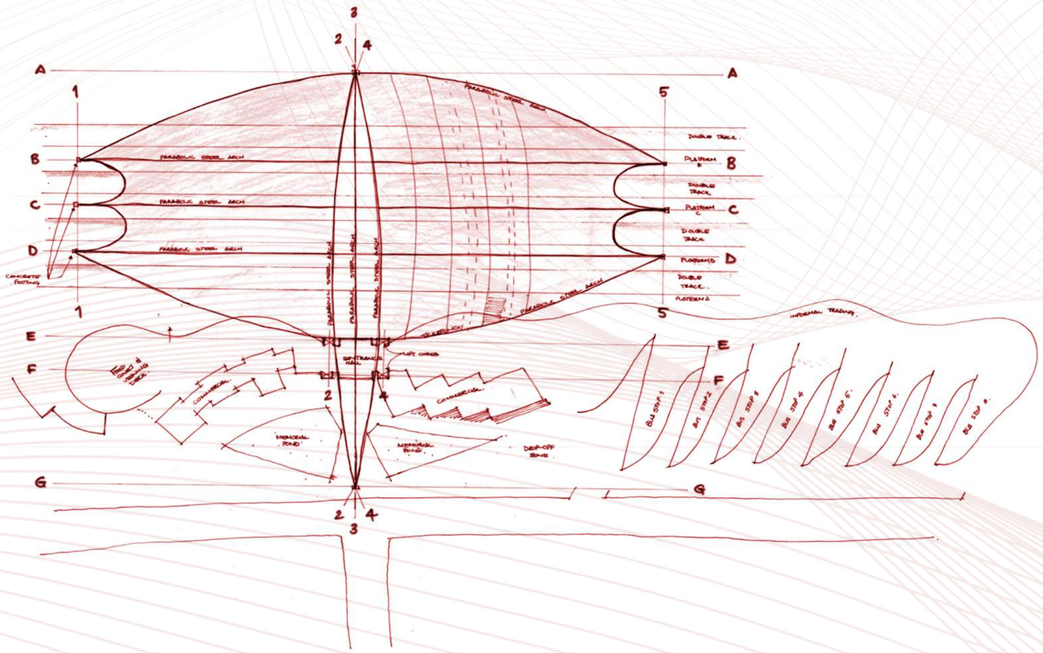


Fig 7.64
Sections & Elevations June Review
(Author, 2024)

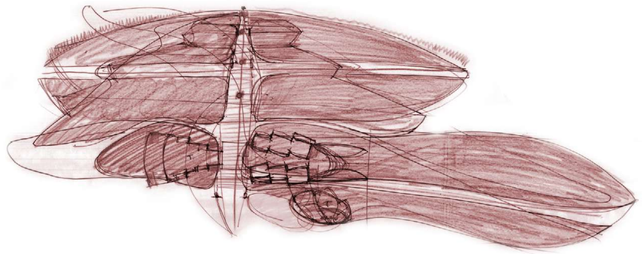


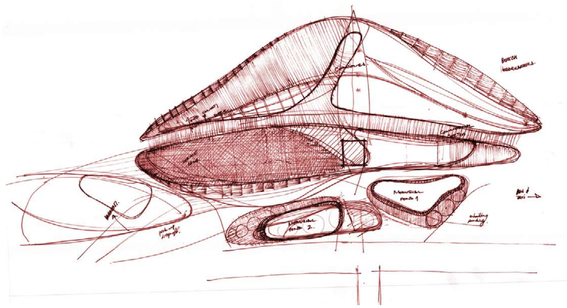
TECHNICAL SYSTEMS

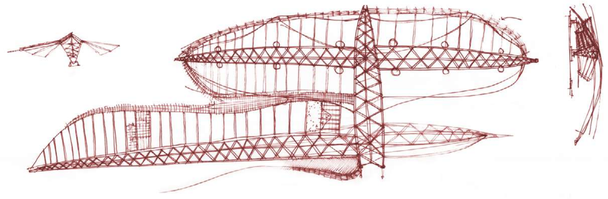
Fig 7.65
Technical Systems Roof Plan
(Author, 2024)

TECHNICAL SYSTEMS
DESIGN DEVELOPMENT

Fig 7.66
Design Development for Technical Systems
(Author, 2024)

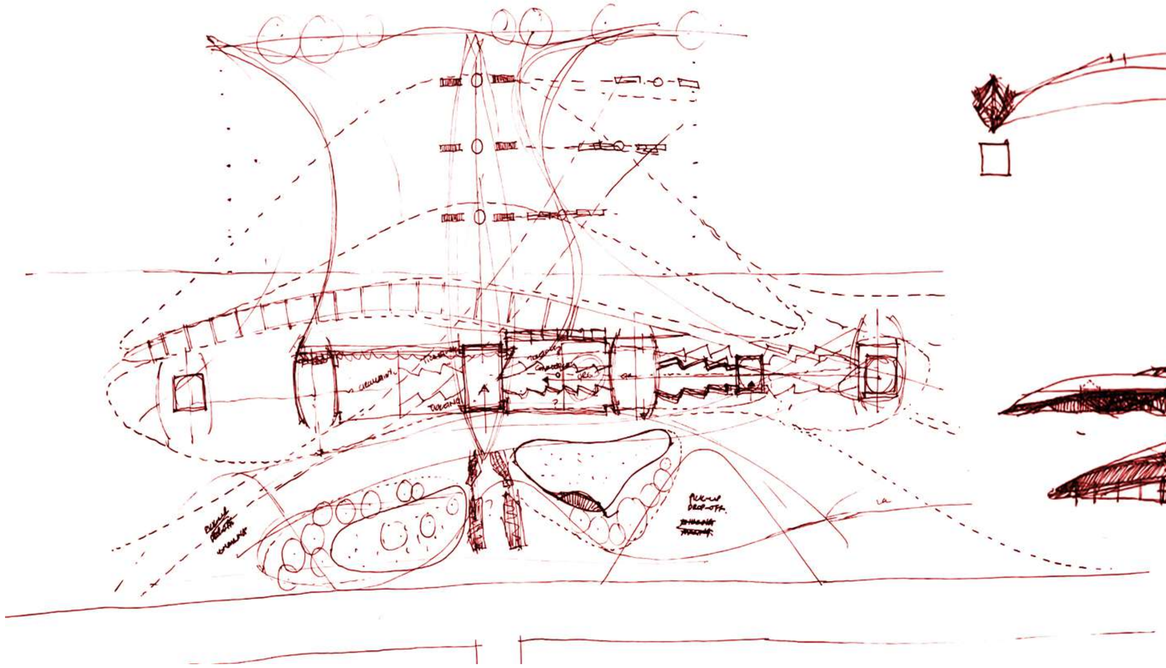


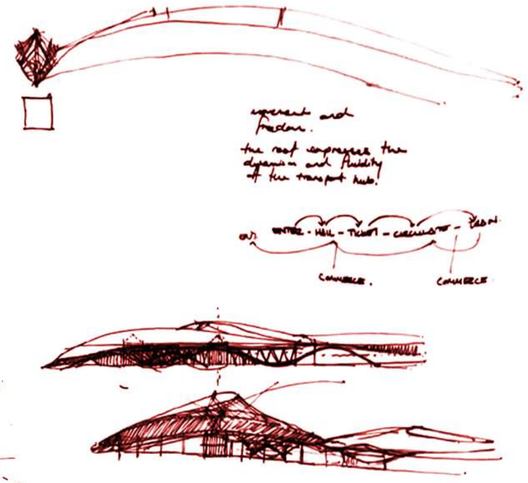


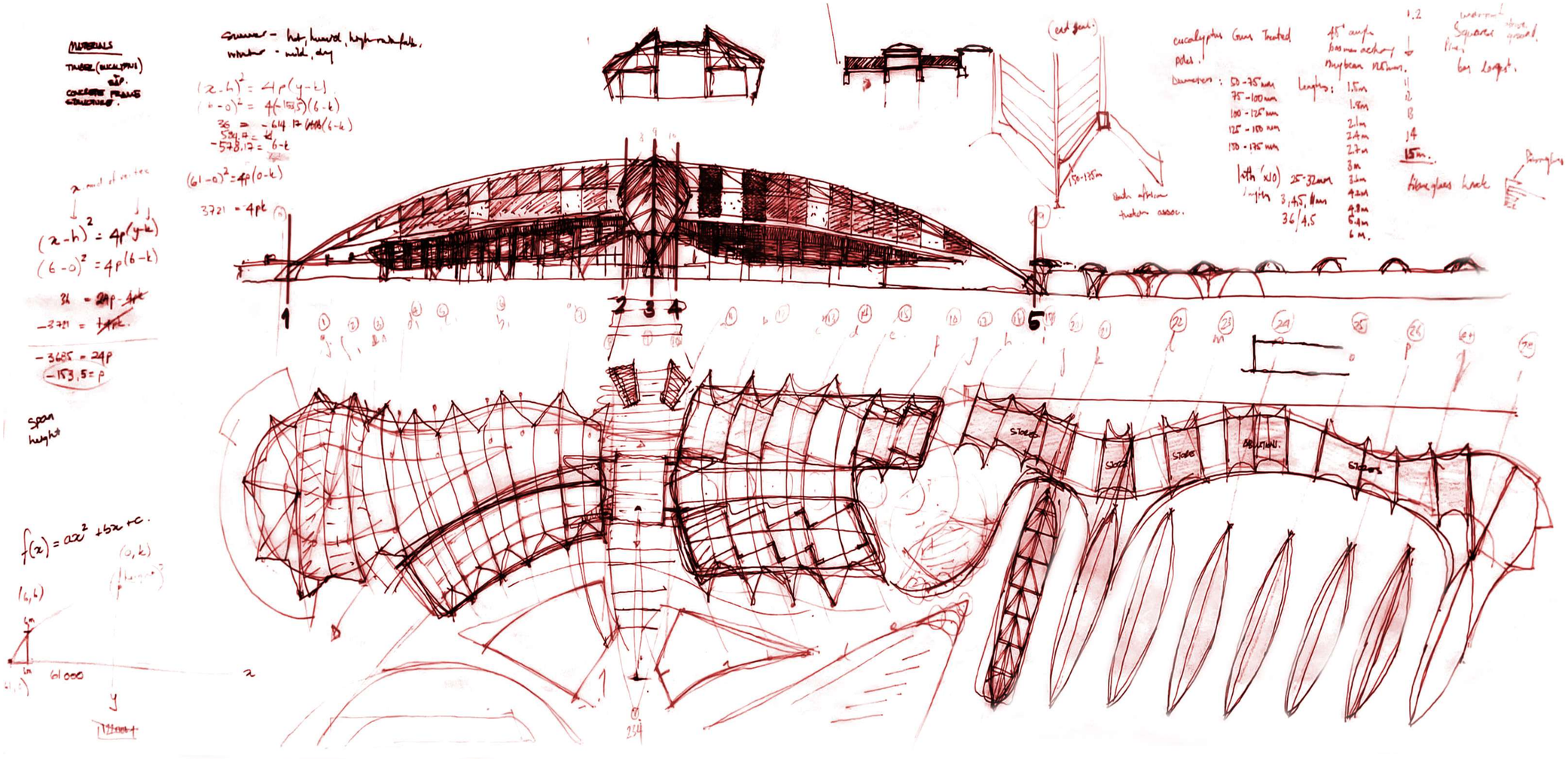


JUNE REVIEW RETROSPECTIVE

The design presented before this, explored the form of the train station and paid little attention to the bus terminals and the creation of an interactive memorial public space. The building also has a democratised programme and made reading the building as though it was out of place. The technical systems explored hereafter begin to address those issues. The process began with redesigning the shed roof in a way that explored cadence and hierarchy in spaces. It also expands toward the bus terminals where it overlaps a secondary/lower roof.







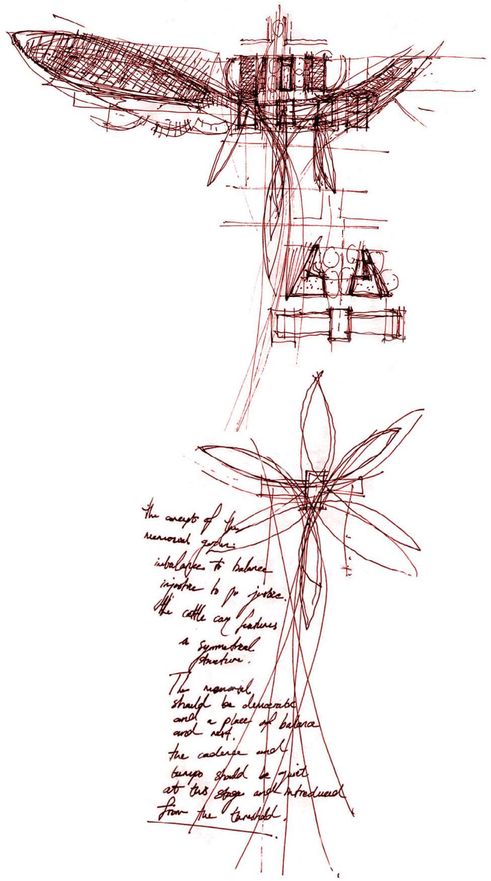
ROOF STRUCTURE PLAN

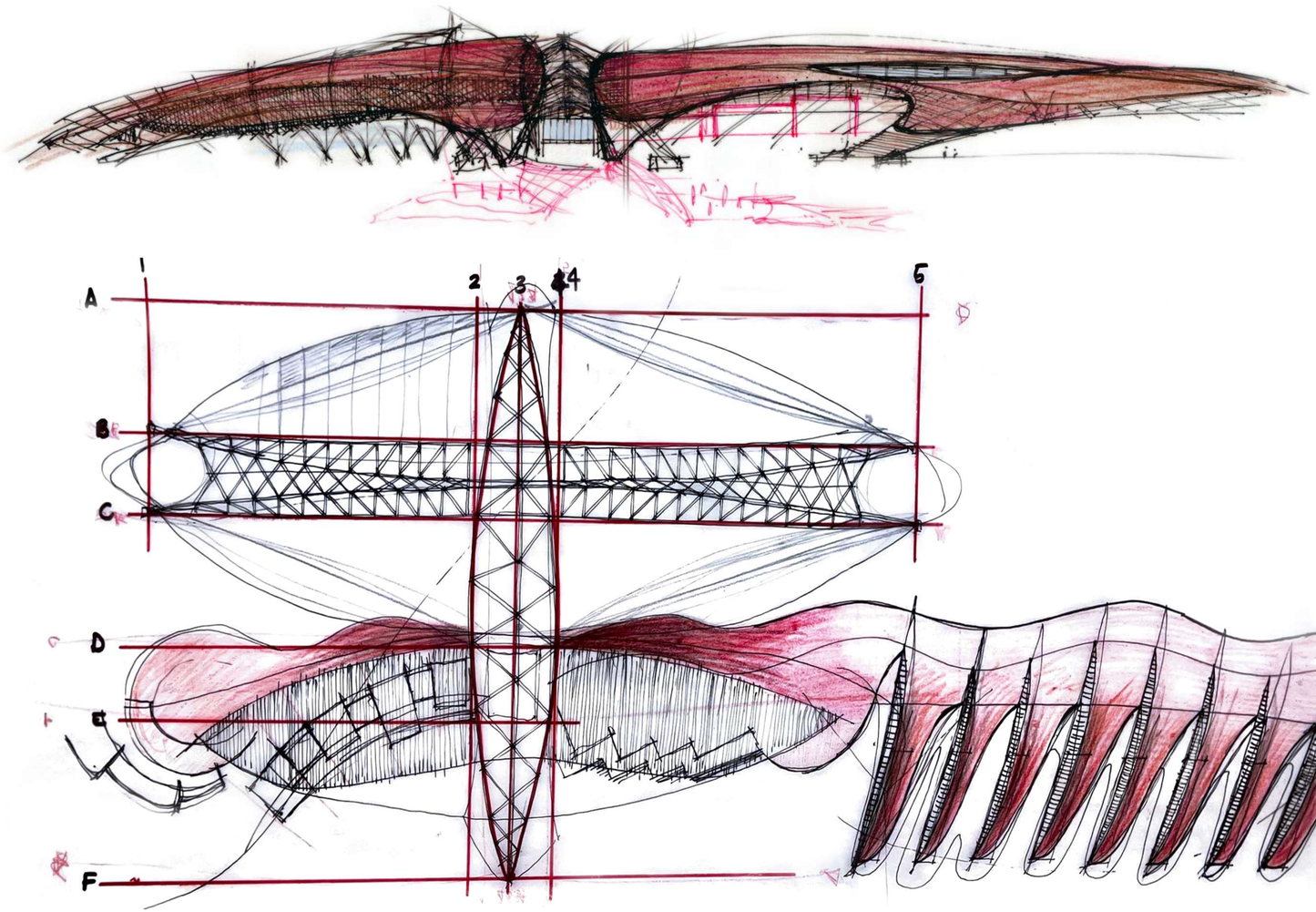
0 20 50m

Fig 7.67
Design Development for Technical Systems
(Author, 2024)

TECHNICAL SYSTEMS

DESIGN DEVELOPMENT





ROOF STRUCTURE PLAN

0 20 50m

Fig 7.68
Form & Plan Development for Technical Systems
(Author, 2024)

TECHNICAL SYSTEMS

SKETCH PLAN & SECTION

Fig 7.69
Roof structure Exploration Sketch
(Author, 2024)

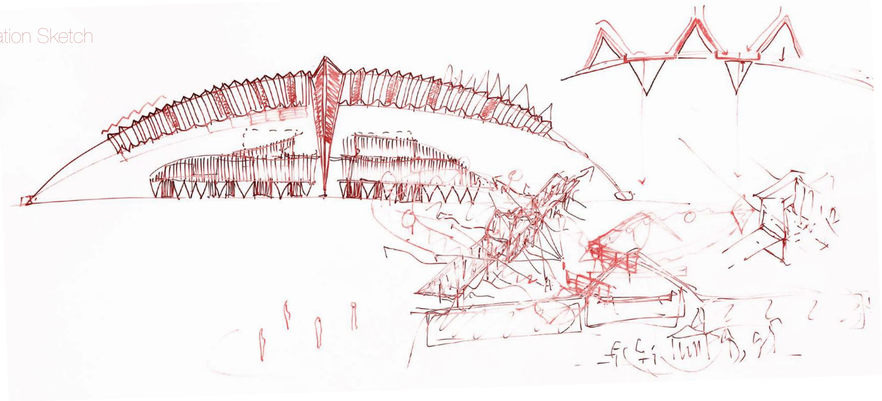
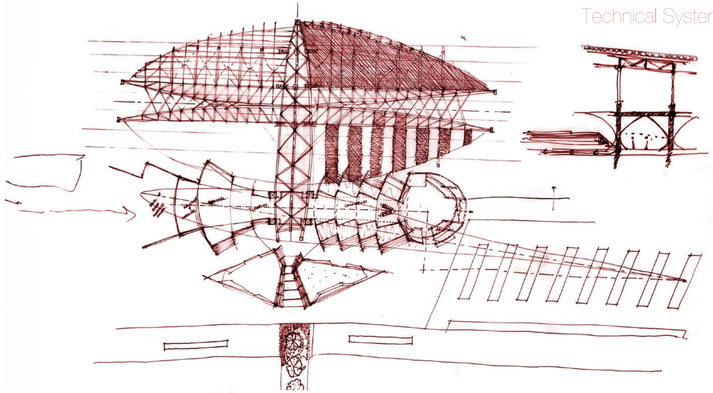
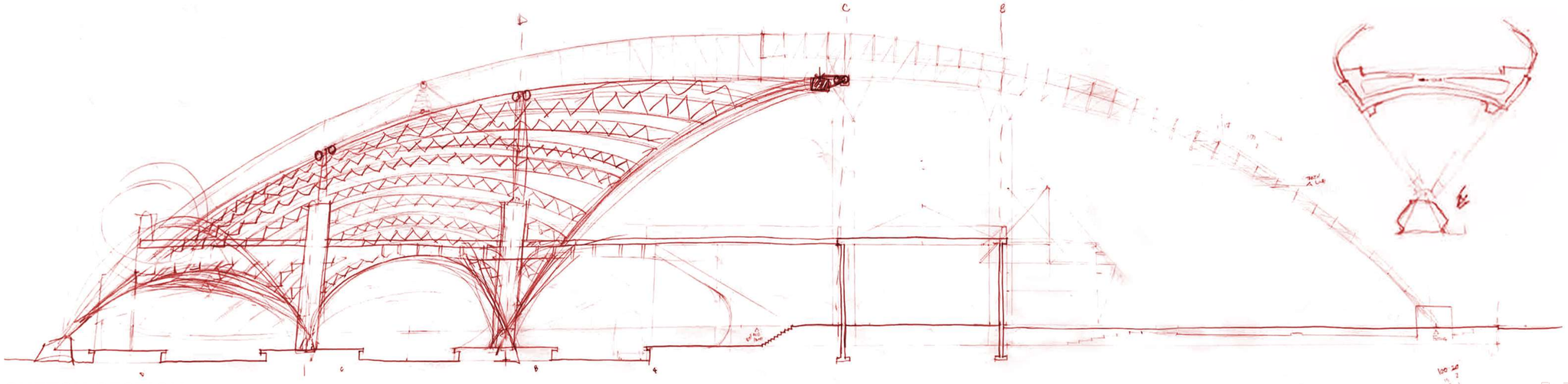


Fig 7.70
Technical Systems Structure Exploration
(Author, 2024)





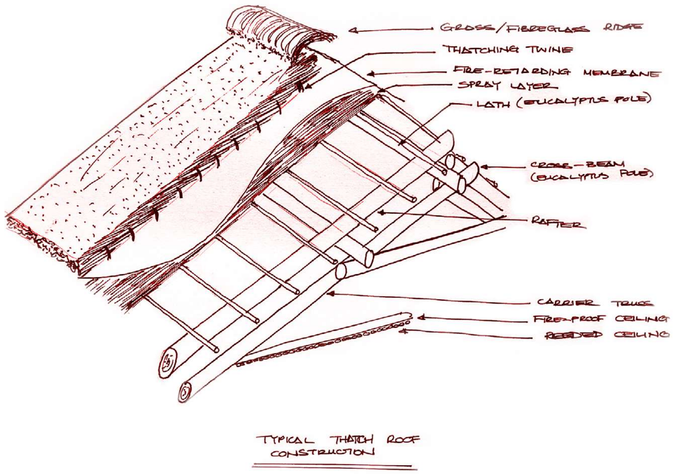
SKETCH SECTION

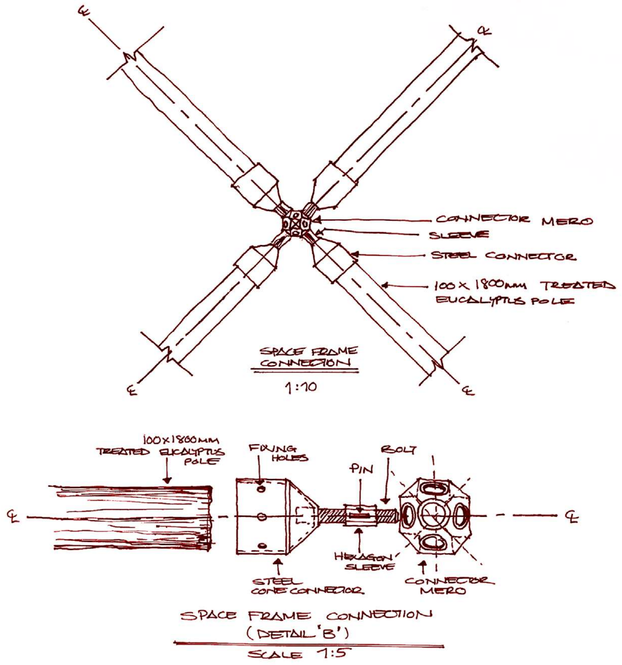
0 10 20 50m

Fig 7.71
Technical Systems Section Sketch
(Author, 2024)

TECHNICAL DETAILS

CALL-OUTS





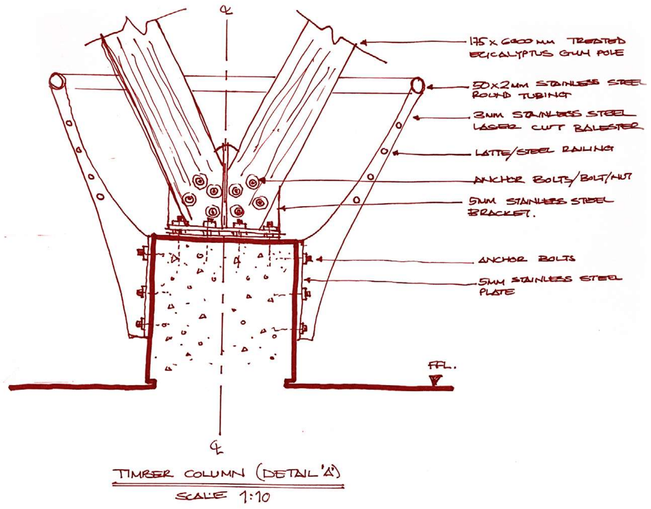


Fig 7.72-74
Call Out Details for Technical System Section
(Author, 2024)

TECHNICAL EXPLORATION

ROOF MODEL

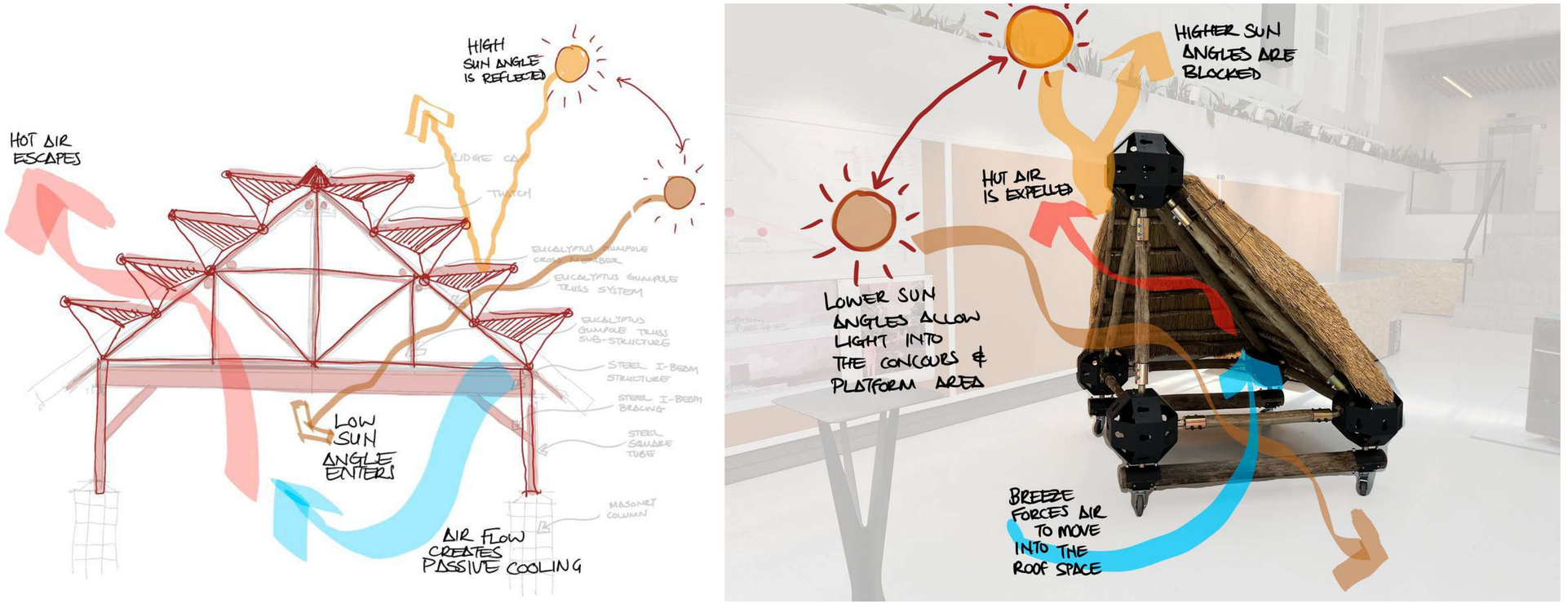


Fig 7.75-76
Exploration of Roof Concept
(Author, 2024)

TECHNICAL DETAILS

CONCEPTUAL STRUTURAL MODEL FURNITURE DETAILS - CONCEPT OF COLUMN STRUCTURE

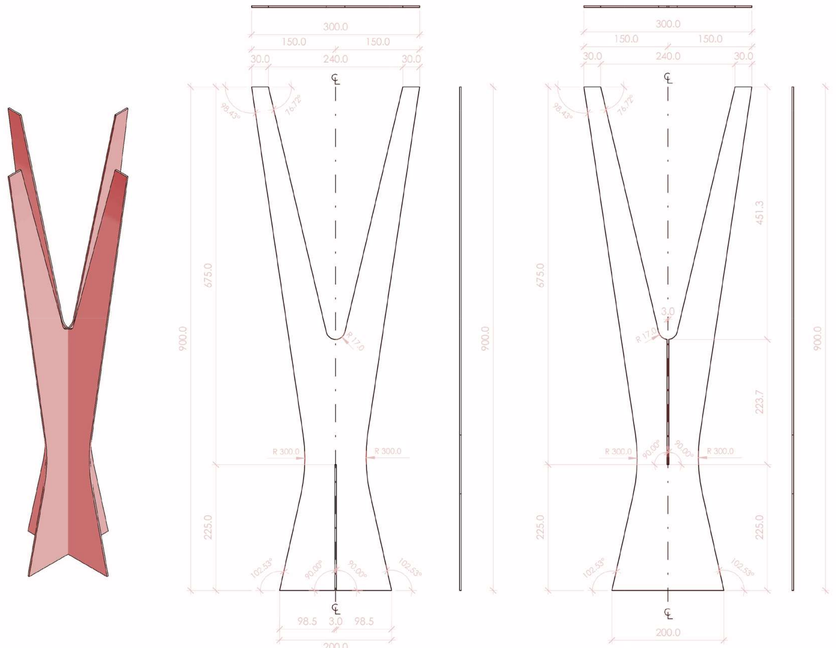
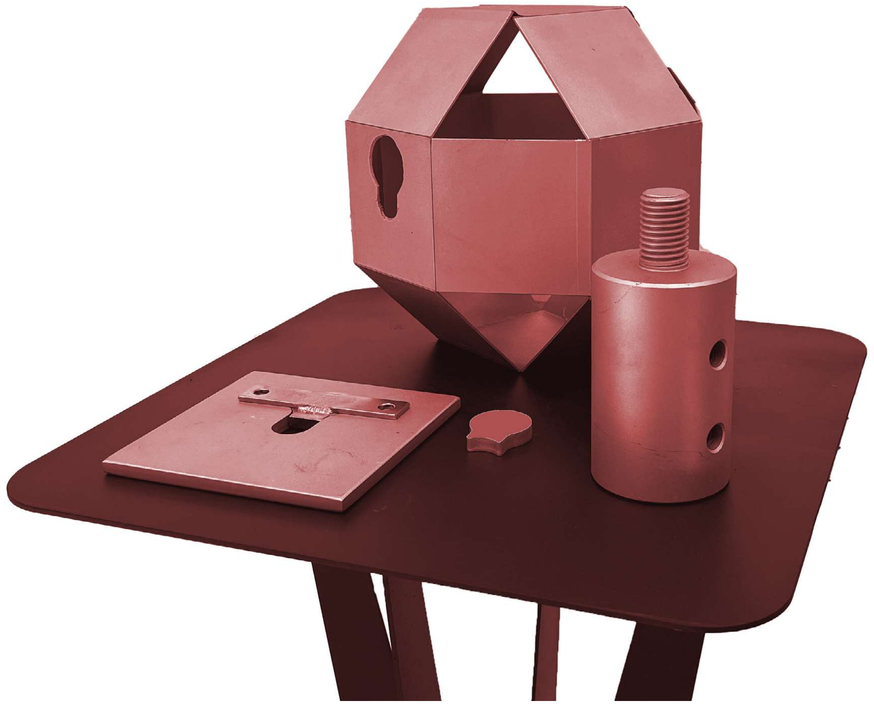




Fig.7.77-78
Table Design Details as Conceptual Models for Structural Column Design (Author, 2024)

TECHNICAL DETAILS

CONCEPTUAL JOINERY MODEL AND ROOF CONNECTION COMPONENT DETAILS



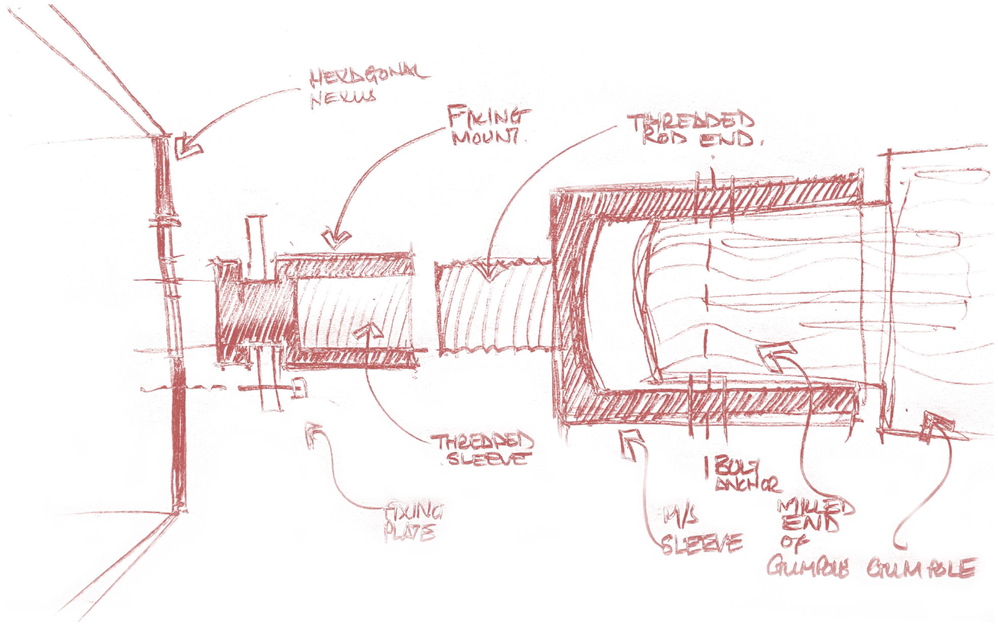


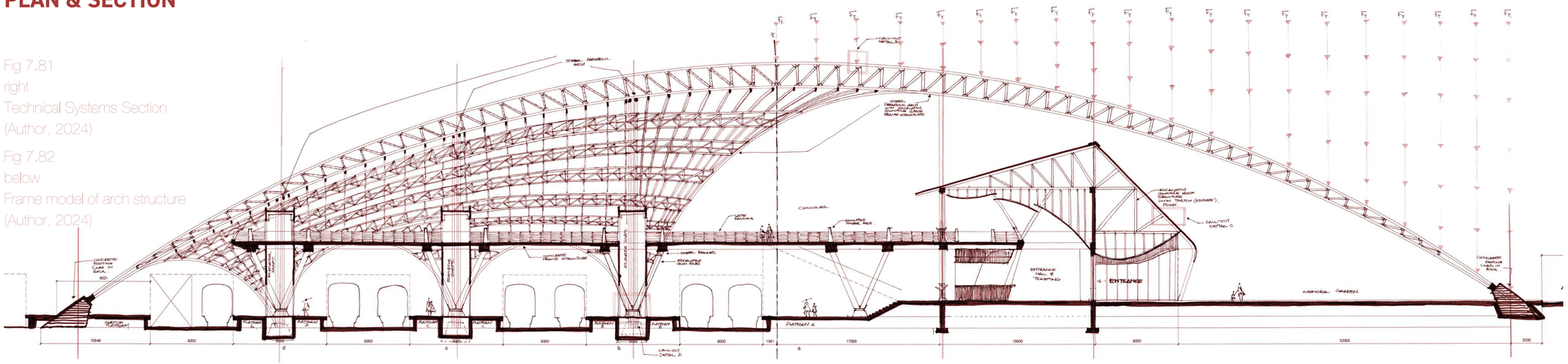
Fig 7.79-80
Conceptual Exploration of Roof Frame Connection Detail
(Author, 2024)

TECHNICAL SYSTEMS

PLAN & SECTION

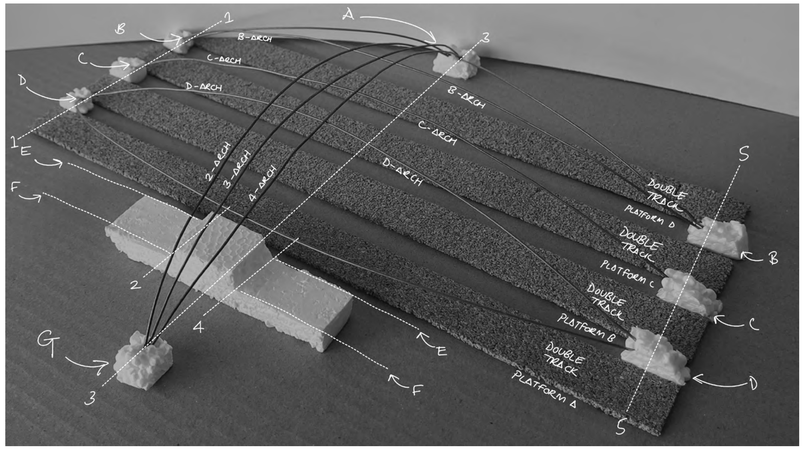
Fig 7.81
right
Technical Systems Section
(Author, 2024)

Fig 7.82
below
Frame model of arch structure
(Author, 2024)



SKETCH SECTION

0 10 20 50m



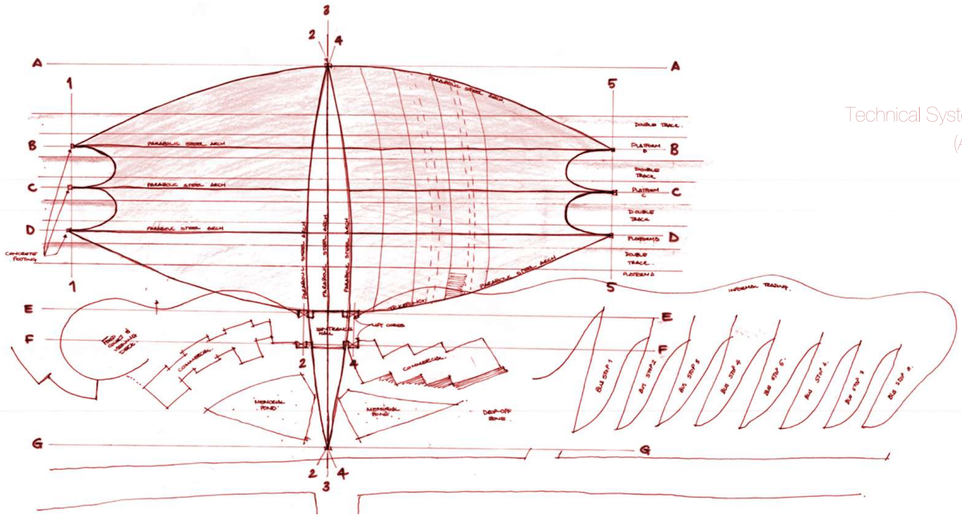
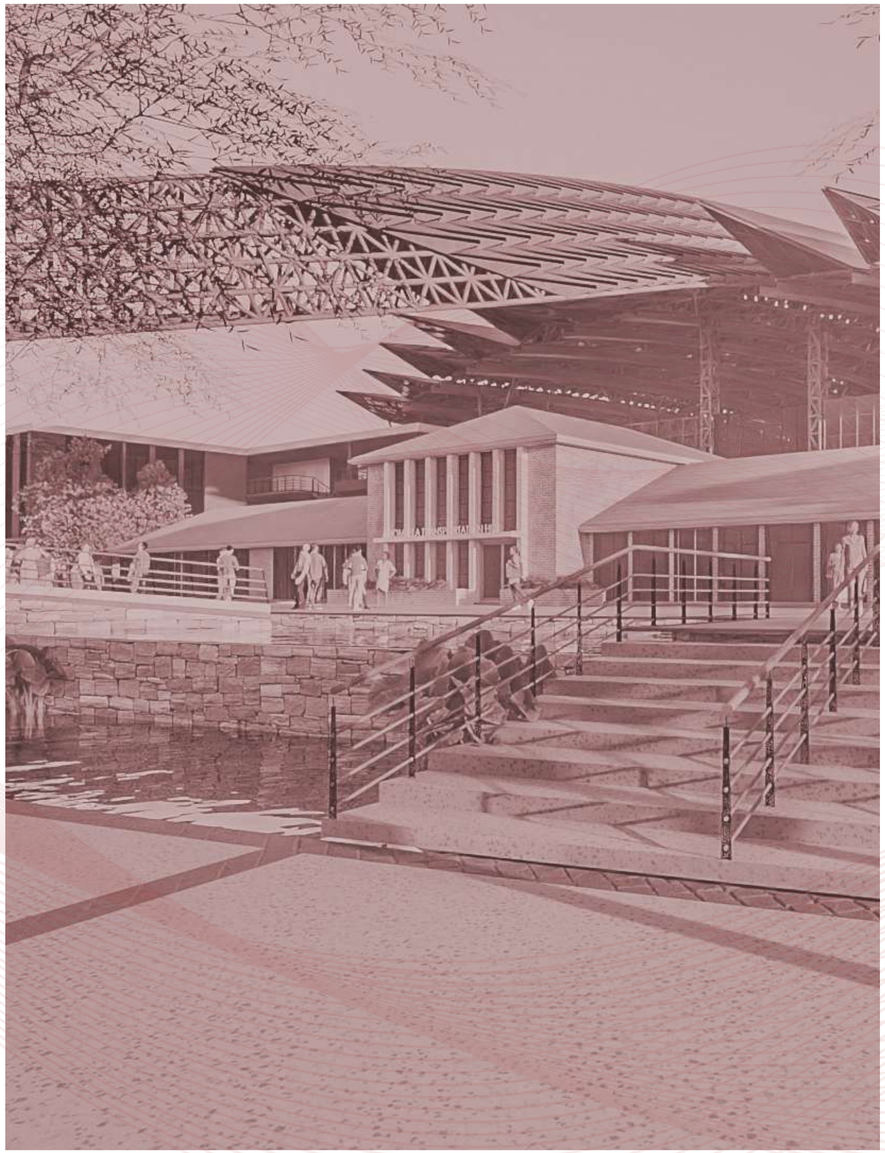


Fig 7.83
Technical Systems roof plan
(Author, 2024)



CHAPTER 8
THE DESIGN



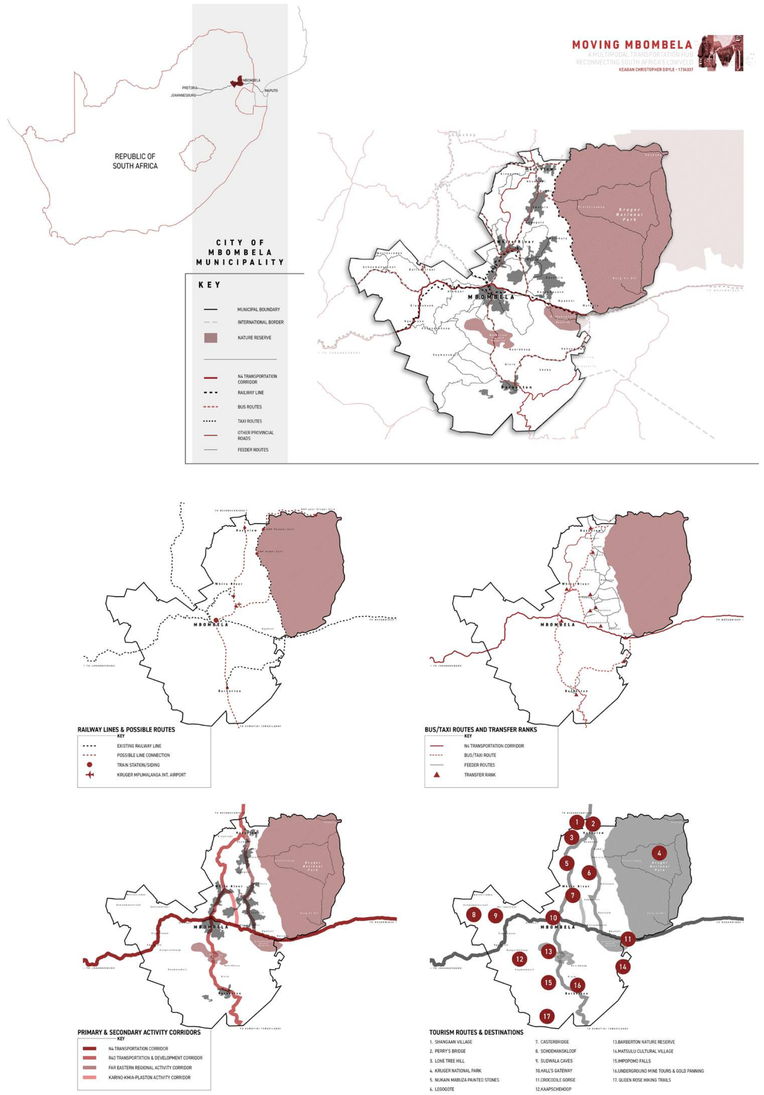


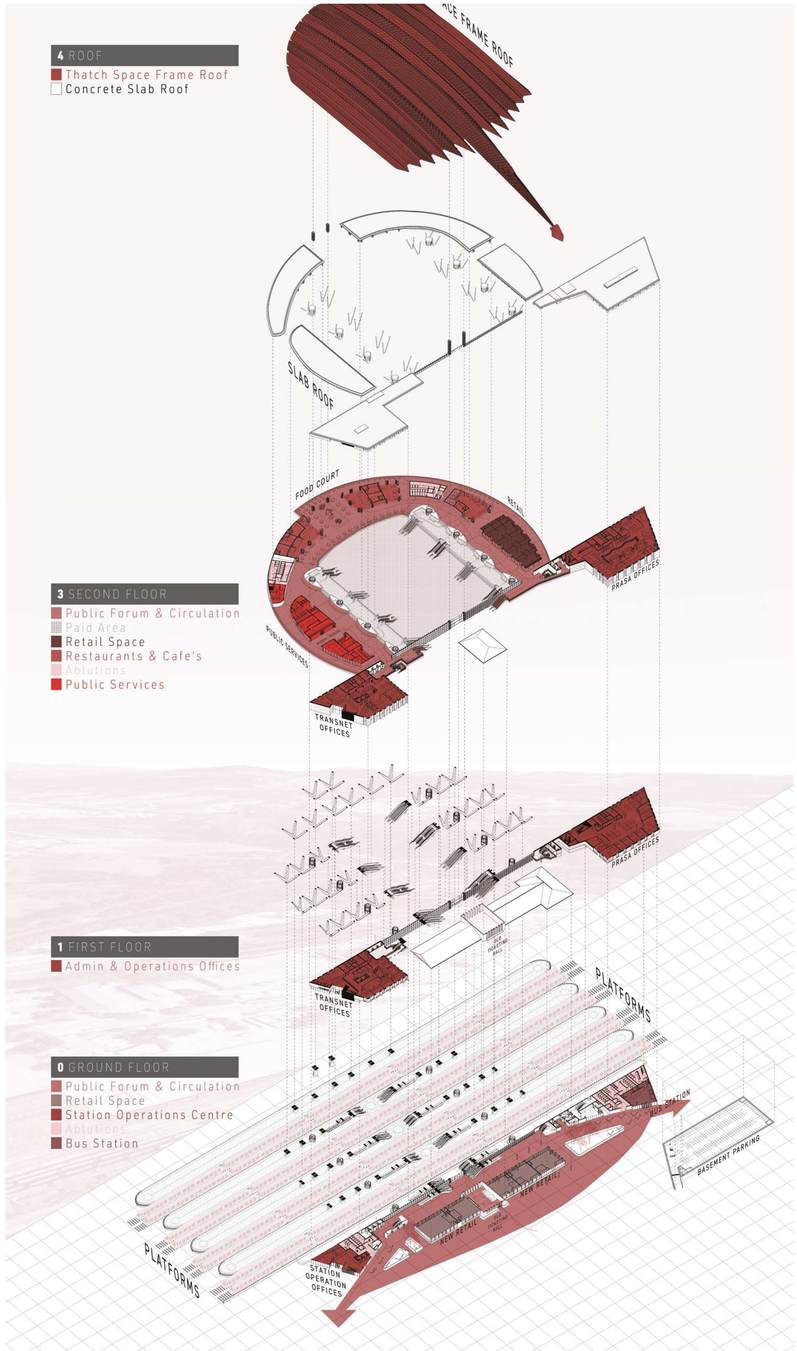


Fig 8.1
chapter 8 page
Render of Memorial Park
(Author, 2024)

Fig 8.2
previous page
Render of Mbombela
Transportation Hub
(Author, 2024)

Fig 8.3
left
Provincial Mapping
Transport & Nodes
(Author, 2024)

Fig 8.4
Master Plan
(Author, 2024)



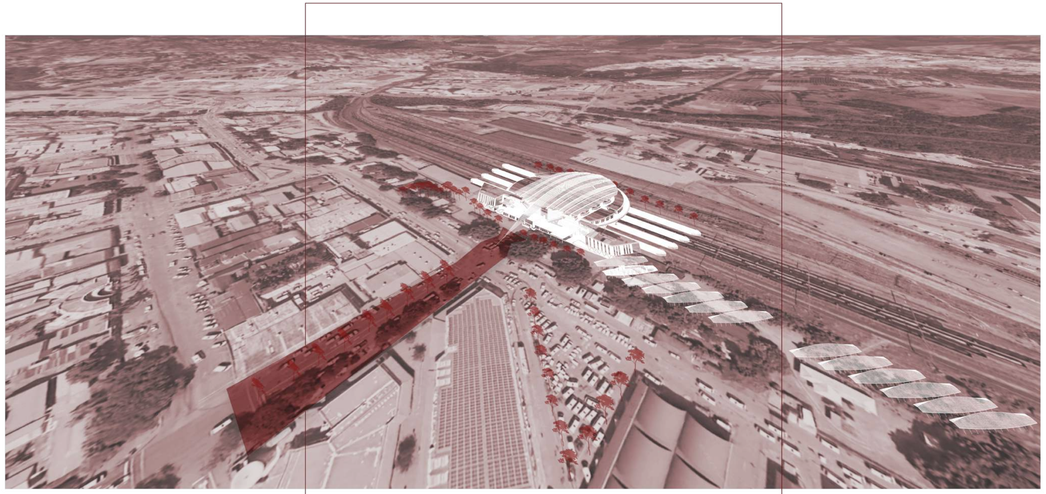




Fig 8.5
left
Exploded Axonometric View of Programme
(Author, 2024)

Fig 8.6
top
Render of Mbombela Transportation Hub
(Author, 2024)

Fig 8.7
bottom
Render of Mbombela Transportation Hub
(Author, 2024)

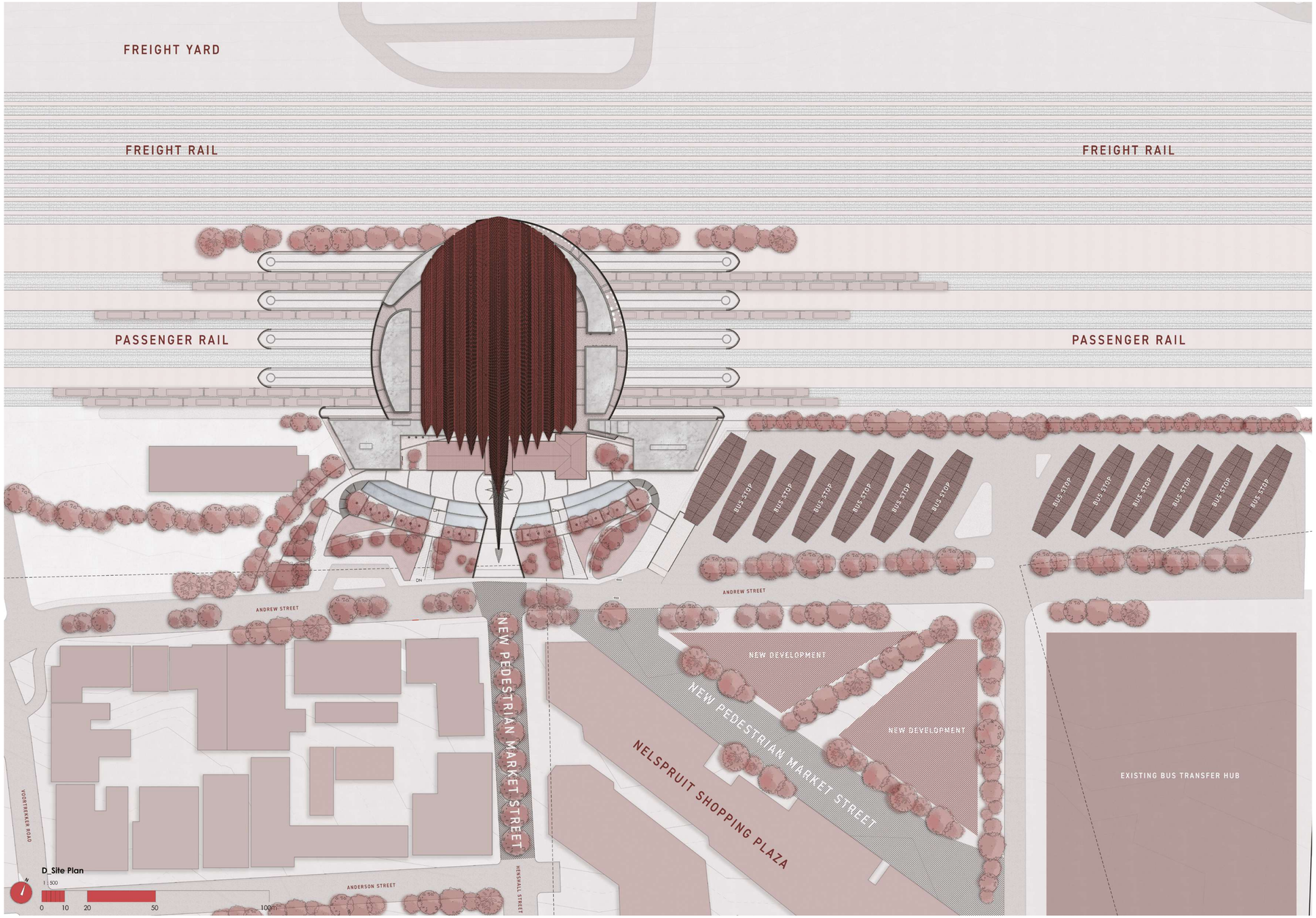


Fig 8.8
Site Plan
(Author, 2024)

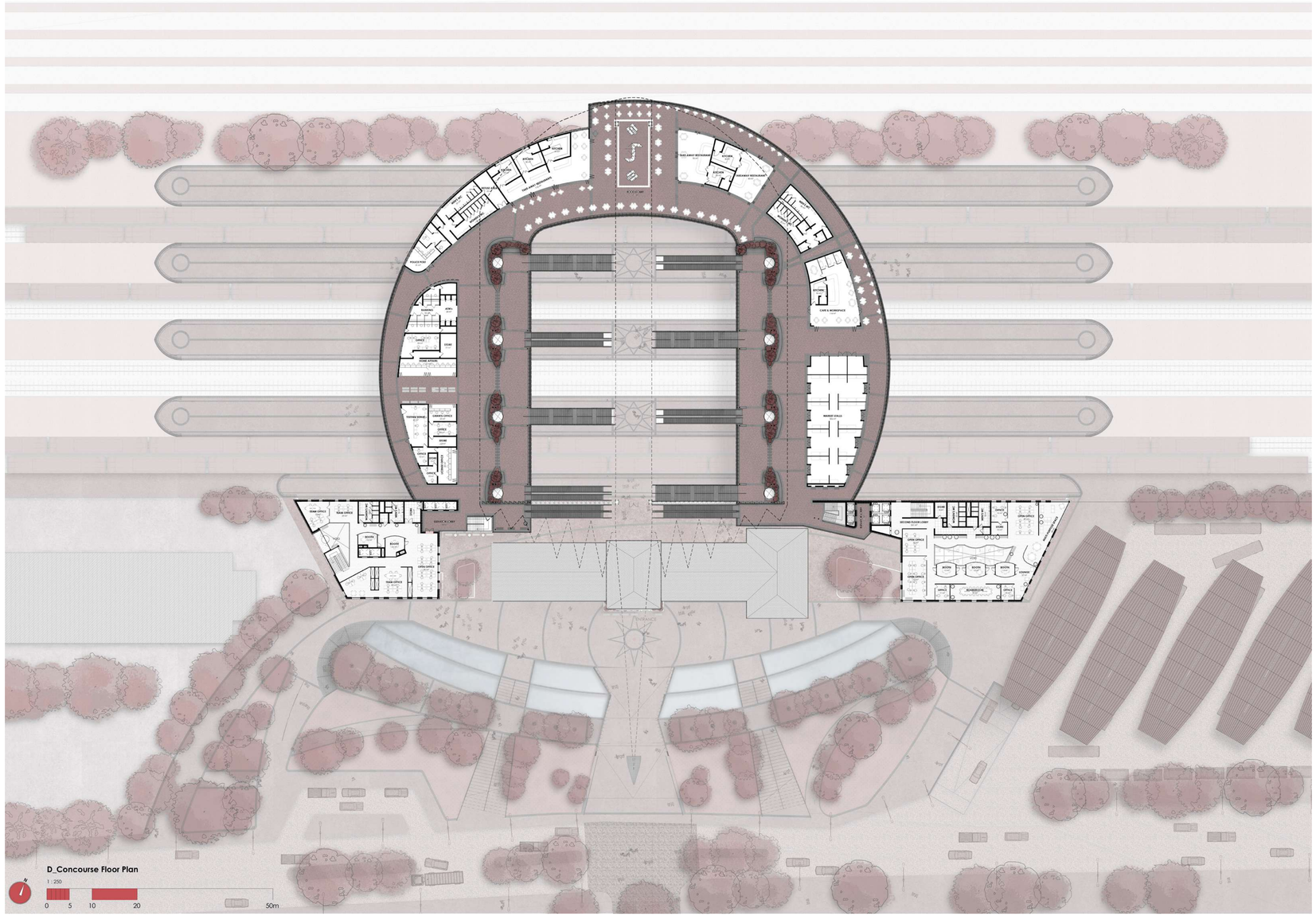


Fig 8.9
Concourse Plan
(Author, 2024)

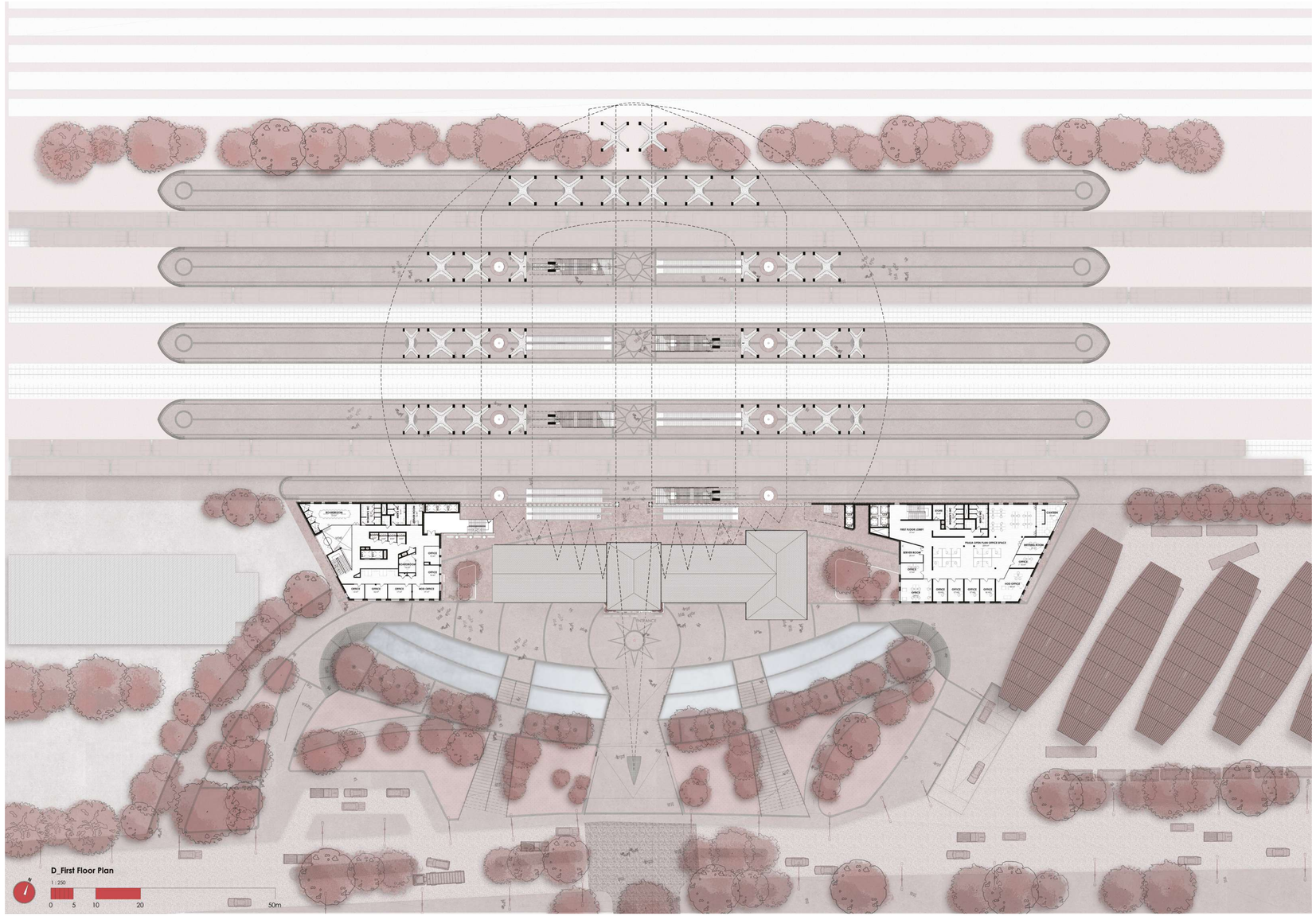


Fig 8.10
First Floor Plan
(Author, 2024)

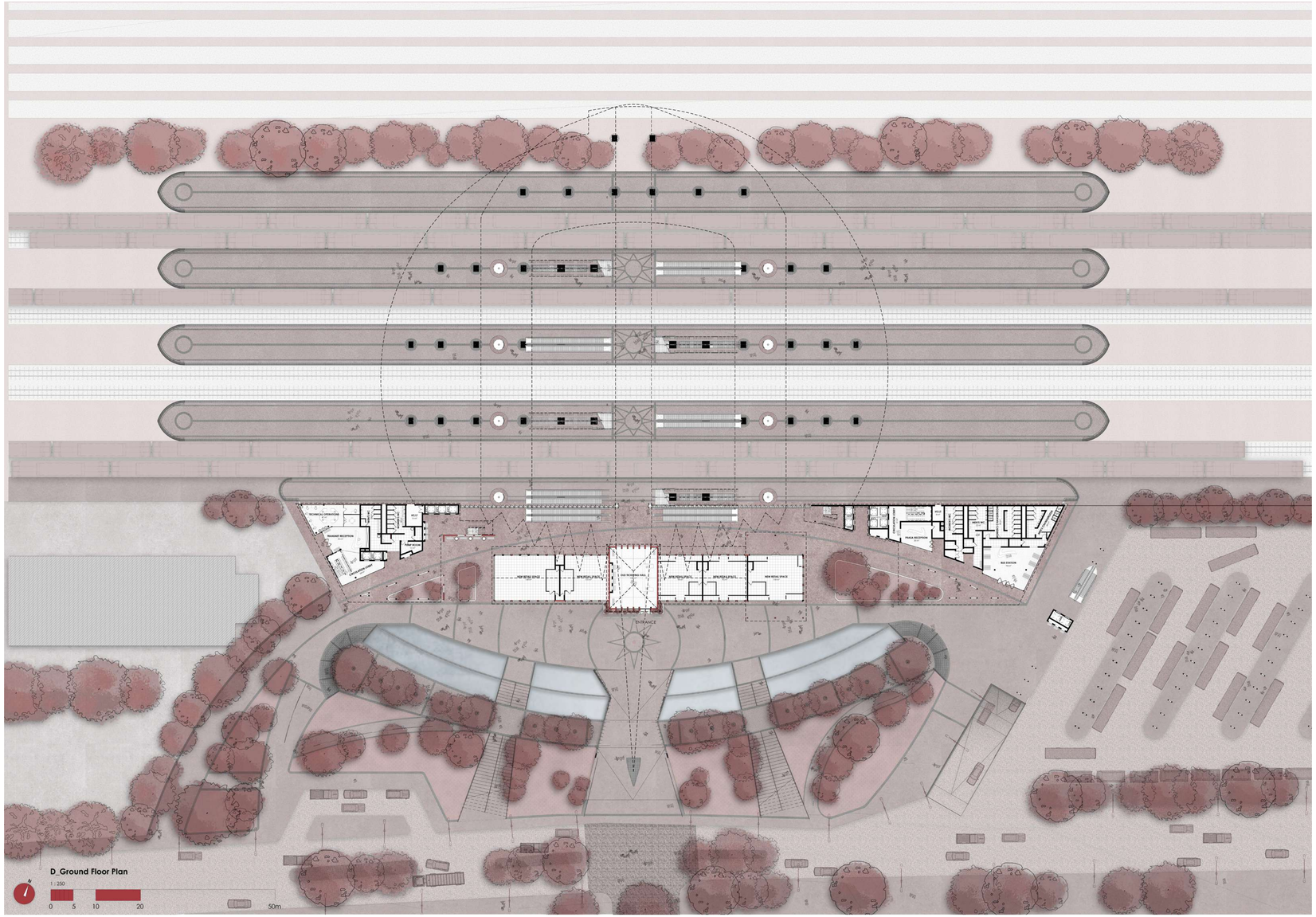
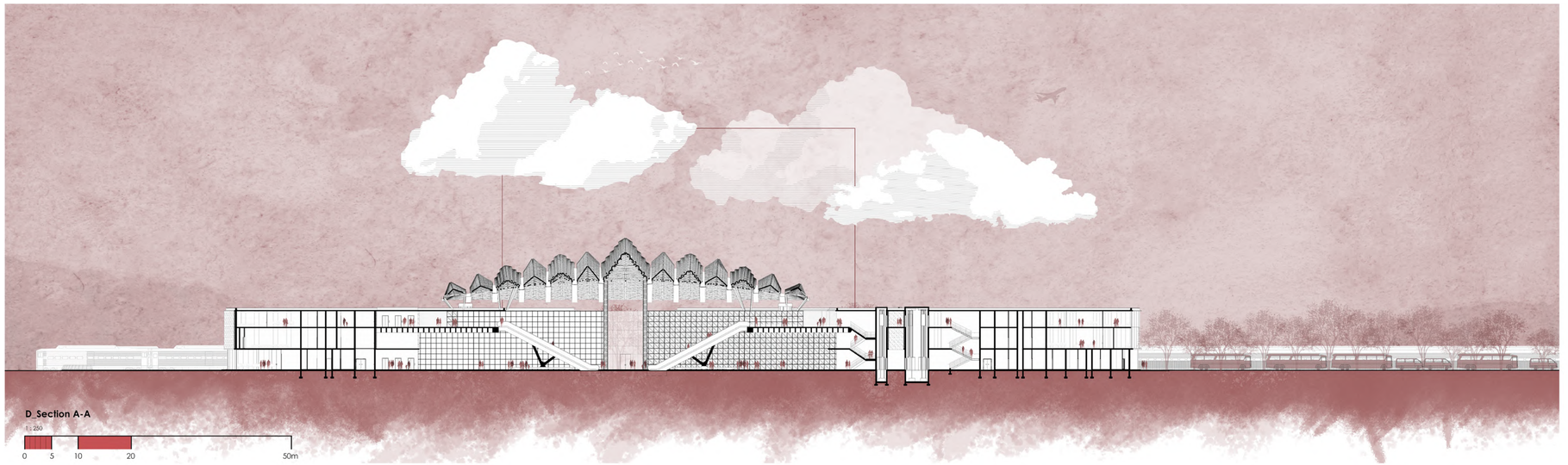


Fig 8.11
Ground Floor Plan
(Author, 2024)



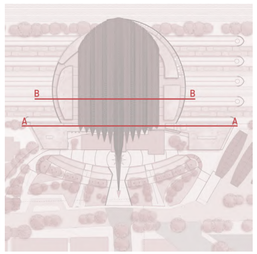
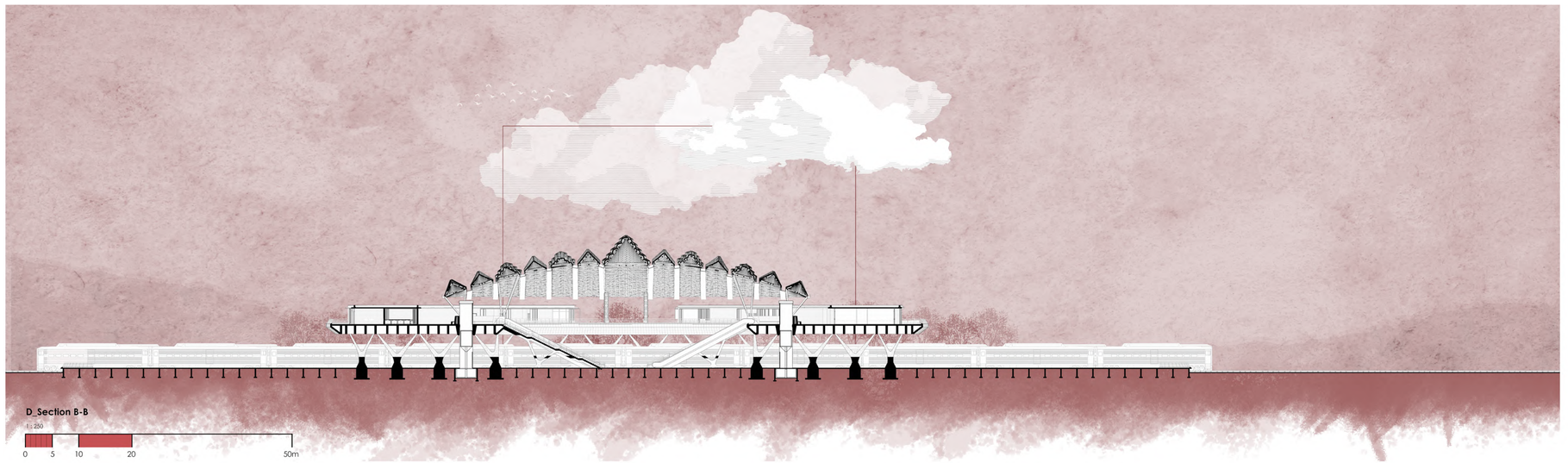


Fig 8.12
Section A-A
(Author, 2024)



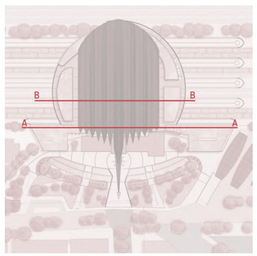
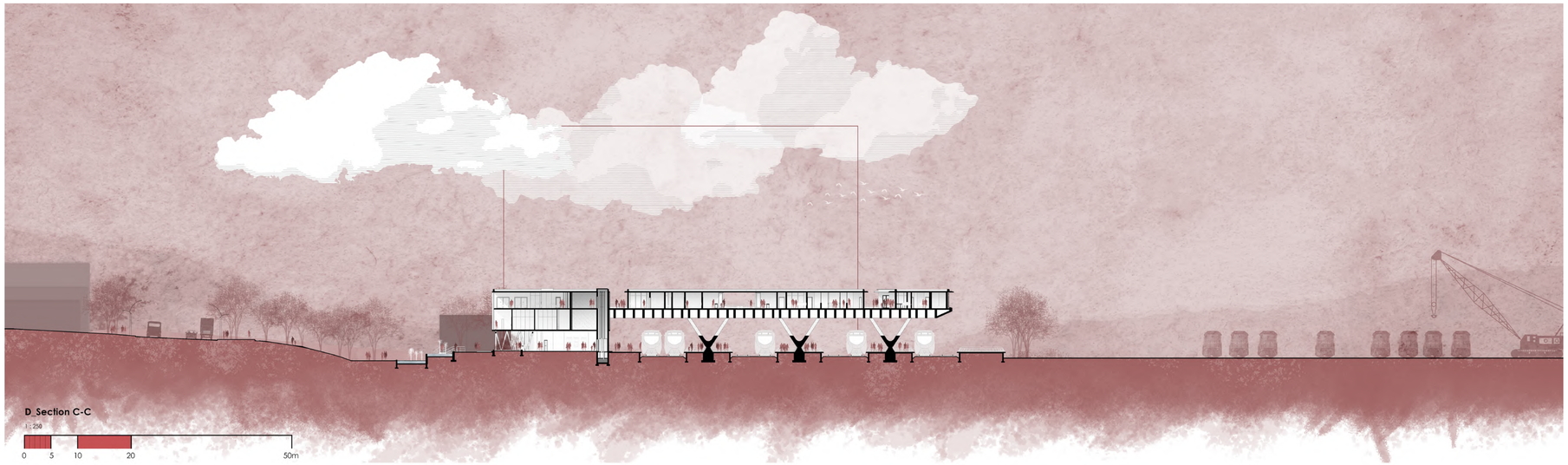


Fig 8.13
Section B-B
(Author, 2024)



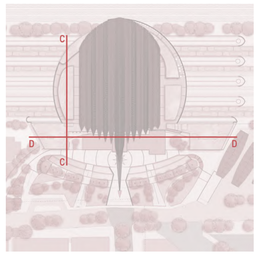


Fig 8.14
Section C-C
(Author, 2024)



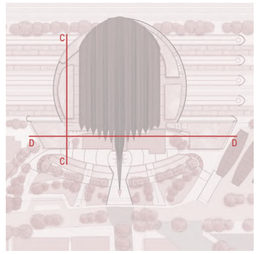


Fig 8.15
Section D-D
(Author, 2024)

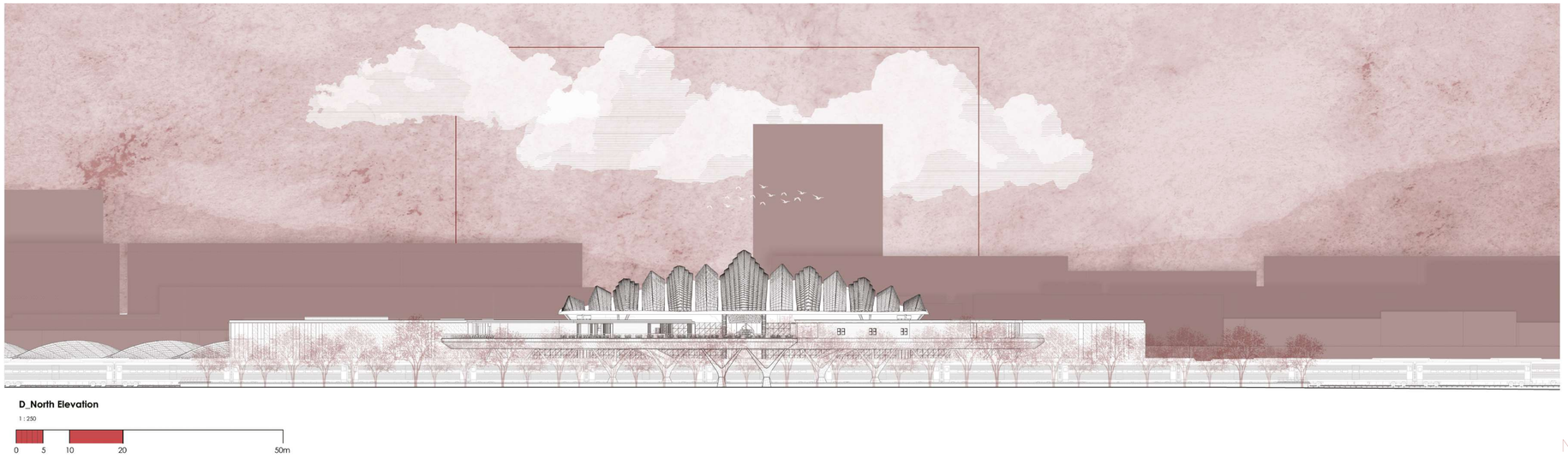


Fig 8.16
North Elevation
(Author, 2024)

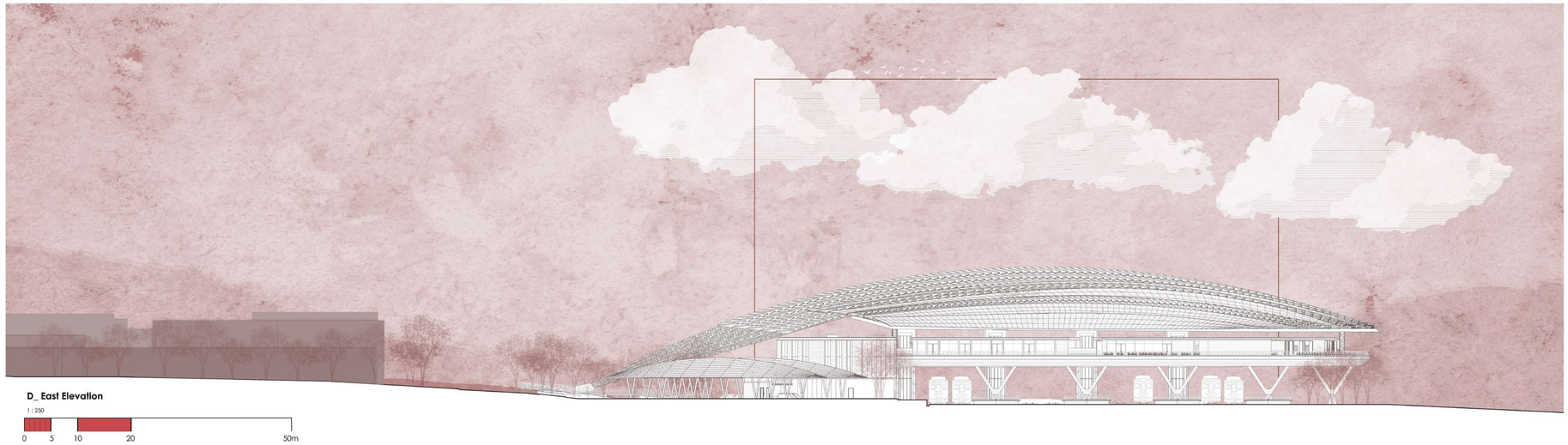


Fig 8.17
East Elevation
(Author, 2024)

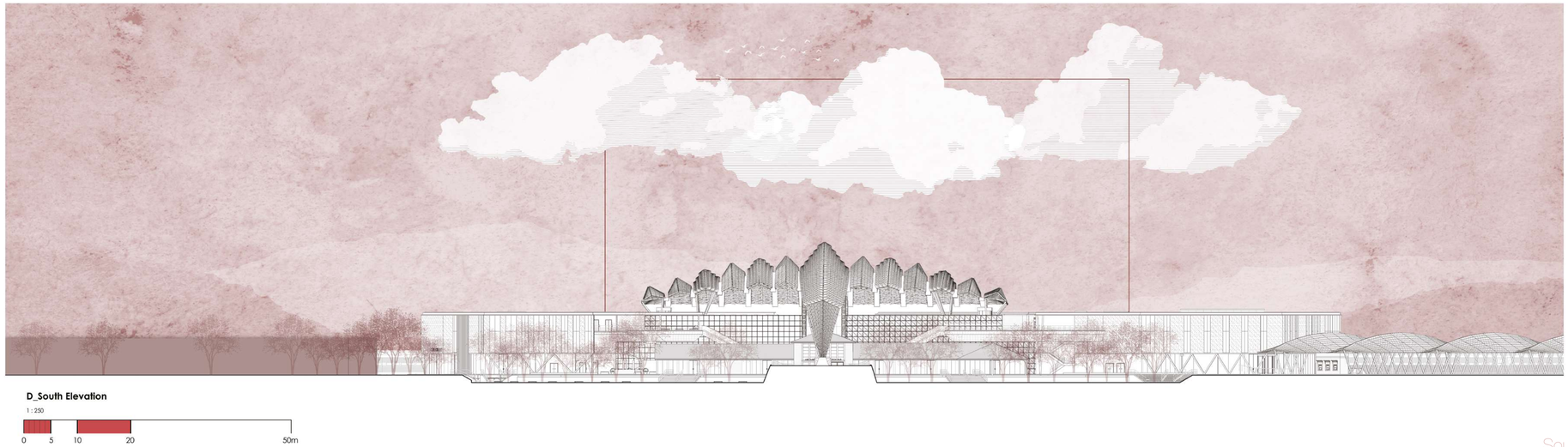


Fig 8.18
South Elevation
(Author, 2024)

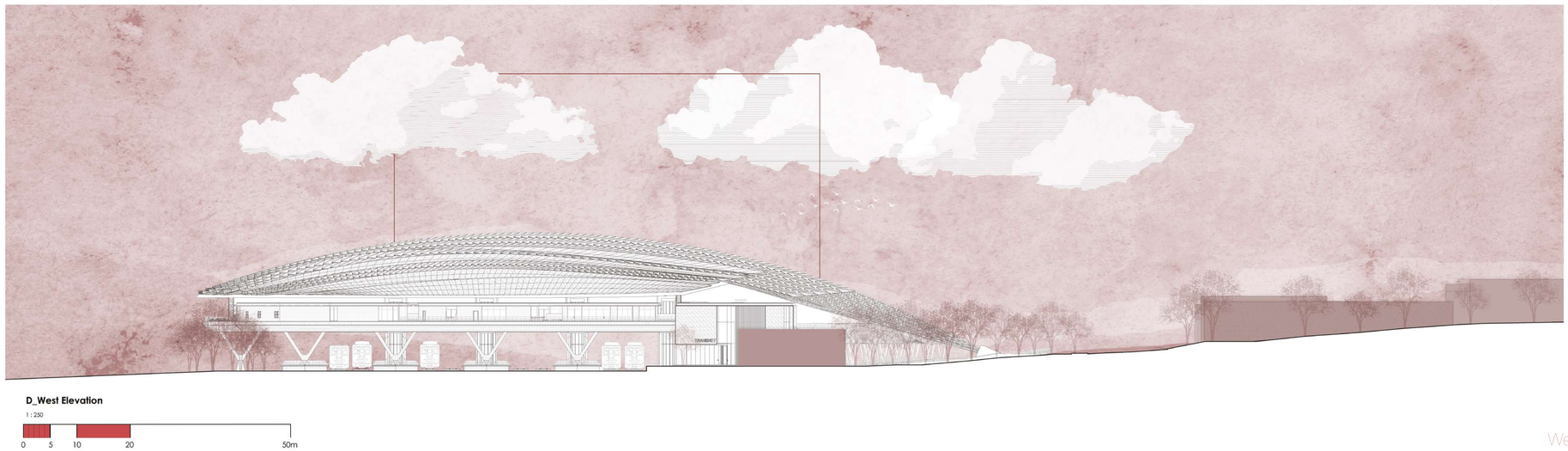
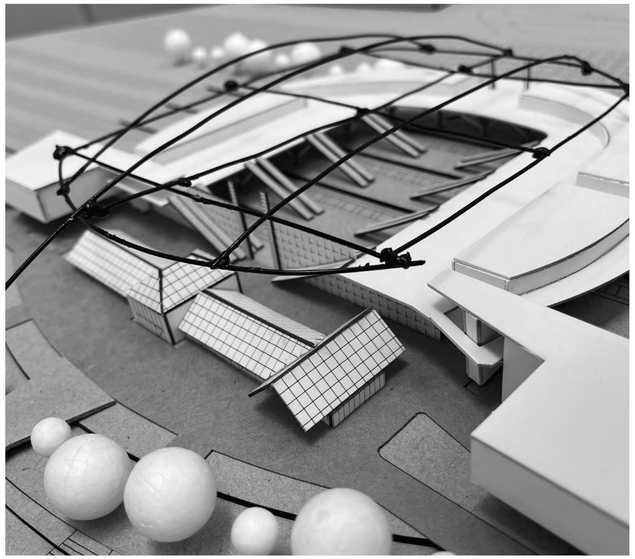
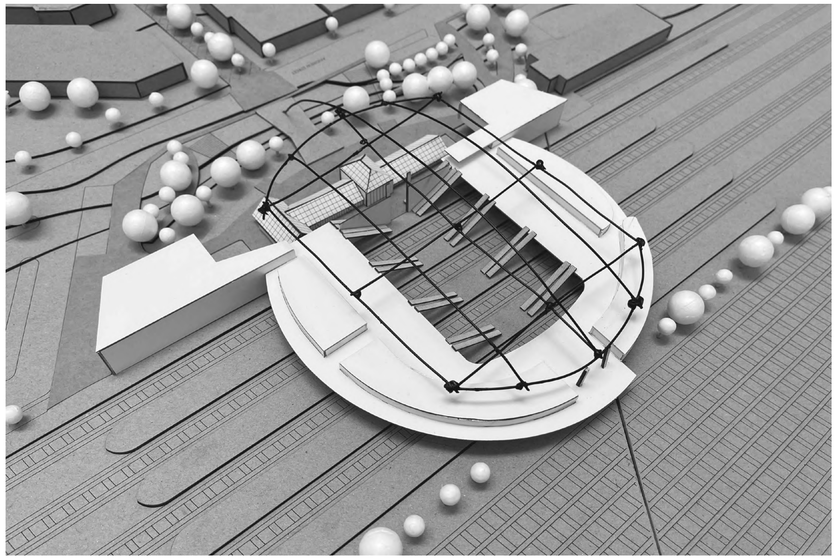


Fig 8.19
West Elevation
(Author, 2024)







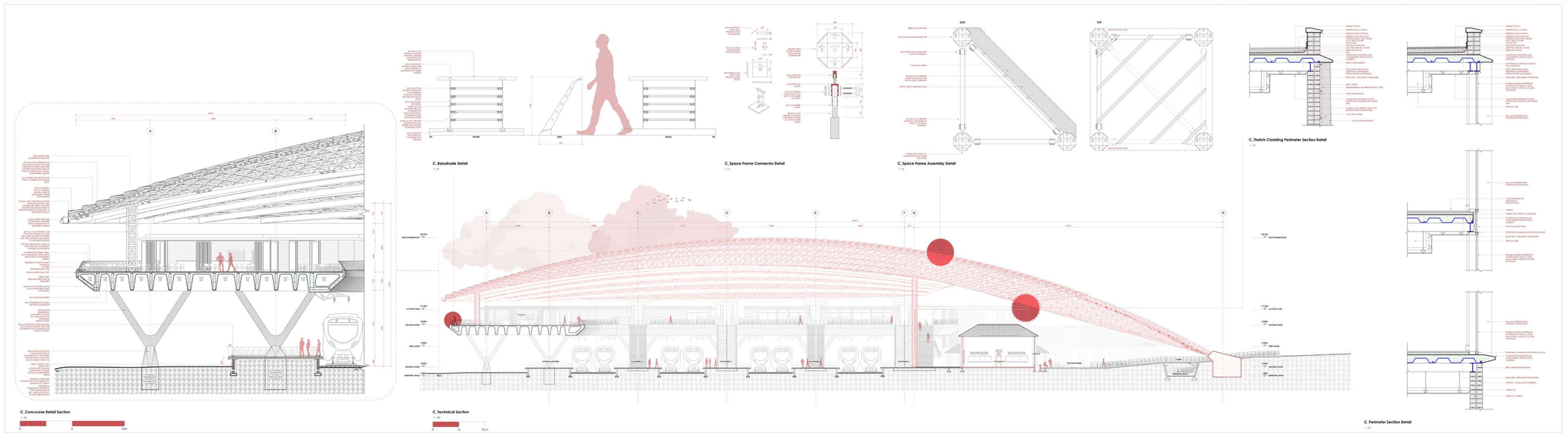

C_Balustrade Detail
C_Space Frame Connector Detail
C_Space Frame Assembly Detail
C_Thatch Cladding Perimeter Section Detail
C_Concourse Detail Section
C_Technical Section
C_Perimeter Section Detail



Fig 8.24
Interior Perspective
(Author, 2024)

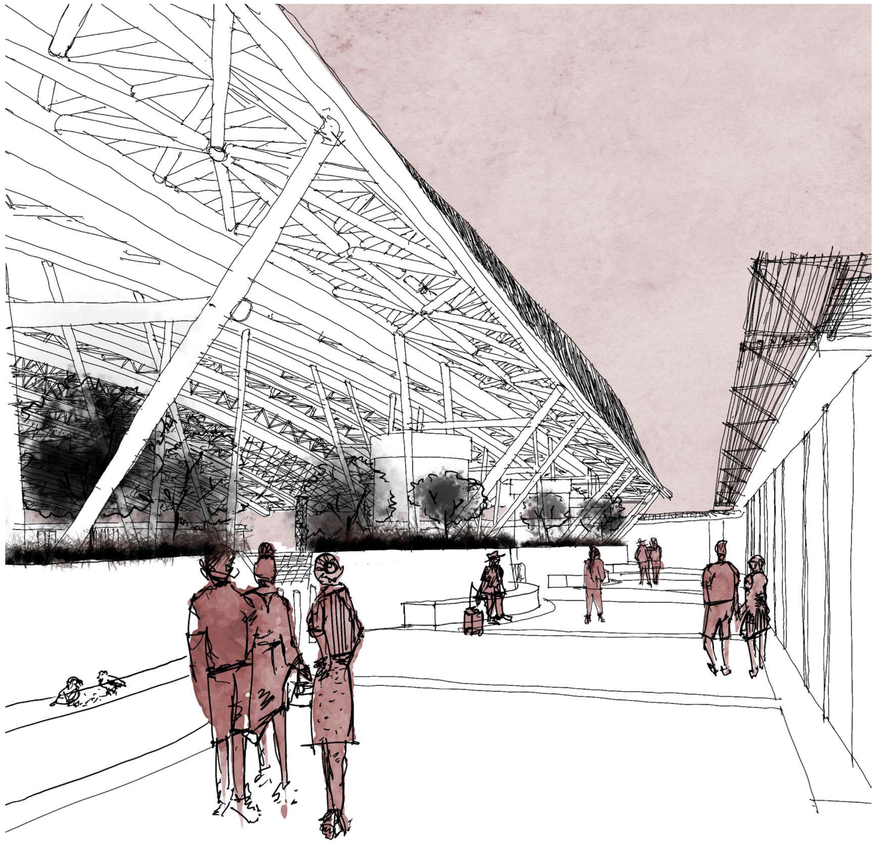


Fig 8.25
Concourse Perspective
(Author, 2024)

Fig 8.20
previous page - top left
Site Model
(Author, 2024)

Fig 8.21
previous page - top middle
Site Model
(Author, 2024)

Fig 8.22
previous page - top right
1:1 Scale Model of Roof Panel
(Author, 2024)

Fig 8.23
previous page - bottom
Technical Section with Perimeter & Assembly Details
(Author, 2024)

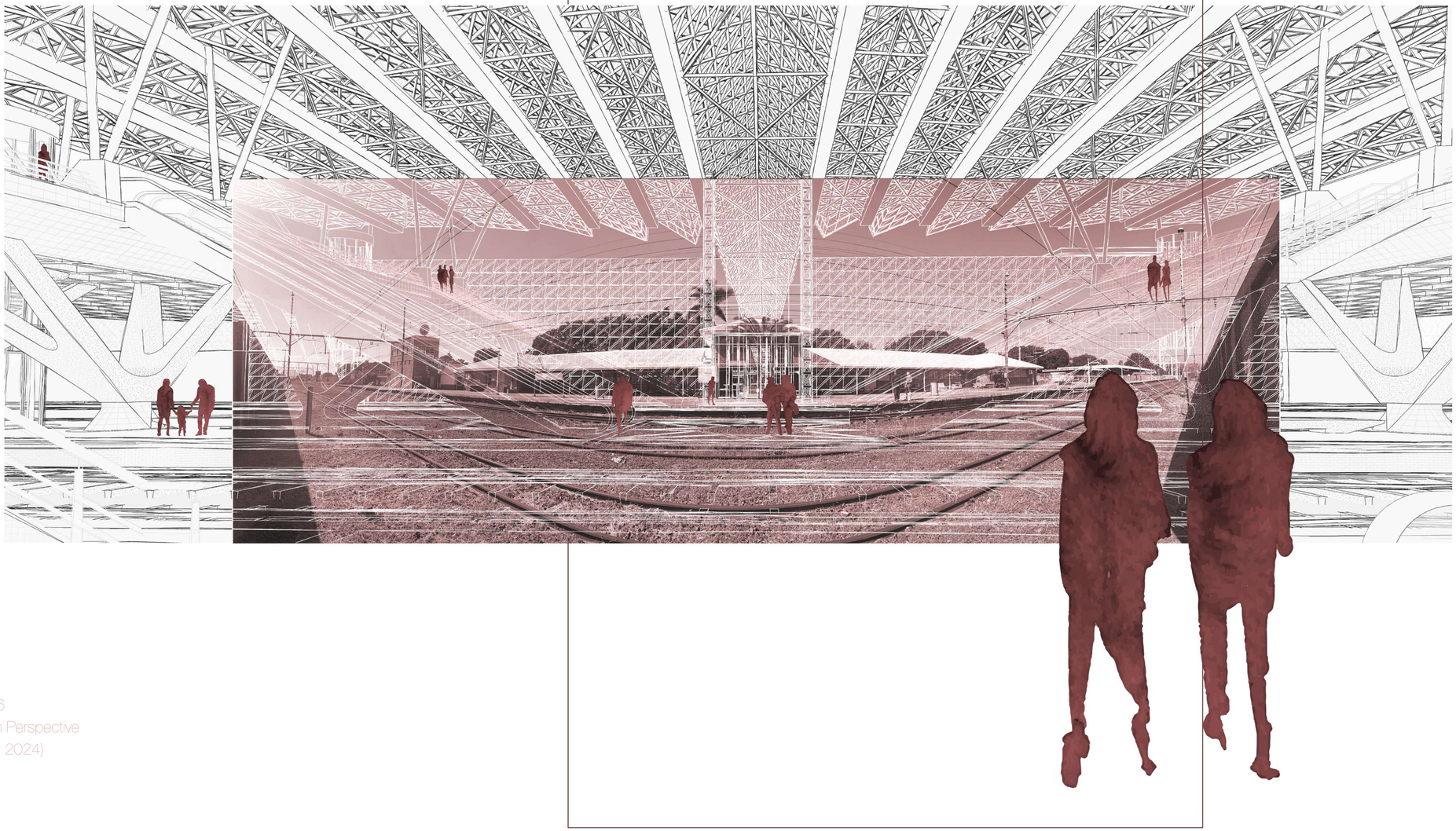


Fig 8.26
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