Songs in Translation

A Centre for Indigenous Music

Woodstock, Cape Town



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2016044527

DECLARATION

Title of the Dissertation
Songs in Translation: A Centre for Indigenous Music in Woodstock, Cape Town

This dissertation is submitted in partial fulfillment of the requirements for the degree M. Arch. (Prof).

Department of Architecture, Faculty of Natural and Agricultural Sciences
University of the Free State.

Candidate

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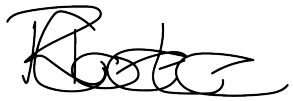
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Supervisors

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Declaration of Original Authorship

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Rohan Cloete

BUYEL' EKHAYA

This is the sounding
Of our re-wakening
We the sleepwalkers
The sleepless wanderers
Driven by a deep hunger
A long-burning thirst

This is the intoning
Of ourselves re-membering
We the abducted
The aching dislocated
Intoxicated by the takers
Sapping urban spaces

This is the resonance
Of our homecoming
We the offspring
Navigating decades of drought
Endless seasons of silencing
Inheritance line rupturing

The string may have been broken
But this chord can never be cut
Our mother – water- carriers
Revive the sacred invocations
uMama recalling the missing ones
Her medicinal rhythms lifting the dust
Unearthing the path homeward
Ancient maps embedded in soul soil
And as we bleed from hearts wounded

Howl from the core, backs once broken
With every breath and echoing note
Each cry to shake off the paralysis
She sings our wisdom borne of great loss
Naming our sorrow
Amplifying bone-deep truth
To pierce our pain-filled forgetting
Repeating these healing refrains

We must return
We must mourn
We must cleanse
We must honour

This is the listening time, the coming together

uGogo is calling, still holding the bow
Offering her voice, knowing her story
Exposing her treasure to mirror ours
She reveals the bridge built in the stars
The past is as intangible as the future
But the earth is still beneath our feet
The water is not easy to reach
But it is not gone, not too far away
And we are still alive, we are here

Vukani, bantu bami!
Vukani!
Buyelan' ekhaya!
Buyani!

(Ndlovu, 2019: online)

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Introduction

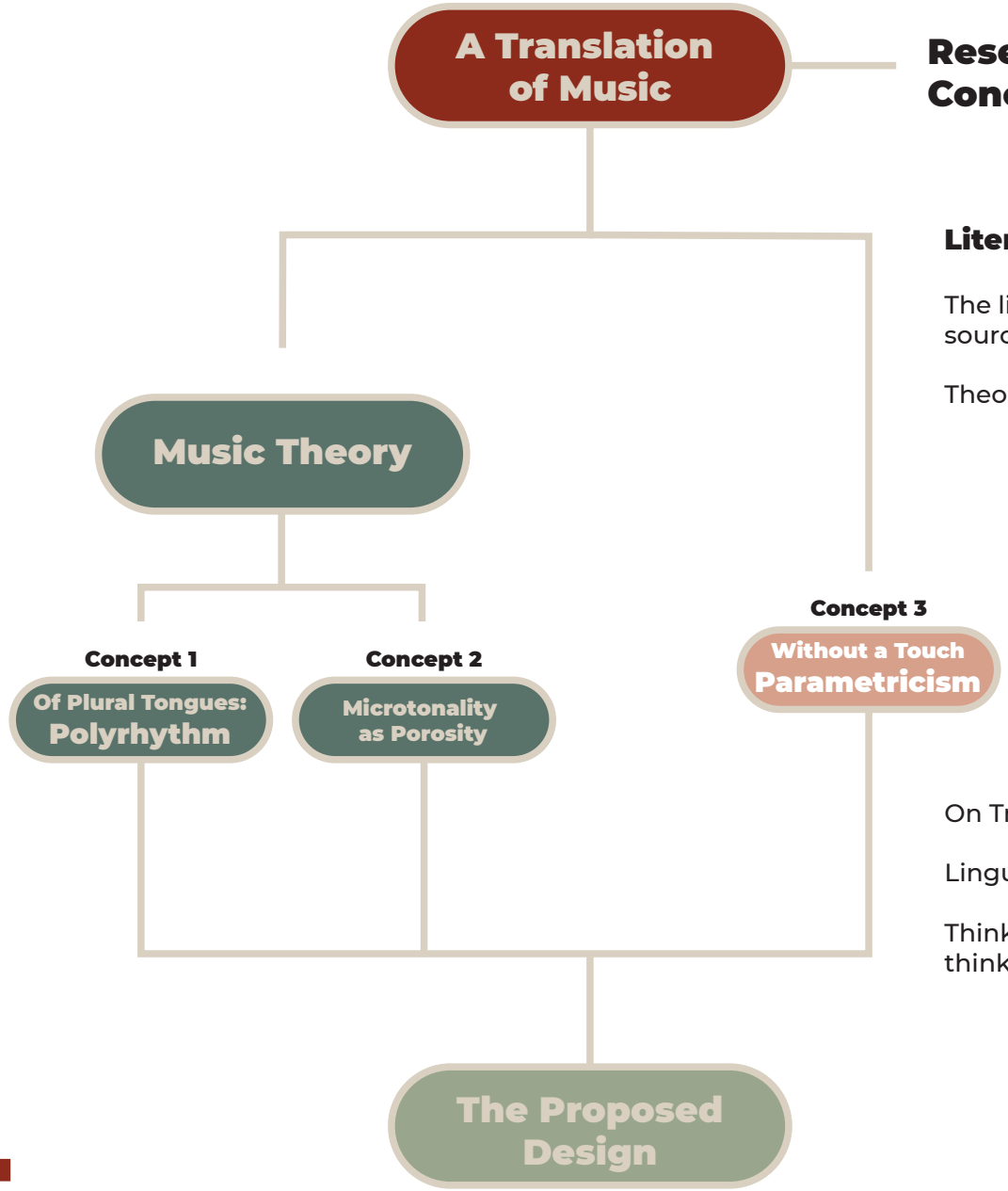
Preserving and Sustaining Indigenous Sounds in Woodstock, Cape Town

Indigenous music is in danger of extinction. The oral nature of carrying the knowledge over from one generation to another further complicates the conservation of the music. Minimal documentation of the music exists, and most of it is documented from a Western perspective. The lack of performance documentation further complicates the preservation since the music and performance cannot be split.

This thesis seeks to explore ways in which indigenous music of different cultures might find embodiment in architecture without being misappropriated. The research considers three different cultures' music based on the cultures found in the geographic location of the proposed design, namely Woodstock, Cape Town. These cultures are: Khoesan, Xhosa, and the Kaapse Klopse (Cape Minstrels).

The research document further explores ways in which the languages of different cultures, but also that of the architecture and context, can work together in the formulation of a place for different identities. Various notions are considered, such as liminality or thresholds as well as generative design methods.

Ultimately, the research investigates theories of ethnomusicology as well as other methods to translate musicology to architecture within a complex physical and non-physical context.



Research and Conceptual Framework

Literature Review:

The literature review includes, but is not limited to the following sources.

Theory for Ethnomusicology - Harris M. Berger, Ruth M. Stone:

1. Linguistic and Semiotic Approaches to Ethnomusicology - Jayson Beaster-Jones

6. Performance Studies and Critical Improvisation Studies in Ethnomusicology - Ellen Waterman

7. Decentering Music: Sound Studies and Voice Studies in Ethnomusicology - Katherine Meizel and J. Martin Daughtry

9. Theories of Participation - Matthew Rahaim

On Translation - Paul Ricoeur

Linguistic Models in Ethnomusicology - Steven Feld

Thinking difference: Theories and models of parametric design thinking - Rivka Oxman

The Clients: IAM Project + SAMRO Foundation

The IAM Project is an indigenous music project by the SAMRO Foundation. SAMRO regulates music rights and registration in South Africa and has been the leader in the field since 1961 by representing more than 12 000 music creators (SAMRO, 2019: online).

SAMRO also focuses on funding and supporting music and arts education through the SAMRO Foundation. The company also fosters and develops creativity across all genres and categories of music in the local music industry by hosting regular conferences and workshops (ibid).

The aims of SAMRO (ibid):

- To create value for the creators and users of music
- To protect the intellectual property rights of writers, composers and music publishers by licensing music users
- To ensure that members whose works are broadcast and played commercially are paid their royalties from license fees collected by SAMRO
- To actively promote the value of copyright

The IAM Project stems from the SAMRO Foundation. There is a constant call for indigenous knowledge systems in South Africa. The SAMRO Foundation intends to promote and document indigenous South African music to reinforce and reinstate indigenous knowledge systems (IAM Transcriptions Project, 2021: online).

The Foundation recognises that indigenous music is in danger of becoming extinct due to globalisation and the Western colonial influence in South Africa. The youth are turning away from indigenous music systems and are following the globalisation trend. This further poses a threat to the continued existence of the music since most of the indigenous music passes from generation to generation (ibid).

The aims and objectives of the SAMRO Foundation (ibid):

- Promote the national arts through sponsorship of various kinds
- Encourage excellence in the arts through education
- Facilitate economic participation in the creative economy
- Influence cultural and arts policy by means of research and advocacy
- To promote living cultural heritage.



Figure 2: SAMRO Logos (IAM Ttranscription Projects, 2019: online)





Figure 1: IAM Transcriptions Project Logo (IAM Ttranscription Projects, 2021: online)

Programme/ Functions

Upper Ground Floor:

Main Entrance: 41m²
- Reception/ Circulation Space: 32,4m²
- Kitchenette: 7m²
- Storage: 2m²

Waiting Area: 29m²

Literature and Sheet Music Library: 73,6m²

Audio-Visual Library: 97m²
- Screening Space: 52m²
- Private Listening Pods: 34m²
- Media Storage/Library: 11m²

Administrative Spaces: 91m²
- Admin/ Auditorium Reception Space: 16m²
- Open Office and Boardroom: 42m²
- Managerial/Financial Office: 16m²
- Aministrative Staff Ablution: 17m²

Auditorium: 145m²
- Backstage/ Recording Studios: 18m²
- Storage: 1,3m²
- Circulation: 25m²
- Stage: 14m²
- Performance Space between Stage and Audience members: 15m²
- Audience Seating: 48,5m²

Foyer Space for Auditorium: 33m²

Chordophone/ Strings Rehearsal Spaces: 74m²
- 3 x 18m² Main Rehearsal Spaces with Desk Space (2m²): 60m²
- 1x Small Rehearsal Space: 14m²

Aerophone/ Winds Rehearsal Space: 42m²
- 2x 19m² Main Rehearsal Spaces with Desk Space (2m²): 42m²

Membranophone/Percussive Space: 56m²
- 2x 19m² Main Rehearsal Spaces with Desk Space (2m²): 42m²
- 1x Small Rehearsal Space: 14m²

Adaptable Orchestral Rehearsal Space: 37m²

Circulation Space/ Open Performance/ Lecturing Space: 221m²

Music Staff + Admin Staff Kitchenette and Staff Room: 32m²

User and Public Ablution: 70m²

Internal Emergency Escape Staircases: 17,4m²

Main Circulation Space: 134m²

Total: 1 193m²

Lower Ground Floor:

Secondary Entrance and Circulation Space: 68m²

Cleaning Staff/ Security Staff and Storage Space: 44m²
- Security Booth: 4m²
- Dressing Room: 6m²
- Temporary Exhibition Space Storage: 4m²
- Cleaning Equipment/ Cleaning Supply Storage: 5m²
- Kitchenette/ Staff Room: 11m²
- Ablution: 2m²
- Circulation: 12m²

Membranophone/Percussive Experiential Exhibition: 42m²

Aerophone/Winds Experiential Exhibition: 42m²

Chordophone/Strings Experiential Exhibition: 42m²

Instrument-Making Space: 295m²
- Adaptable Lecture Space/ Entrance to Instrument-Making Space: 31,5m²
- Kitchenette/ Break-Away Space: 22m²
- Circulation Space: 38m²
- Workers/Attendee Storage: 1,5m²
- Ablution: 7m²
- Instrument Testing and Refinement Space: 51m²
- Instrument Testing Outside Space: 36m²
- Managerial Office Space: 5m²
- Instrument Assembly Space: 45m²
- Instrument Assembly Outside Space: 23m²
- Instrument-Making Hardware and Material Storage Space: 35m²

Internal Emergency Escape Staircases: 17,4m²

Enclosed Outside Performance Space: 64m²

Refuse Yard: 9m²

Mechanical Room: 7m²

Total: 630m²

Total Combined Internal Area: 1 823m²

PART 2

Site Selection + Site Analysis



MACRO ANALYSIS - 12

MEDI CONTEXT - 20

MICRO CONTEXT - 28

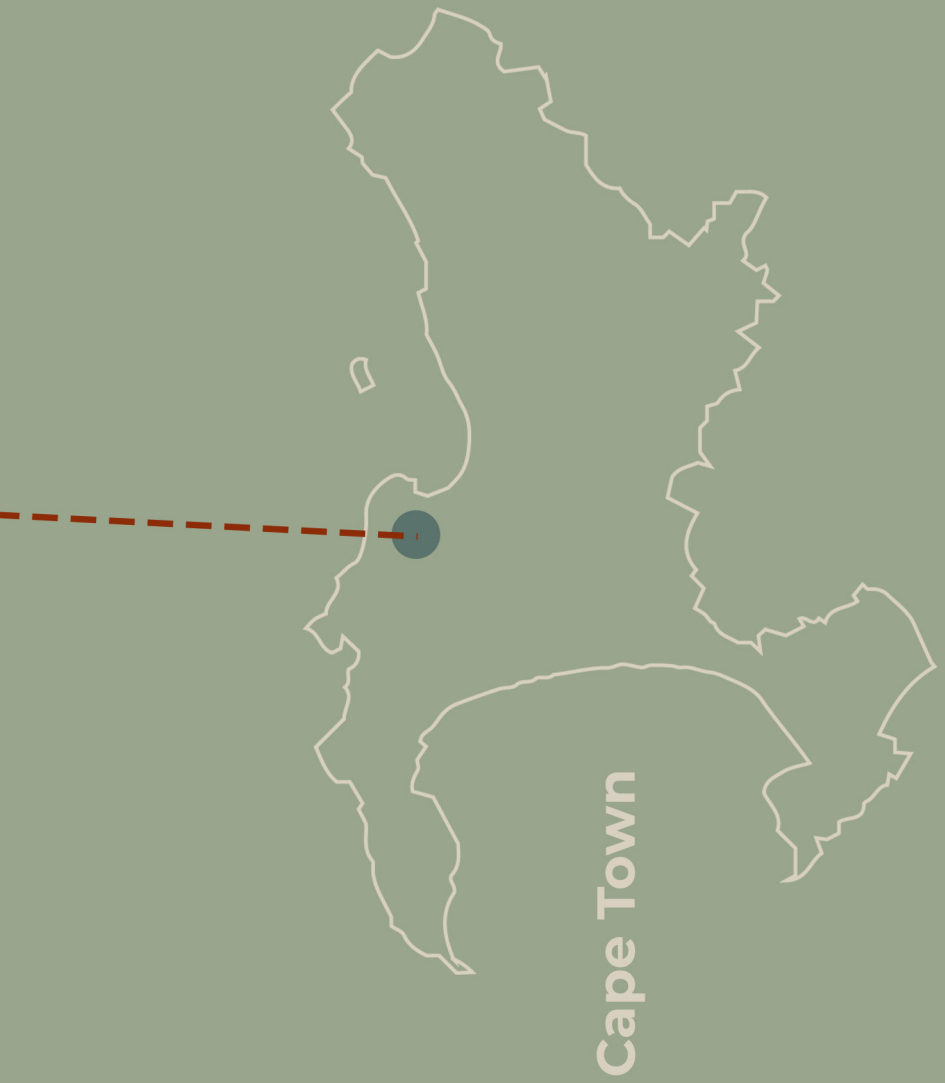


Figure 3: Map Outline (Author, 2022)

Reasons for the Site Selection

The site was chosen for its position in a culturally rich suburb of Cape Town. Various other arts and cultural institutions surround the site, which justifies a new cultural addition.

The site sits at the boundary of several different thresholds within the context. The site is surrounded by residential buildings to the south, industrial buildings to the north and east, and a park to the west. The site is also close to other institutional buildings such as the University of Cape Town which is approximately 4,7km from the site.

A building currently occupies the site. The building, however, is a simple envelope that is being used as a long term car parking rental space with little to no interior spaces or development. Initially the design considered making use of adaptive reuse to still reuse the existing building but failure to obtain any technical details about the building resulted in a redevelopment of the site.

A site in a landscape was also considered, but a more remote area in a landscape posed issues. These issues include access to the site for city users. A music training centre will rely on weekly visitors and attendees to study the music. If the site is too remote, it may result in little to no weekly attendance, negatively impacting the entire project's economic viability.

The second issue is that most of the cultures accommodated in the proposed project have sacred locations in the landscape. This poses a potential problem of placing the site in a sacred space of one of these cultures. This potential issue might either give an unfair advantage to one of these cultures, or it might be considered insensitive and offensive towards the culture in question.

Therefo re, the site was selected for its culturally rich environment and neutral position regarding the potential cultural conflict. This also poses the most economically viable proposition.

Site:
14 Ravenscraig Road
Erf 177344

Singing the Topology

Suspended in rigidity
lies a locus
between the Devil and an ocean

In tensile nature
lies a place
at the edge of home, industry and Trafalgar

A silenced scream
finds its home
between the known, the foreign and the known foreign

A song revived
unearths an audience
at 14 Ravenscraig Road

Woodstock, Cape Town



Macro Analysis

Figure 4: Area Map (Author, 2022)

Macro context

The proposed design lies in Woodstock, Cape Town. Woodstock is a suburb that lies between the foot of Devil's Peak and the harbour of Table Bay. The suburb embodies a rich and multicultural history.

In the form of divergent typologies, fragments of plurality lie scattered within, making for a complex lexicon of several tongues.

During recent years the suburb has been subject to urban renewal, which resulted in a hub for creatives and multi-user precincts. Various forms of art and cultural installations adorn the streets as the suburb grows as an interactive boundary between the divergent typologies.

Woodstock, however, still carries the strong traces of rigidity instated by the history of colonial rule in the area.

A Brief History of Woodstock

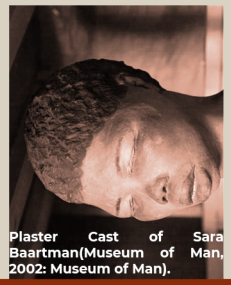
Precolonial Period

The entire Western Cape coastline used to be inhabited by the indigenous Khoekhoe and San groups, often categorised together as the Khoisan or Khoe-San. The primary groups in this region are the Griqua group and the Cape Khoekhoe group (IWGIA, 2011: online).

Figure 5: A timeline depicting a brief history of Woodstock (Author, 2022).

1787

Pieter van Papendorp, who was either a silversmith or farmer, bought the so-called plaats (plots), which resulted in the first name for the area, Papendorp (Brodie, 2015: 133).



Plaster Cast of Sara Baartman(Museum of Man, 2002: Museum of Man).



Treaty House (George, 1837: Willam Fehr Collection).

1692

Three farms formed the original Woodstock – Zonnebloem, Leliebloem and Roodebloem – which lay at the slopes of Devil's Peak (Davies Group, 2021: online).

1803

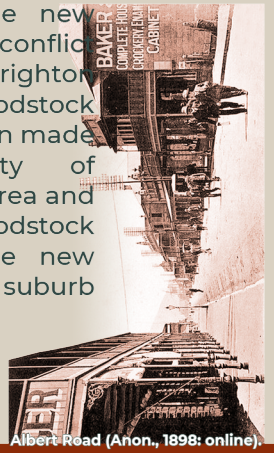
A young Khoe-San servant woman moved to Papendorp to live with her employers. She is now famously known as Sara Baartman, who was put on exhibitions and exploited by Europeans (Brodie, 2015: 133).



Woodstock Beach (Anon., n.d.: online).

1867

The name changed from Papendorp to Woodstock after briefly being called New Brighton. The new name rose out of a conflict between the New Brighton Hotel and Woodstock Hotel. The fishermen made up the majority of inhabitants in the area and voted for the Woodstock Hotel to form the new name of the suburb (Badham, 1987: 22).



Albert Road (Anon., 1898: online).

1890s

Railways started to emerge from the Cape Town city centre to the nearby suburbs (Badham, 1987: 21). A railway ran along the shore through Woodstock, which made Woodstock Beach increasingly popular. The construction of the railway resulted in Woodstock becoming an industrial suburb. A journal article described the neighbourhood as a jarring mixture of urbanity and barnyard setting (Badham, 1987: 22).

The 1950s

The land reclamation project of the foreshore in Cape Town started planning and construction in the 1930s and 1940s. Woodstock, however, was struck by the land reclamation project in the 1950s (Joseph, 2014: online). The project led to the tragic loss of Woodstock Beach. The land reclamation cemented the industrialisation of the suburb even further.

The 1980s and Present Day

The 1980s bears the first physical evidence of urban renewal and gentrification in Woodstock (Garside, 1993: 29). Ever since the first signs of gentrifications rose in the '80s, the prices of properties and rent increased (Joseph, 2014: online). This process was to the detriment of the residents in the area. In the early 2010s, the sale and renovation of The Old Biscuit Mill – a functioning biscuit factory until 1946 – expedited the act of gentrification in Woodstock even further.


Suspended in rigidity
lies a locus
between the Devil and an ocean
Ocean
Woodstock



Figure 6: Photograph from Signal Hill depicting parts of Cape Town (Woodstock) and the landscape (Author, 2021).

Arts and Culture in Woodstock

Much of the gentrification in Woodstock led to the area being known for its vibrant art and culture. The suburb is now well-known for the creatives who inhabit it, especially in mixed-use buildings, such as the Old Biscuit Mill.

Woodstock also houses various educational institutes, such as The Animation School.

Since the 1990s, street art became prominent in the area as a means of cultural expression and interaction with the context.

The suburb became an urban art gallery that sprawls through the streets.

The area also calls for the accommodation of indigenous crafts. The proposed design attempts to answer this calling.

















Figure 7: Photographs depicting some of the street art in Woodstock (Author, 2022).

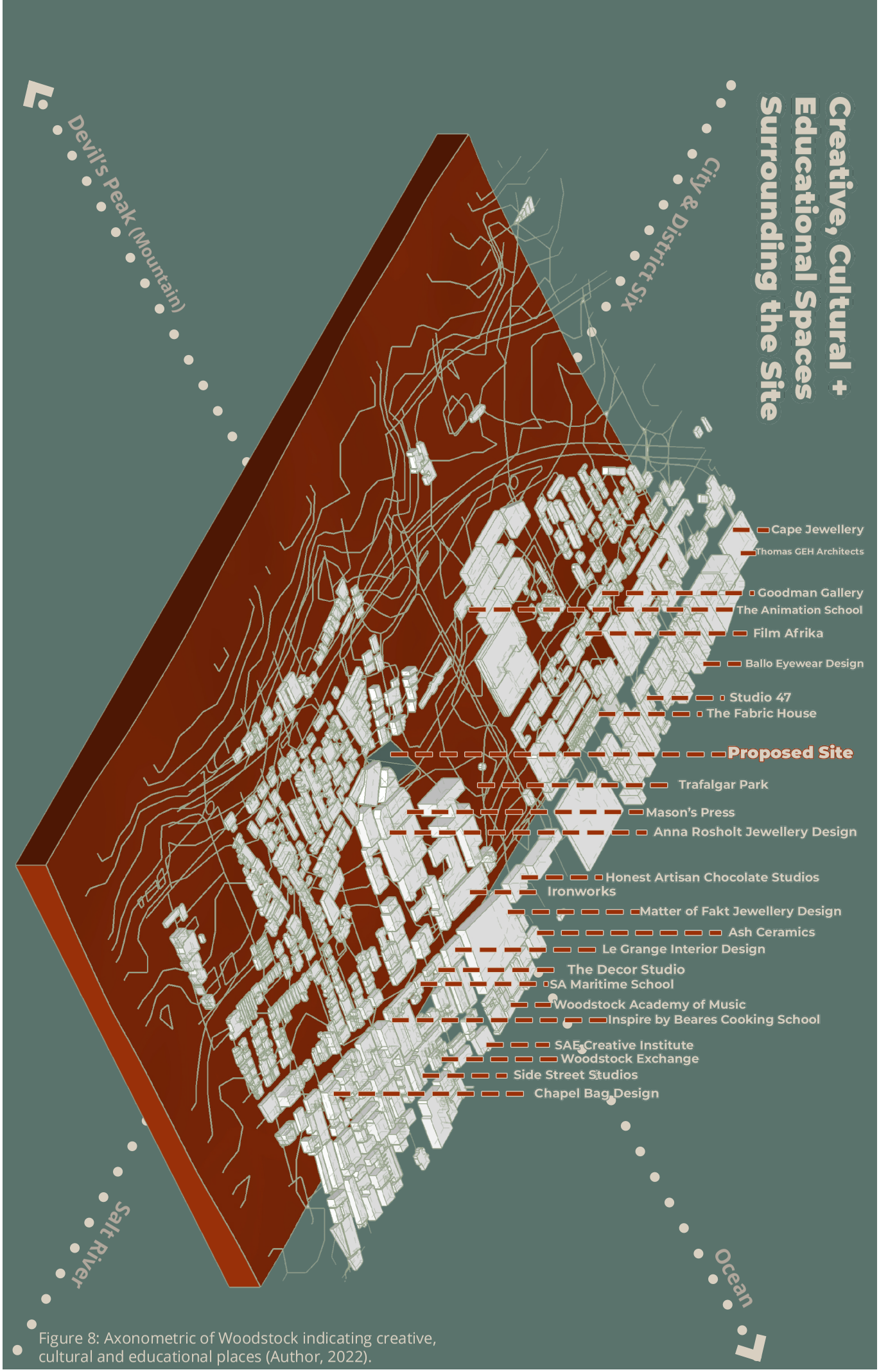


Figure 8: Axonometric of Woodstock indicating creative, cultural and educational places (Author, 2022).

Medi Context

In tensile nature
lies a place
at the edge of home, industry and Trafalgar

Various Thresholds

Woodstock consists of multiple building typologies and areas. Residential areas spill over to industrial regions, merely separated by harsh edges in the form of streets. The suburb, however, also boasts a lot of parks and public green spaces. A total of about 11 green spaces adorn the streets of Woodstock, ensuring softer in-between spaces. According to Alan Berger, professor of landscape architecture, in-between spaces are interstitial spaces that serve as residues without any definite use. These spaces form for an indefinite period between functionally definite spatial arrangements and are suitable for the emergence of spontaneous practices (Berger, 2006: 29).

Therefore, it is clear that these spaces are crucial, especially in a culturally and physically heterogeneous area such as Woodstock. The contrast of these cultures and significantly different built environments create thresholds of tension, which public and open spaces would ideally soften the form of transitional spaces.

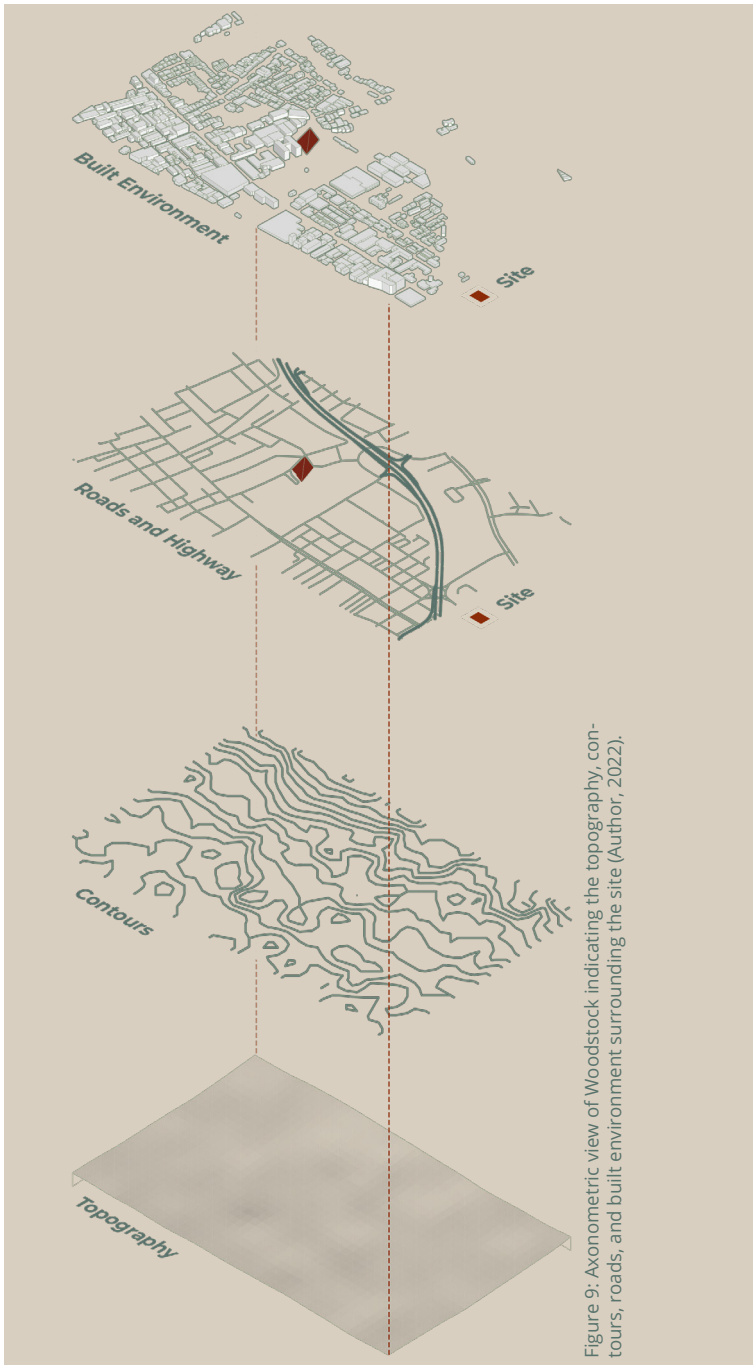


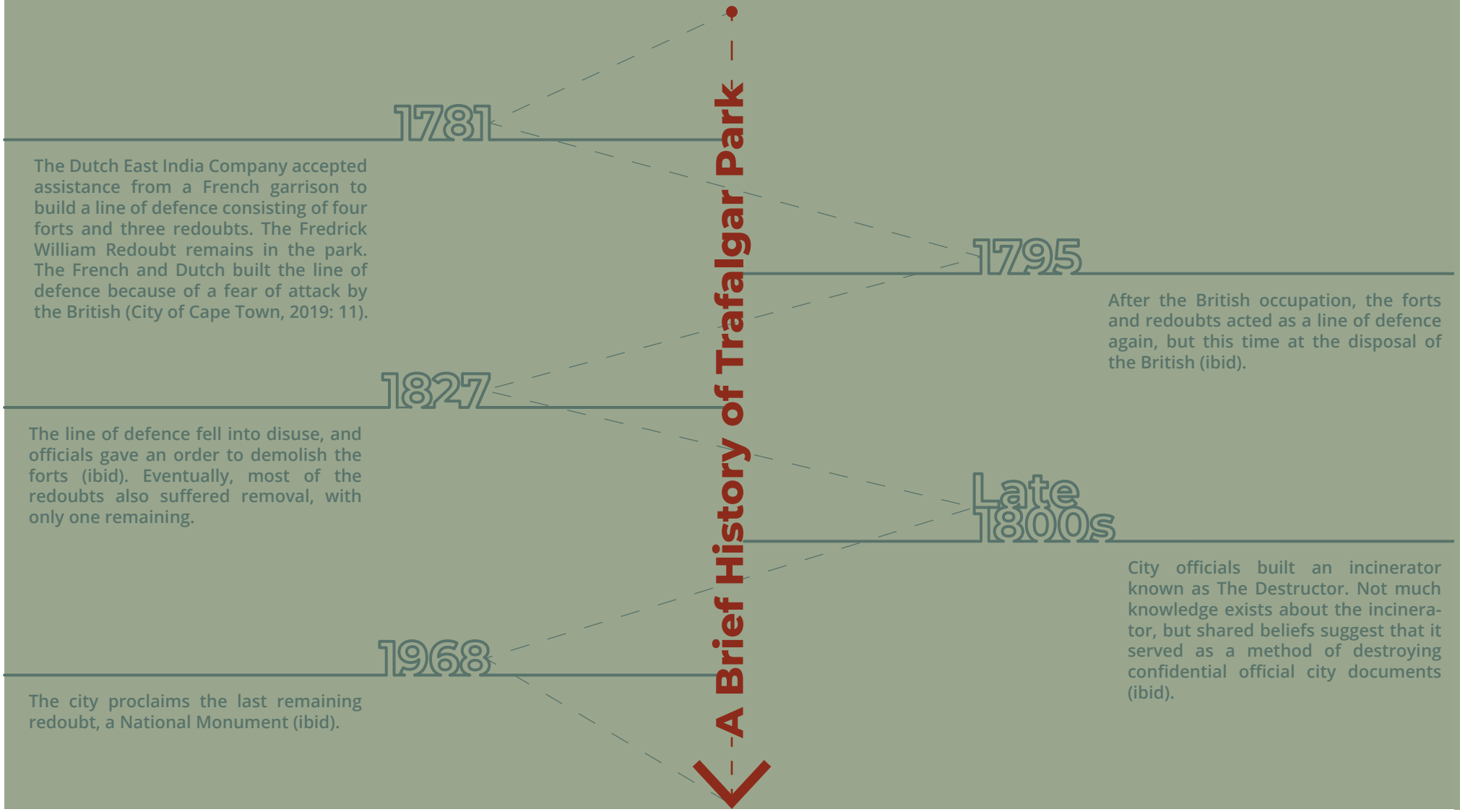
Figure 9: Axonometric view of Woodstock indicating the topography, contours, roads, and built environment surrounding the site (Author, 2022).



Figure 10: Illustrated map view of the regional thresholds surronding the proposed site (Author, 2022).

The Site and Trafalgar Park

The proposed site sits at the southeastern edge of the historic Trafalgar Park and directly neighbours the public swimming pool. Walls and fences between the site and the park act as completely impermeable boundaries. The French Redoubt was declared a national monument in 1968 (City of Cape Town, 2017: online).



Trafalgar Park and Music

Trafalgar Park played host to music festivals various times, closely relating the park and the proposed design. The park yearly features the Heritage Day Picnic, during which local musicians perform throughout the day (van Dyk, 2016: online).

The park features a bandstand that serves as a performance platform in the park and ties to the proposed design with a performance axis. Some troupes of the Cape Minstrel Festival (Kaapse Klopse) frequently have band practices in the park. The pre-existence of performance as a cultural tool firmly roots music in the soil of Trafalgar Park.

Evidently, Trafalgar Park serves as a typical liminal or in-between space. The park offers space for cultu ral hybridity and opportunities to discover otherness. The continuous redefinition of identity is, therefore, possible for those who participate in this space.

Woodstock and Trafalgar Park Revitalisation Framework

In 2003 a revitalisation framework was published for Woodstock and the neighbouring Salt River suburb, which includes a framework for the parks. The framework suggests the implementation of the following points:

Woodstock should be an urban place where real integration takes place

- Access to urbanity
- Mixed-use
- Mixed community
- Access to nature (Parks)

(City of Cape Town, 2003: 29)

Woodstock should endeavour to improve accessibility to the area:

- Attract and keep people in the region through the creation of destination activities or amenities
- The existing context in the area, such as historical structures, should reinforce the identity of Woodstock

(City of Cape Town, 2003: 29)

The Trafalgar Park Precinct:

- Promote and protect the sense of a green continuity from mountain to sea
- Allow the green extent to accommodate additional recreational and public facilities. A visually permeable boundary should apply where any walling or fencing is present
- Encourage and facilitate appropriate development on vacant sites or underutilised buildings within proximity to the park's periphery
- Consider graffiti walls on buildings abutting the perimeter of the park

(City of Cape Town, 2003: 31)



Figure 11: Aerial depicting spots in Trafalgar Park (Author, 2022) (Google Earth, 2022: Online)

Frederick William Redoubt ①



Existing Performance Space (Bandstand) ②



Tree Alley Abutting Performance Space ③



Building Thresholds at the Park Periphery ④



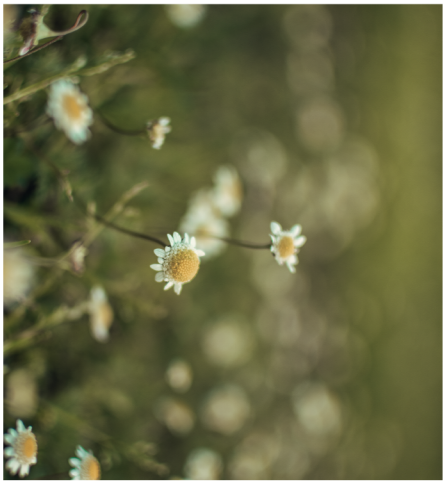
Figure 12: Photographs depicting spots in Trafalgar Park (Author, 2022)



Figure 13: Photographs depicting textures in Trafalgar Park (Author, 2022)

A Vegetation and Ground Covers





B Grass and Weeds





C Stone and Gabion Walls









D Murals on Bandstand Walls

Proposal for Trafalgar Park Development



WORLD DESIGN CAPITAL CAPE TOWN 2014

- BASE DRAWING
- FRENCH LINES
- LAWN AREAS
- MEADOW AREAS
- ORNAMENTAL PLANTING
- FYNBOS & RENOSTERVELD
- PAVED SURFACES
- WATER ELEMENTS
- PARK FURNITURE & EQUIPMENT
- TREE CANOPY

PROJECT:
TRAFALGAR PARK
Sir Lowry Road,
Woodstock

DATE: MAY 2014
DWG No: SQ TPM-SPS-LMP-009
REVISION: 3

SQUARE ONE

SQUARE ONE Landscape Architects cc
www.sq1.co.za | CK 2011/037636/23
#402 Salt Circle, 19 Kent Street, Salt River, 7925
t +27 (0)21 447 8160, f +27 (0)86 610 8350

Figure 14: Master Plan (Square One Landscape Architects, 2016: online)

Micro Context

A song revived
unearths an audience
at 14 Ravenscraig Road

The proposed site is vacant and underutilised. It is located at 14 Ravenscraig Road, in Woodstock. It is a corner site with both Ravenscraig Road and Warwick Street running past it. Warwick Street acts as the threshold between the industrial and residential parts of Woodstock. The proposed site, sitting at the edge of the industrial, residential and recreational (Trafalgar Park), firmly roots the site in a complex threshold and transitional position.

A Song Revived

Since the site sits at this transitional point, it becomes crucial as an activation point in the area. As previously discussed, the Woodstock Revitalisation Framework suggests that sites at the periphery of Trafalgar Park should be activated and integrated with the park.

The integration intends to take place in both function and morphology. The musical function will tie with the park's pre-existing musical facilities and characteristics while adhering to specific cultural aspects. The landscaping will link with the urban landscape design by Square One Landscape Architects, which comprises a skateboarding/BMX park.

Wind:

Cape Town is well known for its winds, which are especially prevalent in the areas under Devil's Peak. The southeaster often moves around Devil's Peak before descending into the City Bowl. The nature of the wind in the region accounts for the previous name of the Mountain, Windberg, which translates to wind mountain (Brodie, 2015: 136).

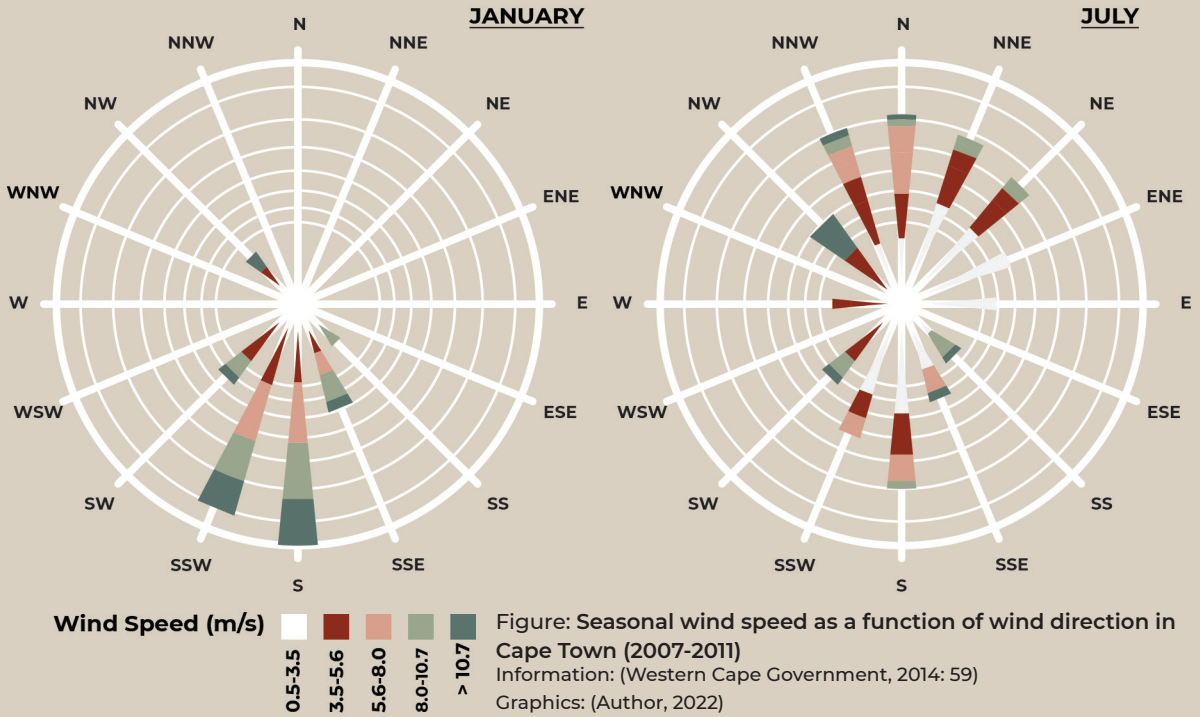


Figure: **Seasonal wind speed as a function of wind direction in Cape Town (2007-2011)**
Information: (Western Cape Government, 2014: 59)
Graphics: (Author, 2022)

Temperature:

Cape Town has a mild temperature with little major variations during different seasons.

Record High: 41
Average Maximum: 22
Average Minimum: 11
Record Low: -1

(South African Weather Service, 2011: online)

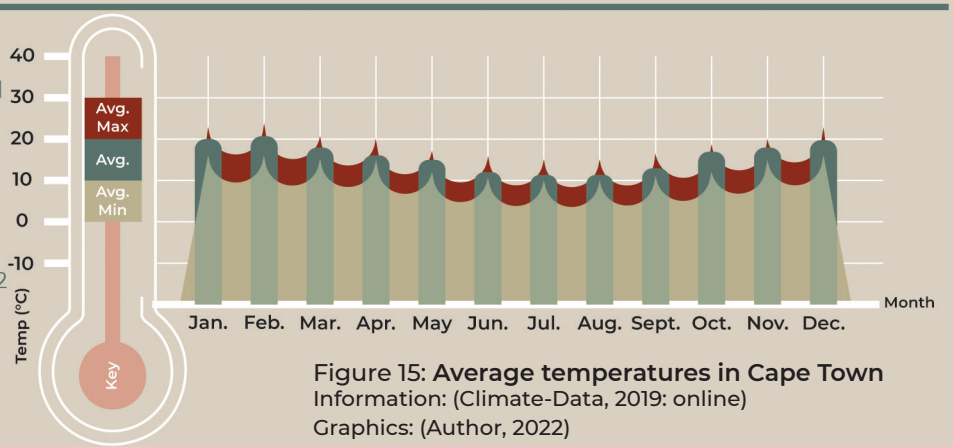


Figure 15: **Average temperatures in Cape Town**
Information: (Climate-Data, 2019: online)
Graphics: (Author, 2022)

Precipitation:

Cape Town has a typical Mediterranean climate with dry summers and rainy winters.

Average Yearly: 515mm

Highest Record in 24 hours: 65mm

(South African Weather Service, 2011: online)

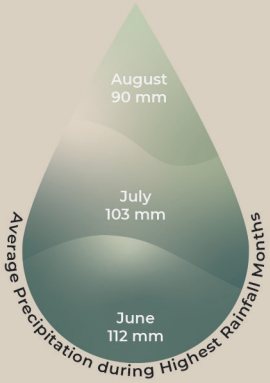


Figure 16: **Average Precipitation**
Information: (Climate-Data, 2019: online)
Graphics: (Author, 2022)

Hours of Sunshine:

The month with the most daily hours of sunlight is December. The average amount of exposure during December is 10,85 hours (Climate-Data, 2019: online).

The month with the lowest amount of daily hours of sunlight is June with approximately 6 hours of exposure (ibid).

Cape Town averages 101,57 hours of sunshine a month (ibid).

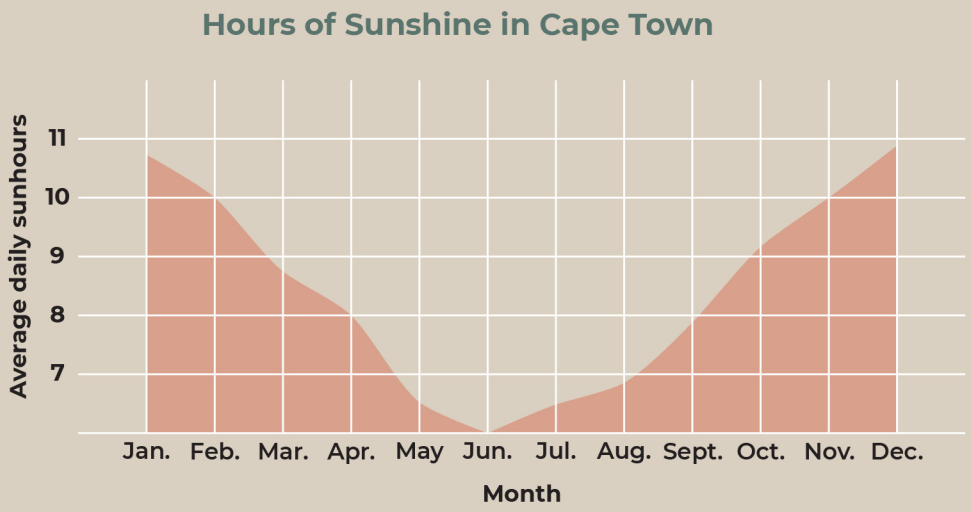


Figure 17: **Average amount of hours of Sunshine** Information: (Western Cape Government, 2014: 59) Graphics: (Author, 2022)



Figure 18: **Sun study during different hours around site** (Author, 2022)

Site Specifications:

Zoning: Mixed Use 2(MU2)

Primary use: Industry, place of instruction, institution, place of entertainment

Table of floor factor, coverage and height in Mixed Use Zone

Subzone	Floor Factor	Coverage	Maximum height above base level to top of roof
MU1	1,5	75%	15m
MU2	4,0	100%	25m
MU3	6,0	100%	38m

(City of Cape Town, 2015: 97)

Table of building lines in Mixed Use Zones

Subzone	Street building line and common building line		
	Points on a building above base level		
	up to 10m	over 10m up to 25m	over 25m up to 38m
MU1	0m	4,5m	n/a
MU2	0m	4,5m	n/a
MU3	0m	0m	(Height minus 25m) ÷ 2

(City of Cape Town, 2015: 97)



Figure 19:

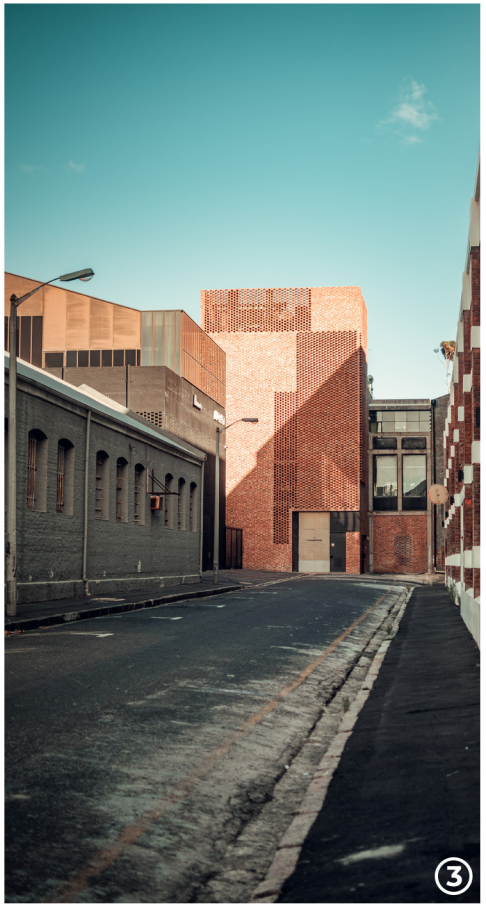
Map of Woodstock Indicating the Location of Built Environment Structures and Textures Depicted

(Author, 2022)

Figure 20: Structures and textures surrounding the site (Author, 2022)















Concrete Frame and Wall Structure



Bagged and Painted Walls



Black Brick infill with Glazing as Pattern



Theoretical Discourse
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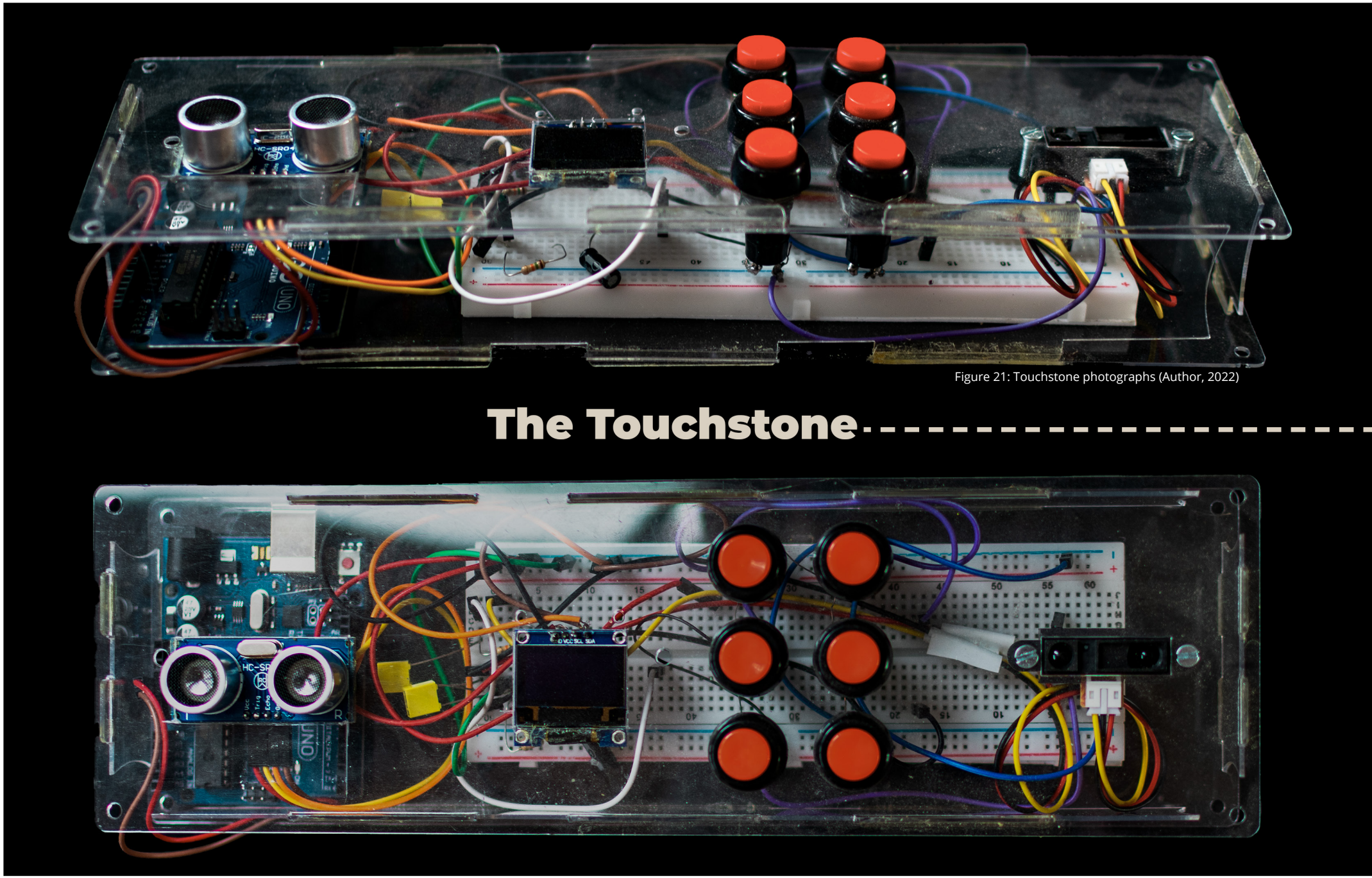
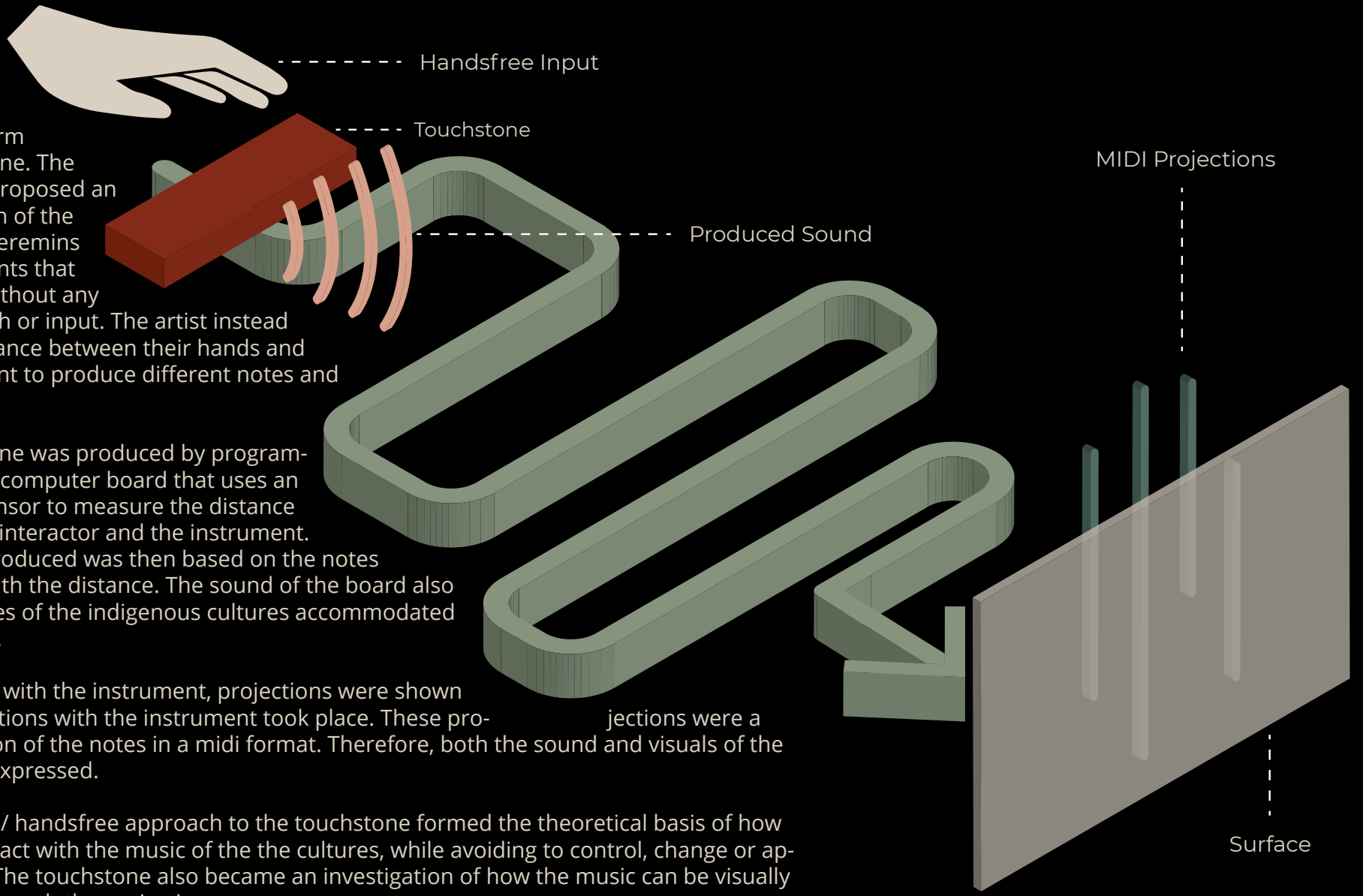


Figure 21: Touchstone photographs (Author, 2022)

The Touchstone

The Touchstone Interaction

The first theoretical approach to the design was in the form of a touchstone. The touchstone proposed an interpretation of the theremin. Theremins are instruments that are played without any physical touch or input. The artist instead uses the distance between their hands and the instrument to produce different notes and pitch.



The touchstone was produced by programming a small computer board that uses an ultrasonic sensor to measure the distance between the interactor and the instrument. The sound produced was then based on the notes associated with the distance. The sound of the board also sampled notes of the indigenous cultures accommodated in the design.

Finally, along with the instrument, projections were shown when interactions with the instrument took place. These projections were a representation of the notes in a midi format. Therefore, both the sound and visuals of the music were expressed.

The no-touch/ handsfree approach to the touchstone formed the theoretical basis of how one can interact with the music of the the cultures, while avoiding to control, change or appropriate it. The touchstone also became an investigation of how the music can be visually expressed through the projections.

Figure 22: Touchstone infographic (Author, 2022)

Songs in Translation

Introduction

The proposed design is concerned with the preservation and continued existence of indigenous music. Even though various indigenous groups and forms of music exist in South Africa, the design proposes focusing on the predominant indigenous groups in the surrounding areas of the proposed site and Cape Town, namely Khoesan, Xhosa and the Kaapse Klopse.

The theoretical underpinnings to this approach stem from the touchstone and are developed in three distinct concept models. Each concept model proposes a unique but interconnected way to approach the indigenous music of the cultures without trying to control, appropriate or change it. All three concepts seek a way to equally include all three cultures without misappropriating any of them.

Ultimately, the concepts seek a way to translate indigenous music into an architectural language that is representative of all three cultures by investigating linguistics as rhythm and performance, microtonality in music as a liminal device, and parametric design as an approach to syncretism. Finally, the theory begs the research question:



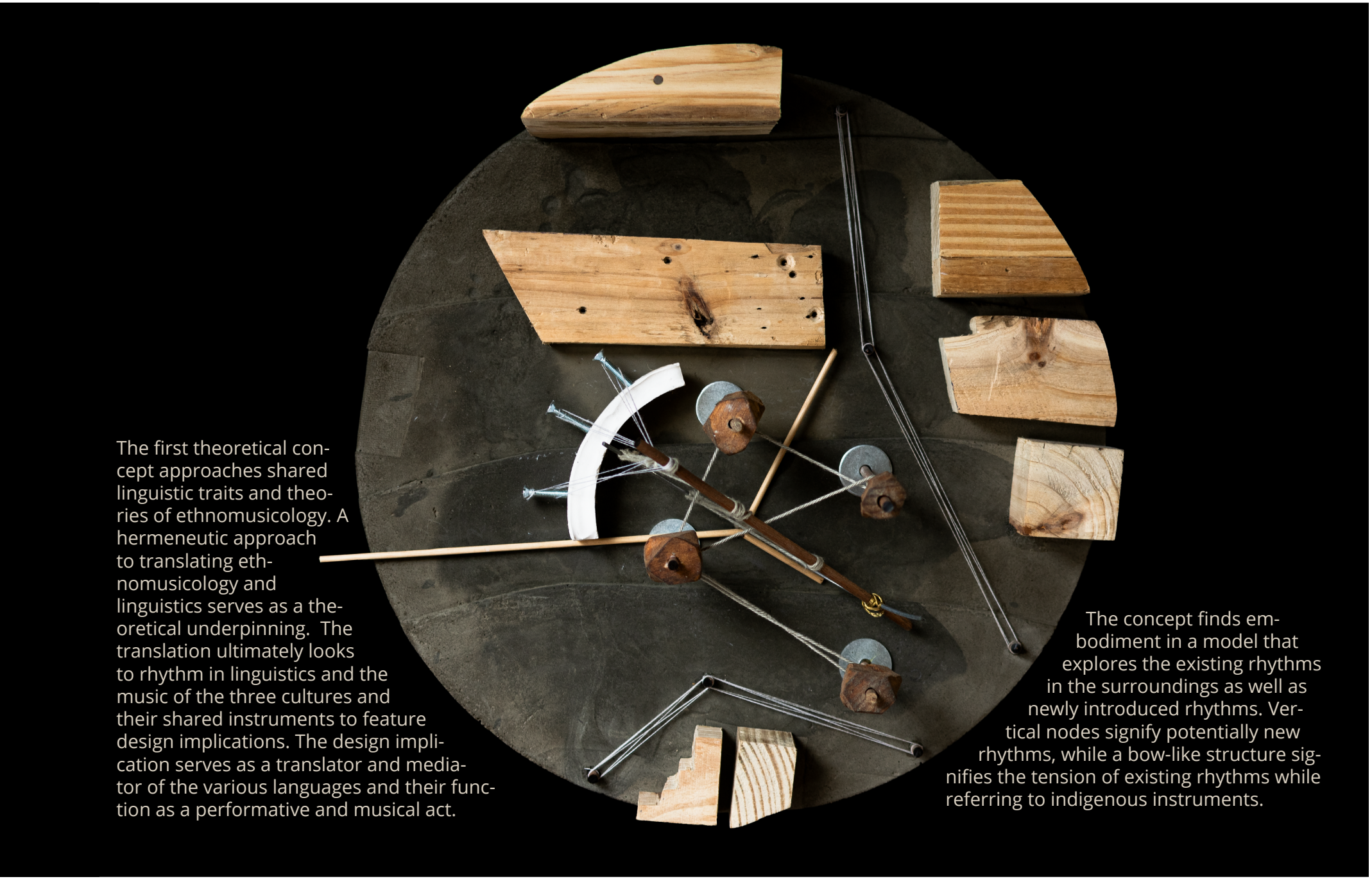
How may an ethnomusicological and parametric approach to architecture augment the translation and expression of indigenous music of the Khoisan, Xhosas and Cape Minstrels, while avoiding mis-appropriation in the plural contextual setting of Woodstock, Cape Town?

Figure 23: Spectogram of the music used in the touchstone (Author,

Of Plural Tongues/
Concept 1



Figure 24 & 25: Side and top view of concept model 1 (Author, 2021)



The first theoretical concept approaches shared linguistic traits and theories of ethnomusicology. A hermeneutic approach to translating ethnomusicology and linguistics serves as a theoretical underpinning. The translation ultimately looks to rhythm in linguistics and the music of the three cultures and their shared instruments to feature design implications. The design implication serves as a translator and mediator of the various languages and their function as a performative and musical act.

The concept finds embodiment in a model that explores the existing rhythms in the surroundings as well as newly introduced rhythms. Vertical nodes signify potentially new rhythms, while a bow-like structure signifies the tension of existing rhythms while referring to indigenous instruments.

Ethnomusicology in a trialogue

Translation serves as an archetype for linguistic hospitality. It involves negotiation between host and guest languages (Kearney, 2019: 1). The negotiation, however, requires a double onus: to remain faithful to one's language while remaining attentive to the novelty of the foreigner's. Failure can occur in the process of this negotiation. Firstly, the urge to assimilate and absorb the "other" into the "same". This approach reduces the peculiarity of the guest to the overriding norms of one's native language (ibid). Secondly, the opposing urge is to evacuate one's linguistic dwelling, sacrificing one's native speech to the incoming "other" to an extent where there is no longer a host to receive the guest (ibid).

To prevent this notion of failing in translation, one should take a middle road of linguistic hospitality. The adequate translator is neither master nor slave (ibid). A "hospitable" translator approximates correspondences between tongues without assuming that the translations are adequate or final. Instead, a crucial step is to resist the lure of "perfect translation" and honour a dialectic balance between proximity and distance. The idea of proximity exists as the notion of welcoming the "other" into our midst. The idea of distance exists as acknowledging that something always becomes lost in translation; the "other's" meaning can never be entirely mine (Kearney, 2019: 2).

Since the proposed design attempts to provide for three different cultures' music, the design should seek a means of translation between these cultures and a possible architectural language. The translation should serve beyond the extent of linguistics; however, one can learn a lot from the shared character found in the different languages of each culture and the music produced by such languages.

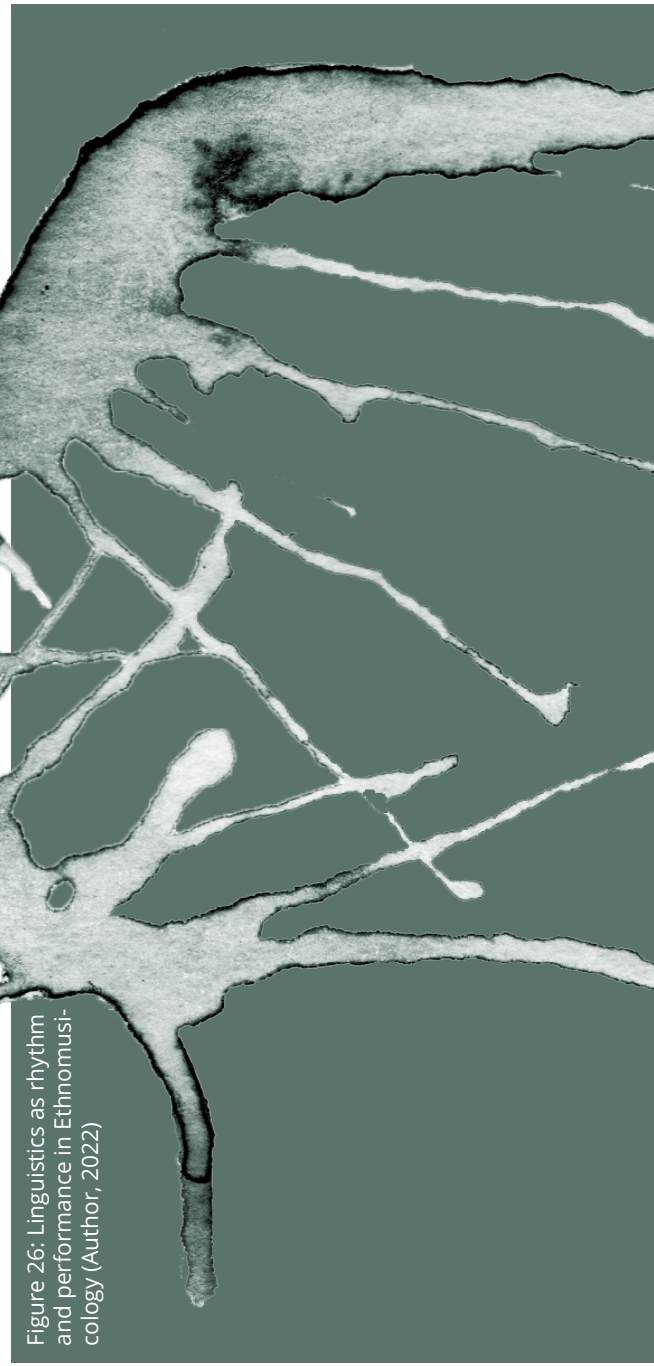


Figure 26: Linguistics as rhythm and performance in Ethnomusicology (Author, 2022)



Linguistics in Ethnomusicology

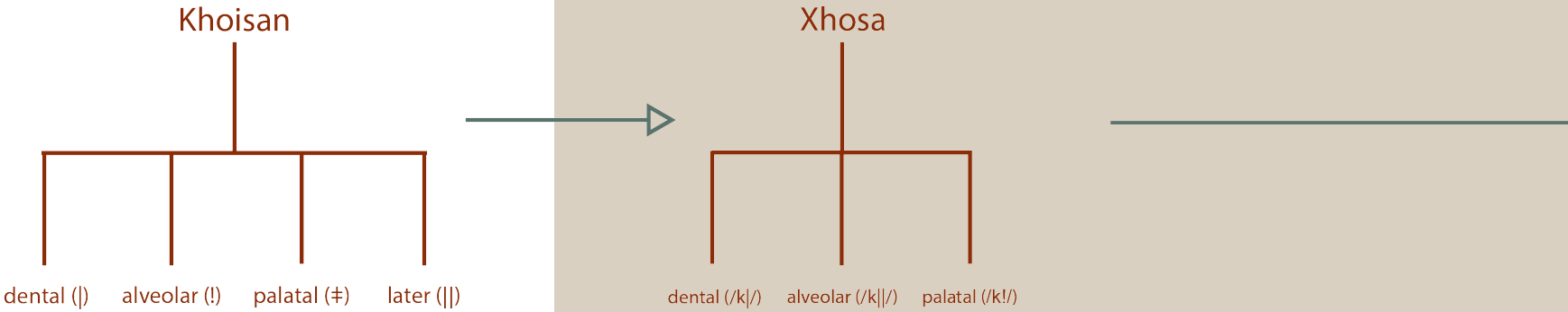
Similar to language, music serves as a concept for a means of communication. According to anthropologist and musician Jayson Beaster-Jones, various scholars use notions of linguistics and semiotics to understand meaning-making in music (Beaster-Jones, 2019: 35).

Sociolinguists and linguistic anthropologists draw relations between language use and linguistic performance. This view of language moves past the structuralist approach to language. Instead, it examines how language-in-use is necessarily situated within and possibly transformative of its social and historical context. According to linguist Roman Jakobson, fundamental insight into this is that speech's meanings cannot be removed from its performance contexts (Beaster-Jones, 2019: 31).

In this, Jakobson also explored the aesthetics of everyday vocabularies, such as language's poetic function. This exploration refers to but is not limited to rhythm in language. Rhythm also plays a crucial part in music, especially in ethnomusicology. Rhythm's importance becomes apparent in the ordering and regulation of tune (ibid).

A Shared Rhythmic Language

A relationship exists between the Khoisan languages and Xhosa. A rhythmic system exists in these languages known as the “clicks”. The origin of the clicks is not explicitly known; many anthropologists argue that it is an onomatopoeic device. The clicks in the Xhosa language, however, is known to derive from the Khoisan languages (Figure). The Khoisan, on the other hand, got many of their rhythmic instruments (such as the *mbira* in figure) from the Xhosas (Olivier, 2002: online). There exists, therefore, a transactional nature between the cultures and their rhythms – both in language and music. Non-structural linguists acknowledge that linguistic communities are not internally homogenous nor separated from their linguistic neighbours. This notion is particularly noticeable in loan words,



This transactional nature further extends through the third culture’s music housed in the proposed design, the Minstrel Carnival or *Kaapse Klopse*. The *Kaapse Klopse* roots its music in the expressive practices of Cape Town’s creolised slave population. The music incorporates European, indigenous African, and Asian influences to create a genuinely unique indigenous music known as the *goema* beat (Inglese, 2014: 125). The name *goema* comes from the goema drums made from empty wine barrels (Layne, 2019: 15). This makes the *goema* inherently rhythmic. The *goema* encompasses a vibrant street culture rooted in Khoisan, Christian and Muslim practices (ibid: 126).

Therefore, all three cultures share common characteristics in terms of rhythm. These shared characteristics allow for the marrying of these cultures in terms of their musical beat structure.



Figure 27: Painting of a *mbira* (Author, 2022)



Indigenous Music and Participants of the Polyrhythmic Structure

As mentioned, all three cultures in the argument share characteristics in terms of their rhythmic structure. An investigation into this structure reveals that the indigenous groups typically use polyrhythmic systems (Olivier, 2002: online). A polyrhythm, or cross-rhythm, is the concurrent amalgamation of conflicting rhythms in musical compositions (Britannica, 2013: online). The polyrhythm makes for a complex rhythmic structure, which always exists in plurality. According to musical theorist David Penalosa, Western music's central parts archetypally stress primary beats as opposed to sub-Saharan African musical parts (Penalosa, 2009: 21).

From a theoretical perspective, these cross-rhythms may symbolise the challenges of everyday life and the emotional stress encountered (ibid). Playing or participating in cross-rhythms while being grounded in the primary beats prepares the participant for maintaining a life purpose while dealing with the challenges of everyday life (ibid). Interestingly, many non-Saharan languages don't have a word for rhythm, which ties the concept of rhythm tightly into the fabric of sub-Saharan life itself. The rhythm becomes the embodiment of the people, symbolising interdependence in human relationships (ibid).

The interdependence signifying the human relationships reflects these cross-rhythms, which results in a call-and-answer technique known as a hocket (Robotham & Kubik, 2016: online). A typical cross-rhythm used in the music of the mentioned cultures is a 4:3 polyrhythm. The 4:3 polyrhythm consists of four notes played over a three-note time rhythm.

This rhythmic structure can ultimately be translated into an architectural language. The architecture loses and gains spatial rhythm. Rhythm is used as a design device or gesture of ordering.

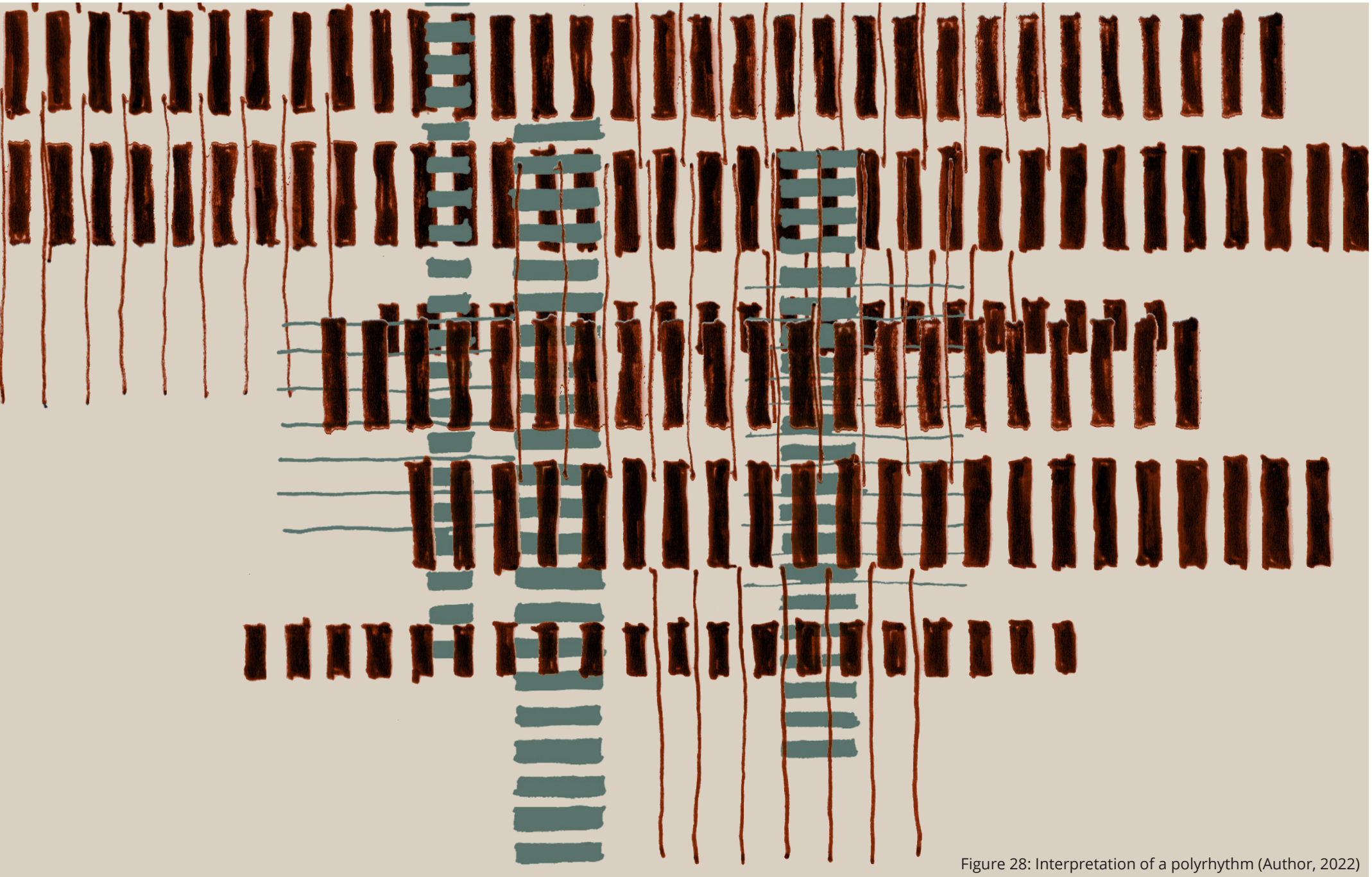


Figure 28: Interpretation of a polyrhythm (Author, 2022)

Olympic Archery Range

Rhythmic Structure Precedent

Architects Enric Miralles and Carme Pinos
Barcelona, Spain
1991



Figure 29:Exterior View of the Archery Range (Janssen, unknown: online)

The design served as a pavilion for the 1992 Olympic Games in Spain. Functionally, the project served as an archery range (Langdon, 2014: online).

The design plan reads as a very dynamic diagram, which is also suitable for its function. This precedent relates to the proposed design in its rhythmic approach.

The Topology

The site on which the design finds itself sits at a steep slope. According to the architects, the site extrapolates preexisting topographic contour lines as plan derivation while adhering to the function of the athletic spaces and changing rooms (Langdon, 2014: online).

The design creates freeform internal layout shapes, while a series of rectilinear roofing units sits over the plan. This creates a complex rhytmic structure in the topological approach to the design. From roof to floor, different layers of rhythm exist, which creates a notion similar to a polyrhythm.

The pavilion's design becomes a careful consideration of its placement in the landscape, but it doesn't obey a rationally ordered programme or tectonic system. It is instead a product of imaginative and expre ssive architecture (Langdon, 2014: online).



Figure 30: Roof View (Sukuki, unknown: online, adapted by author)

The Morphology and Structure

The pavilion composition consists of two principal elements: an exposed concrete wall system and a retaining wall nestled into the hill from which the structure emerges (Langdon, 2014: online). The project also required quick construction and disassembling. The design to construction turnaround resulted in the use of prefabricated, curved, modular concrete panels with holes to allow for light (Langdon, 2014: online).

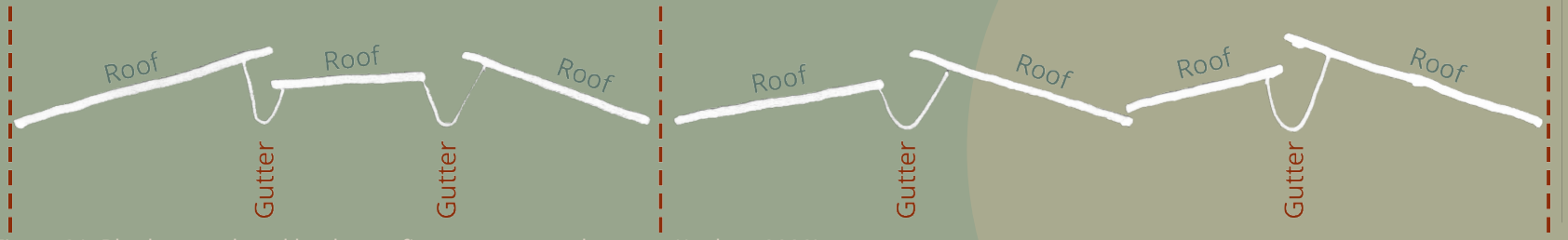
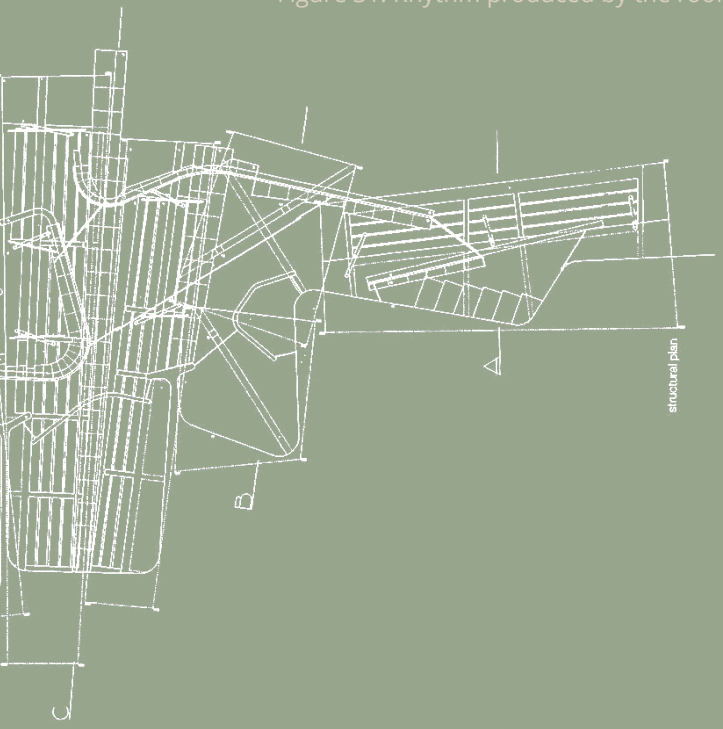


Figure 31: Rhythm produced by the roofing structure and gutters (Author, 2022)



While the topology of the building follows a specific rhythm, the morphology represents the movement of the athletes within (Langdon, 2014: online). Both the topology and morphology, however, explores the idea of dynamism and rhythm but with different approaches. Therefore, the two methods answers the same rhythmic question, but in distinct languages.

The rectilinear roofs remove themselves from the curvilinear walls with complex and angled columns. The roof sections lift from varying angles, which allows for clerestory windows, and extends to seemingly infinite overhangs. The gutter details also contribute to the roofs rhythm by connecting the opposing roof sides. As a unit, the roofing speaks of a complex rhythim structure which is legible from the front elevation.

The Proposed Design and the Precedent

The design proposes to follow a similar rhythmic unit system with the roofing and enlarged gutters, while referring to the industrial nature of the surrounding context. Ultimately, the roofing becomes an expression of the function contained in the structure.

Figure 32: Plan (Miralles & Pinos, 1991: online, adapted by author).

The Design and the Polyrhythm

The proposed design uses the notion of the 4:3 polyrhythm as an informant for the plan layout of the structure. The plan consists of three “wings”, each representing the three cultures’ music that extends into a semi-circular plan surrounding the outdoor performance space. Each wing has a designated function, while a cavity wall splits them. On the southwest side of the wings, different types of library spaces, as well as administration, originate. On the northeast side of the cavity wall, the wings are, from north to south, defined by rehearsal spaces, movement/open rehearsal spaces, and a movement space. The transitional space created by the cavity wall between the wings houses four boxed spaces. These four boxed spaces are the sonic experiential spaces on the lower ground floor and reception on the upper ground floor, which lies opposite the wings. The sonic experiential spaces represent the three main instrument groups found in the indigenous music systems of the cultures and dictate the layout of the types of rehearsal spaces that align with the boxes. The first experiential space houses the membranophone/ percussion interpretation space. The space consists of an interactive drum-like installation against the cavity wall made from steel frames that are covered with leather/fabrics. The second sonic experiential space accommodates the aerophone/winds/brass experiential space. This space proposes interaction with instruments that are typically blown on. However, blowing the interactive instrument by public users is a health and sanitary issue. Therefore, the design proposes a series of vertical ridged pipes mounted on a circular rail that can be spun. This creates a similar interactive instrument as a corrugaphone or “whirly tube”. The corrugaphone is a type of musical instru-

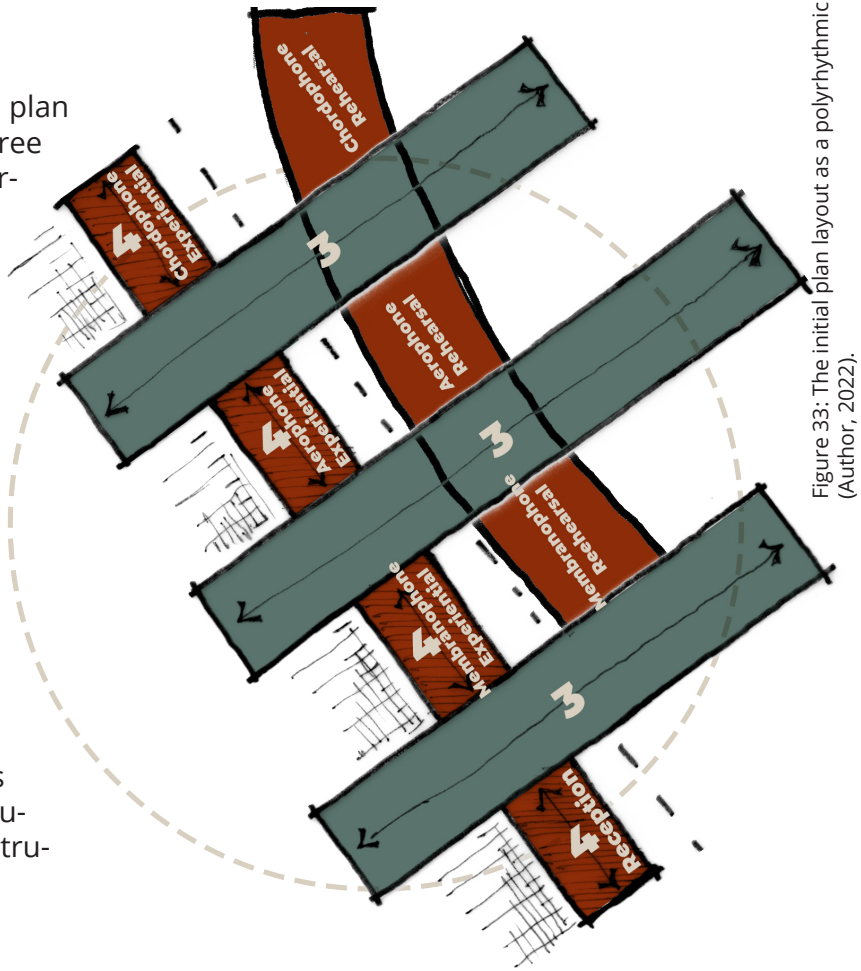


Figure 33: The initial plan layout as a polyrhythmic layout (Author, 2022).

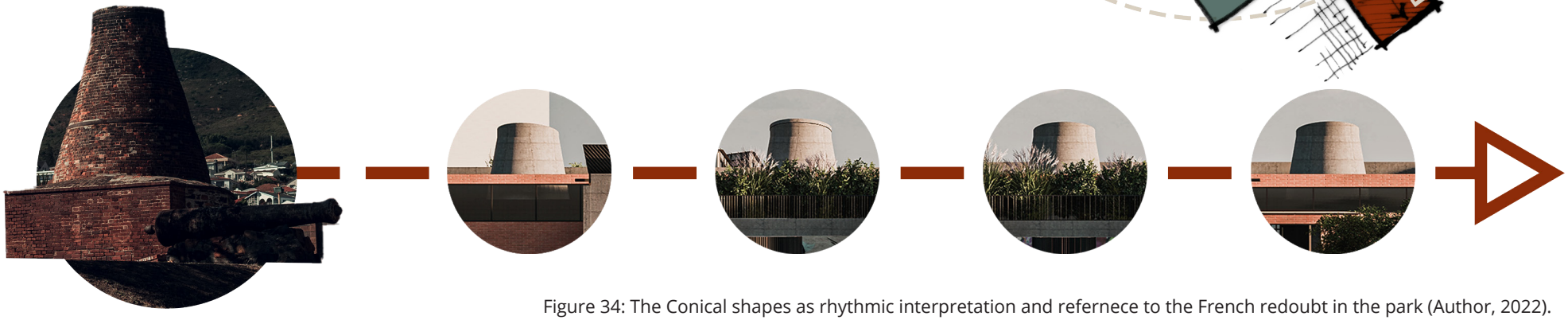


Figure 34: The Conical shapes as rhythmic interpretation and refernece to the French redoubt in the park (Author, 2022).

ment that one “plays” by swinging it in a circle (Science World, 2021: online). It is typically made of a corrugated plastic tube. The air passing through the tube produces the sound (figure 35)(ibid). The last sonic experiential space features an interpretation of chordophones/string instruments. This space consists of a timber instrument constructed with various beam-like structures. Each beam-like structure connects with the one next to it with pieces of nylon string. These strings can then be played by plucking them.

Combining these sonic experiential spaces and the three wings, the notion of the 4:3 polyrhythm manifests itself in the architecture. The sonic experiential spaces also consist of conical light shafts penetrating the roofs. These conical shapes also simulate their unique rhythm and reference the French redoubt found in the neighbouring park.

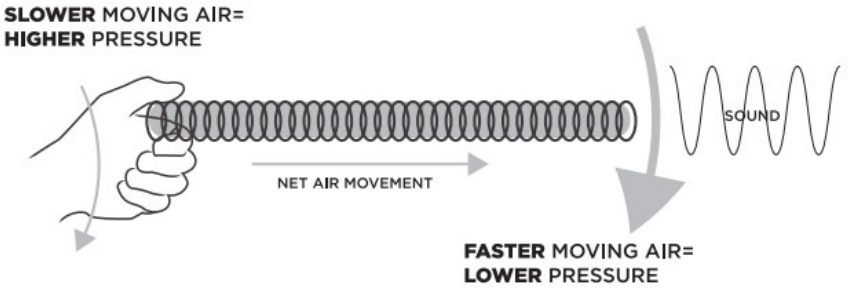


Figure 35: Diagram of the working of a corrugaphone (Science World, 2021: online)

The roofing structure of the wings also finds its form from the polyrhythmic approach and the sawtooth roofing of the industrial buildings surrounding the site. The roofs ultimately become an adaption of a sawtooth roof with a unique rhythm. Each rehearsal space is composed of multiple roofing units, each facing in a different direction than the previous. A large curved gutter also intersects the northern and southern rehearsal spaces to form a unique rhythm. These roofs also allow the spaces below to receive northern sunlight without sitting directly against the north façade. Therefore, even spaces that find themselves against the south façade will receive north light.

The initially proposed structure supporting and surrounding the roofing also finds its inspiration from rhythm, but in the form of a shared instrument – the lamellophone or mbira (figure 39). The mbira was commonly used in the Xhosa cultures, and the Khoisan eventually adopted it in a similar way that the Xhosas adopted the “clicks” of the Khoisan languages. The design looks at the structure and tectonics of the instrument as an informant. The instrument consists of lamellae or tongues that are fixed to a wooden board with staggered metal tines. The proposed design translates this into a double timber beam structure, which wraps around, and is supported by, a steel beam and split column structure. The structure also becomes a

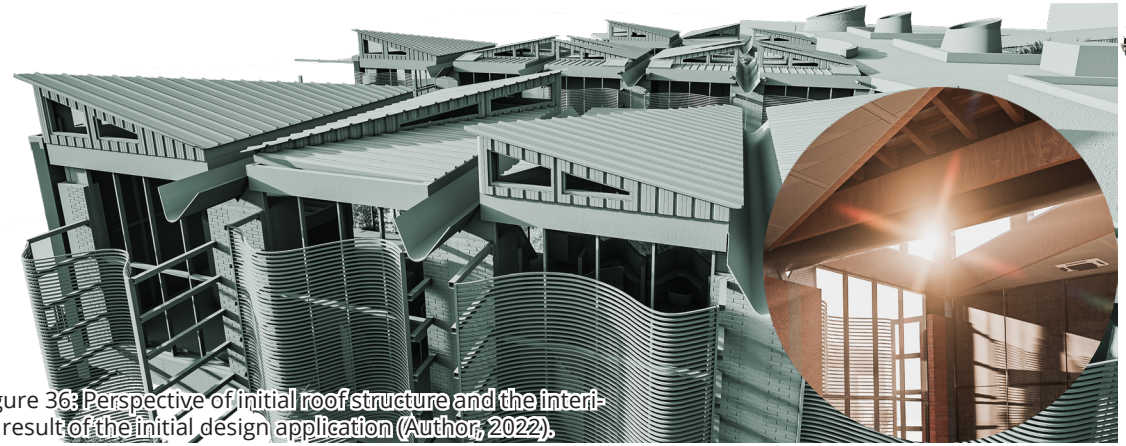


Figure 36: Perspective of initial roof structure and the interior result of the initial design application (Author, 2022).



Figure 37: The rhythmical structure of the roof and reference to the industrial context (Author, 2022).

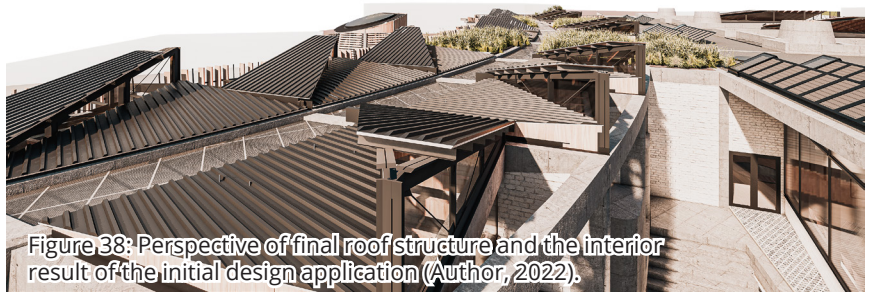


Figure 38: Perspective of final roof structure and the interior result of the initial design application (Author, 2022).

supporting device of the extended gutter and ultimately forms part of the rhythmic appearance of the roofing.

The finalised design, however, reinterprets this structure and refers to the umrhubhe instrument, which is also shared by both the Khoisan and Xhosas, to form the concrete gutter which splits these spaces.

Apart from the rhythms found in linguistics and instrumentation, language also becomes a performative and narrative device – especially when referring to ethnomusicology. The performance and narrative approach to music also find translation in the architectural language.

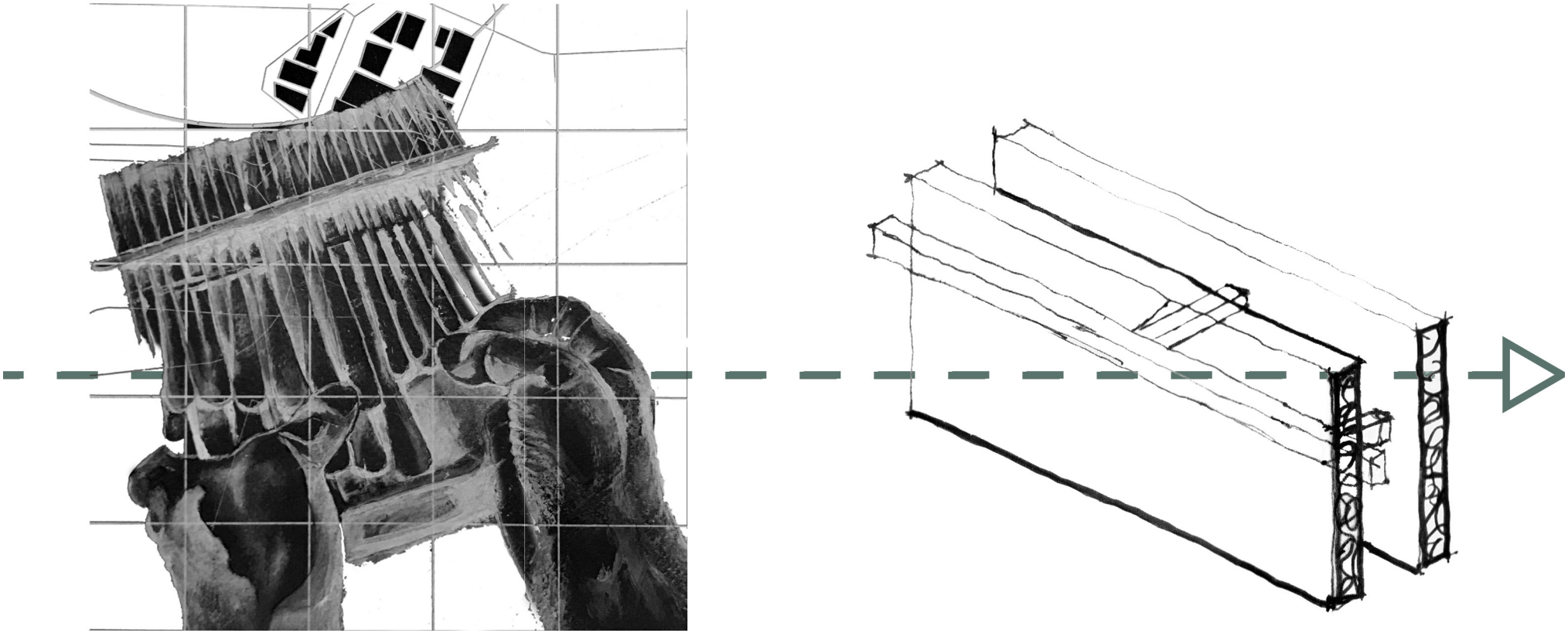


Figure 39: A structural translation of the *mbira* (Author, 2022).

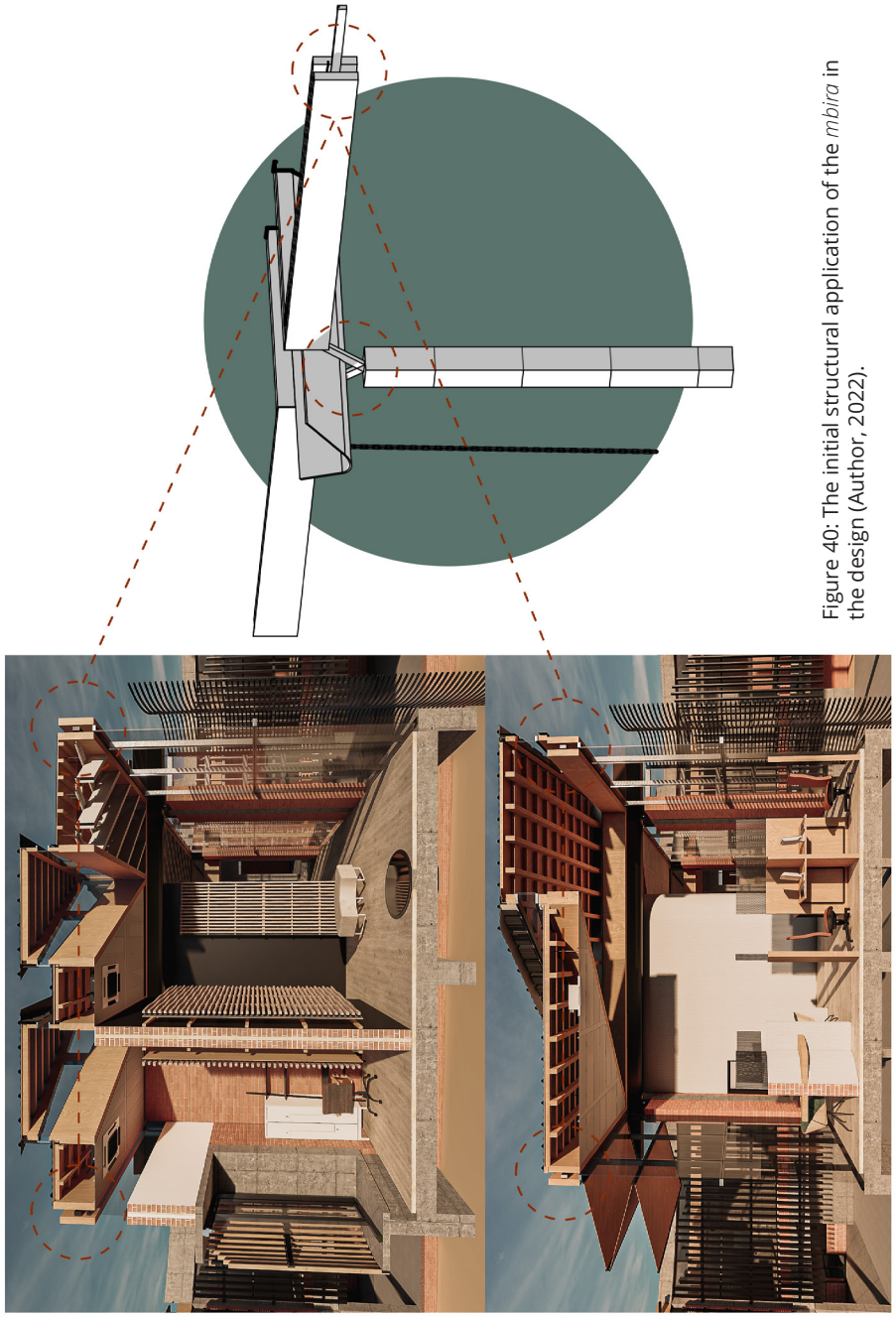


Figure 40: The initial structural application of the *mbira* in the design (Author, 2022).

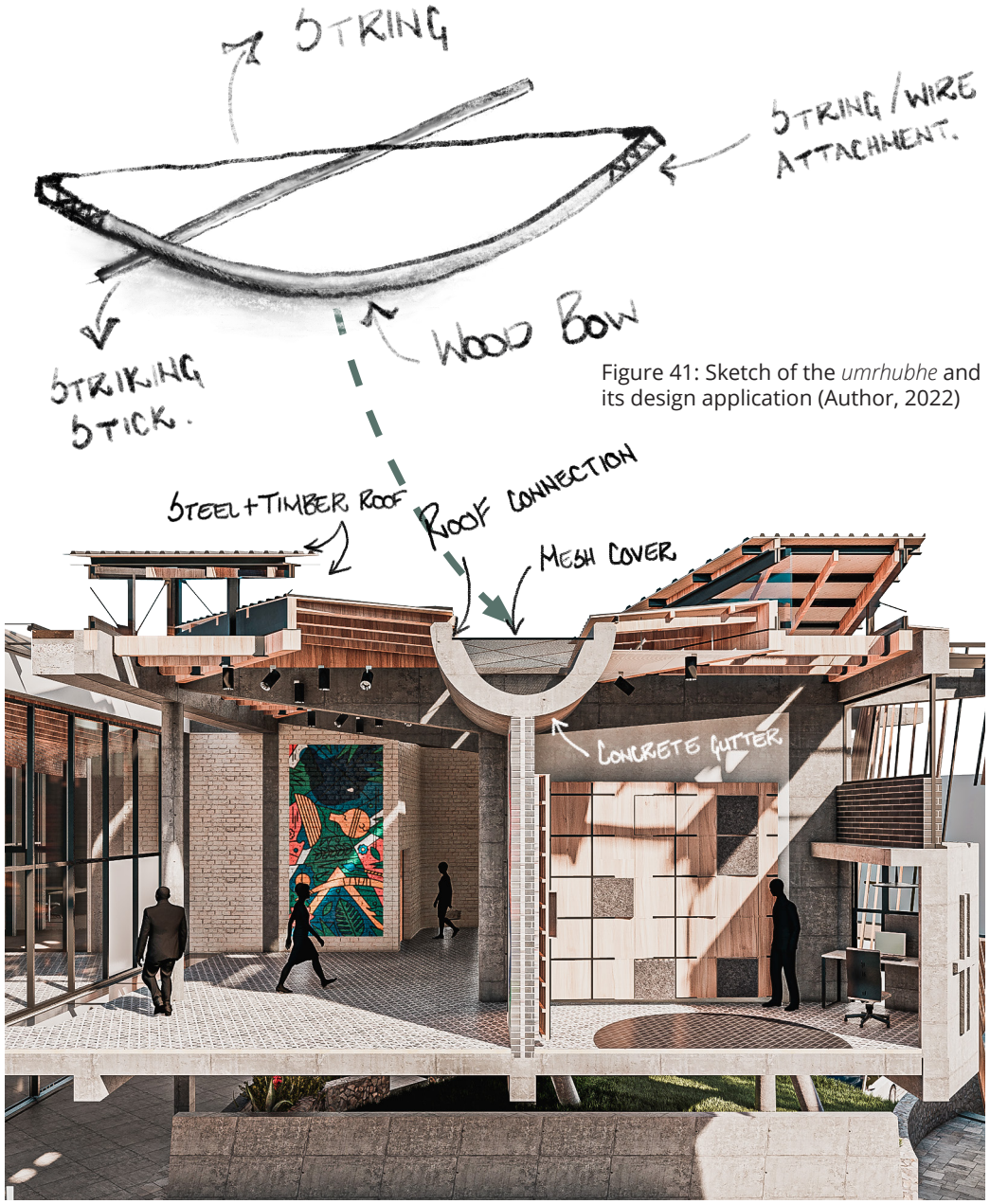


Figure 41: Sketch of the *umrhubhe* and its design application (Author, 2022)

Linguistics and Performance Studies in Ethnomusicology

According to music theorist Ellen Waterman, the study of performance in ethnomusicology moves the focus away from music as text; instead, the study looks at the musical performance as the interpretation of the text (Waterman, 2019: 141). This notion of performative music shifts from questioning the meaning of the music and instead examines the narratives and social and cultural uses of the music (ibid). Early work in the study of performance studies finds influence in linguistics. These studies expand the field by looking at the structures of language and the analysis of speech acts. There are two critical aspects of this notion: performative language and multi-functionality (ibid: 143). According to Waterman, performative language is the language that produces the thing that it names, and this results in a narrative approach to performance (ibid).

As previously discussed, certain rhythms exist within languages, especially those with clicks. These rhythms add to the performance aspect of the languages. However, the notion of narrative further extends the performance aspects within the music, without using actual words or text—the idea of narratives in performance contributes to the dynamism of the performance.



Figure 42: Performance as dynamism (Author, 2021).



Figure 43: Circular Khoisan Performance as dynamism (Author, 2022).

Performance as Narrative and Dynamism

Performance, in general, can be seen as a dynamic act. However, it might not always be dynamic when considering music as performance. In Western music, performance is usually static, especially in Classical music. The performers find themselves on a platform or stage while the audience views from the opposite stationary position. In indigenous music, however, that is not the case.
According to musicians and music lecturers, Givewell Munyaradzi and Webster Zimidzi, indigenous music is a communal gathering and a shared cultural activity of a particular society's people (Munyaradzi & Zimidzi, 2012: 193). Music becomes an expression of the day-to-day activities of life and is a social event associated with specific social occasions (ibid).

Since an indigenous musical performance is a communal activity, there is no separation between the audience and the artists. When an artist creates music, it can be shared by all the members of the group. Therefore, the music is not produced and owned by one artist but rather by the entire group (Munyaradzi & Zimidzi, 2012: 195).

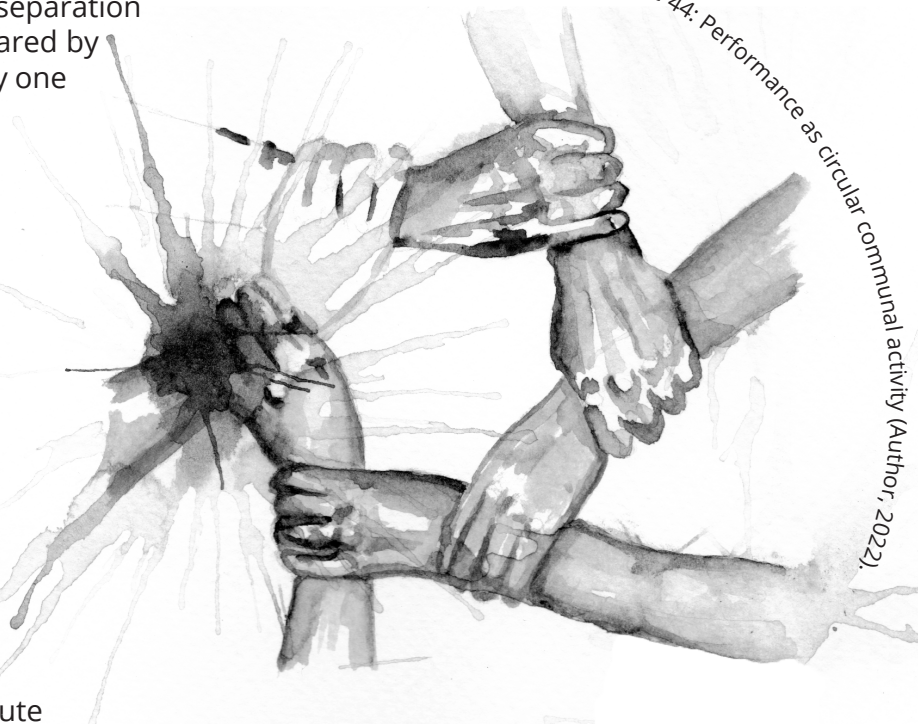


Figure 44: Performance as circular communal activity (Author, 2022).

Narratives also play a prominent role in this expression related to quotidian life or social occasions. This notion proves indigenous music as a more dynamic musical performance since both the audience and artists can be seen as equal participants of a shared narrative that takes place through music and movement.

When looking at the three cultures accommodated in the proposed scheme, it becomes clear that each culture uses movement in a specific way with music. The most frequent form of movement or dance in indigenous traditions is a dance performed in a closed circle, with dancers facing the centre or in a line following a circular path that is often centred on the musicians. Usually, the performers move along the circle line – counterclockwise (Picton & Harper, 2017: online). This type of dance is apparent in both Khoisan and Xhosa music performances, and the circular notion is also prominent in the cyclical narratives and traditional dwellings of these cultures.

The movement of the Cape Minstrel Festival's troupes used to take a circular route through Cape Town before the Group Areas Act (GAA) (Gregory, 2018: 14). The GAA was an act that assigned racial groups to different residential areas. Circle dances were also typical in the Cape at one time, such as the kransdance. The musician would be in the centre while women were dancing in a circle around the artist (Gregory, 2018: 15). However, after the GAA, the performance route changed from a circular route to a uni-directional route (figure 45) tied to a progression through different areas of Cape Town (ibid).

The notion of movement/dynamism and narrative can be translated to architecture in various ways, one being the architectural promenade.

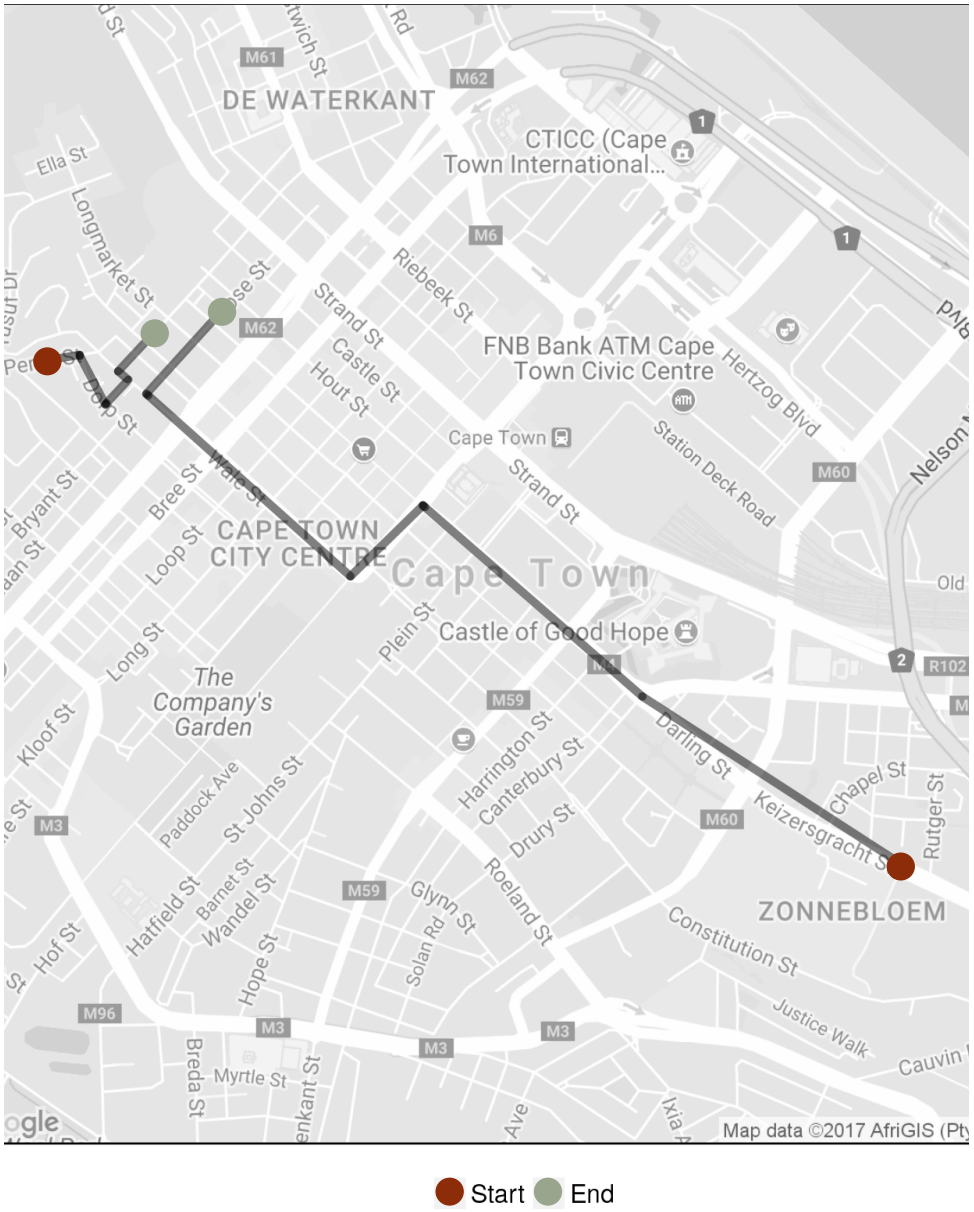


Figure 45: Unidirectional Route of Cape Minstrel Festival (Gregory, 2018, adapted by author).

Dynamism and Narrative as the Architectural Promenade

According to the theorist Juhani Pallasmaa, buildings condition our reading of time; like the cinematic, literary arts or music, they can speed up, slow down, halt and reverse time. Essentially, architecture can amplify the experience and perception of time, and this is most effectively done through the consideration of movement (Pallasmaa, 2015: 10).

Movement is an inevitable occurrence in any building; therefore, it is not significant in itself, but when the movement becomes a celebrated ritual, it creates a fully embodied experience of movement. Modernist architect, Le Corbusier, preferred the embodied experience of movement through space as opposed to the static background of architecture. He famously expressed this preference through the architectural promenade. Le Corbusier's promenades are characteristically perceived as chronological progressions, occasionally employing narrative to induce visions of the past and the future (Louw, 2016: 26).

Ultimately, this supports the notion that architecture is four-dimensional, a movement through space and time. Architecture is experienced subjectively, both in the spatial and temporal experience, but according to theorists, different experiences of time, however, do exist.

Narrative and Types of Experiential Time

Architectural theorist, Peter Eisenman, mentions two types of experiential time: narrative time and durational time (Eisenman, 1999: 252).

Narrative time refers to the perceived time of an experience, while durational time refers to the actual time of completion of the experience.

Narrative time is essentially the absencing of time. A promenade with the primary aim of absencing time can create an increased awareness of cosmic time, longer natural cycles, biological life cycles or a particular narrative. Architecture can deliberately attempt to provide an opportunity for mental and emotional displacement. Such promenades also allow for less of a connection to the physical environment or context. However, the aim is not to create a space of timelessness like that found in shopping malls, but rather to create an increased awareness of other times (Louw, 2016: 29). This type of time is therefore related to cyclical narratives and movements in the round.

However, durational time – or the presencing of time – can create a heightened experience of place and the present moment. It progresses linearly. It is, therefore, more concerned with its context and depends significantly on it (figure 46).

Similarly, an architectural promenade is a musical spatial journey with moments for moving faster or slower, changes in direction, places for pause and reflection. It can be a journey in time by offering different temporal experiences. Through the purposeful engagement of the senses, or the employment of memory and imagination, it can create an increased awareness of the present or of larger time cycles, and it can mentally transport a person to another time and place. A promenade might not be entirely one or the other, and the two types are not necessarily mutually exclusive. Still, it can be a significant tool to enhance one's experience of space and time, and therefore narrative (Louw, 2016: 29).

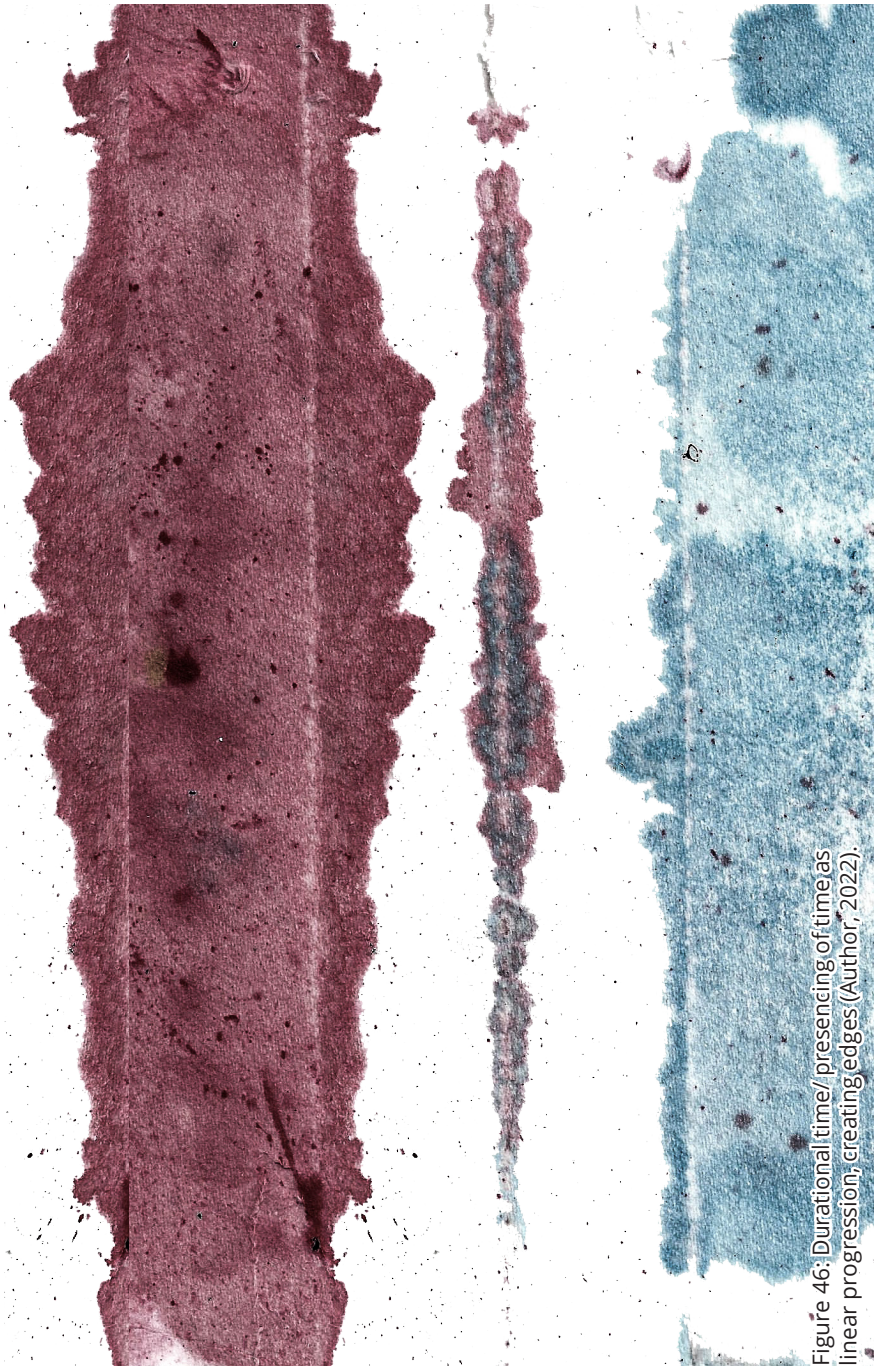


Figure 46: Durational time/ presencing of time as linear progression, creating edges (Author, 2022).

Liminality and the Design

The proposed design is orientated to align with the existing performance space/band stand in the neighbouring Trafalgar Park (figure 47). This creates a movement or performance axis with the park and the site of the proposed design. The plan's orientation also gives access to the maximum real estate of the kite-like shape of the site without breaking up the design into smaller buildings or one large mass.

The proposed movement or performance axis also intends to allow the troupes of the Cape Minstrel Festival to use it as a rehearsal route from their practice space in the park to the corner of the site of the proposed design. This axis creates an open ground floor on the site, which allows permeability to the park at all times, and it becomes a promenade of durational time since it is linear and directly related to its context. The site of the proposed design ultimately becomes an extension of the park.

On the upper ground floor of the proposed design, a vertically parallel promenade is formed. This space is dedicated to the main circulation on the design between the rehearsal spaces and the libraries/admin spaces.

The movement/performance axis culminates on the corner of the proposed site in an open circular performance space, which finds its morphology from the circular performance nature of the Xhosa and Khoisan groups. Space is provided on the first floor to look down on performances within the circular performance space. This allows for the plotting of movement, which is usually part of the transcription process of the music since the movements/dances and music cannot be split or viewed separately when documenting the music.

Towards the northeast point of the site, an enclosed circular performance space is also found and diverges from the performance axis.



These performance space ultimately also activates the corners of the site and eases the transition from the industrial to the residential context by providing a cultural and recreational space in collaboration with Trafalgar Park.

This transitional space can be viewed in terms of liminality and thresholds. Both the physical context as well as the cultural and performative context provides liminal spaces or spaces of transition. The following part elaborates on this topic.



Figure 47: Site plan of the proposed design showing performance axis
Aerial Footage: (Google Earth, 2022)
Render: (Author, 2022)

Microtonality as Porosity/ The notes in-between

Concept 2



Figures 48 & 49: Concept model of the 2nd concept (Author, 2022)



The second theoretical concept looks at the shared nature of microtones in ethnomusicology. Western music uses tones in intervals called semitones. An interval in music is the inclusive distance between one tone and another (DeVoto, 2013: online). When this distance between one tone and another is equal and played successively on a tonal scale, it is known as a semitone. A semitone can also be defined as a half step. There are 12 equal semitones in an octave, starting at “A” and ending in “G” (Nettl, 2016: online). These semitones are assigned to specific soundwaves, which doesn’t allow for any soundwaves in between Therefore, an artist is limited to using the notes “A” to “G.”

other
to be played.

The notion of microtonalities opens the idea of porosity in the music. It refers to the concept of thresholds/ liminality since there are either larger or smaller transitional spaces between what are typically considered notes.

This notion manifests itself in a concept model which explores the existing context surrounding the site of the proposed design. The model suggests possible transitional spaces between the site, the built environment and the neighbouring park.

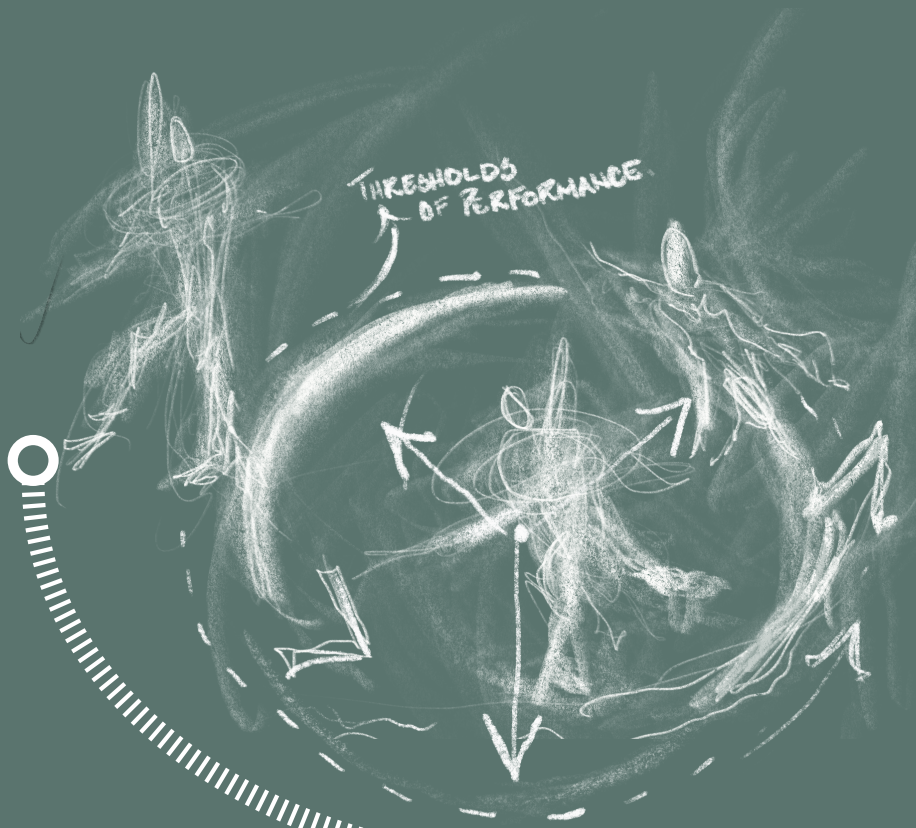
Transitions or liminality also extends to the realm of performance and music in general.

Liminality and Ethnomusical Performance

The value of liminal spaces become apparent in the result of thresholds. The interpretation of liminality has various contexts, ranging from the social and cultural to the spatial (Zimmerman, 2008:5). According to the sociologist, Bobby Alexander, the root word limen "is derived from the Latin word for 'threshold', which means 'being on a threshold" (Alexander, 1991:31). American architect, Fred Koetter, defines the liminal as "the realm of conscious and unconscious speculation and questioning – the 'zone' where things concrete and ideas are intermingled, taken apart and reassembled – where memory, values, and intentions collide" (Koetter, 1980:69)

Performance studies also see liminality as a transitional state (Waterman, 2019: 145). Considering performance as a liminal space of possibility corresponds to the affective dimension of many musical performances. Many cultures use music as a liminal ritual space to achieve social transformation within a group (ibid). The social transformation usually becomes apparent in ceremonies to celebrate birth, marriage, death and coming of age, among others. In some rituals, music also forms a liminal phase to facilitate psychological transformation (ibid). This is especially the case with ceremonies found i n Xhosa and Khoisan communities.

The idea of liminality in performance can also extend to physical space. The participants in a ritual performance occupy a liminal space between the aesthetic performance of music-making and everyday activities (Waterman, 2019: 148). Liminality, however, also extends to urbanity, as discussed in the site investigation chapter.



Figures 50: Performance and liminality (Author, 2022)

The Site and Liminality

Landscaping, in urbanism, is a practice that utilises the spaces between structures, whether buildings or infrastructure (Pittaluga, 2020: 19). This practice offers a similar interpretation of transitional spaces. City voids serve as “reserves of indeterminacy” and places for potential action, open and flexible (Pittaluga, 2020: 19). These spaces serve as liminal spaces.

The French philosopher, Michel Foucault, recognise these liminal spaces as the one that concurs with the everyday experience. Liminality is inherent in the “traditional space” concurrent interconnection with the daily space (ibid).

In the Third Space Theory, developed by the theorist Homi K. Bhabha, these transitional spaces represent a potential for cultural hybridity that allows difference without an assumed or imposed order (Bhabha, 1994: 4). This space forms by encountering otherness; it is a space of interaction, mediation, and translation from one view to another (Pittaluga, 2020: 19). Those involved in the process constantly redefine their identities in these spaces (ibid).

Since the site sits at a transitional point between the industrial surroundings, the residential context, and the recreational space of the park, it becomes an essential liminal space. The design proposes to address this through permeable spaces.

Liminality and the Design

One of the boundary walls, however, also contain some murals similar to a majority of Woodstock. To address this, the design proposes to reinstate murals on the south side of the building (figure). By including murals and street art, the proposed design also eases the transition between the greater context of Woodstock and the site.

According to the City of Cape Town officials, Trafalgar Park will undergo an upgrade to increase the community's ability to use the space (Brophy, 2016: online). The proposed design will link with the proposed urban design for the park. This proposed urban design indicates a BMX/ skateboarding area in the part of the park that directly neighbours the site of the proposed design. A typical BMX/ skateboarding park is morphologically composed of concrete slopes and hills. The proposed design attempts to link with this notion by using the existing steep slope of the site while introducing new landscaped hills and slopes. This further eases the transition of the proposed site and the park.



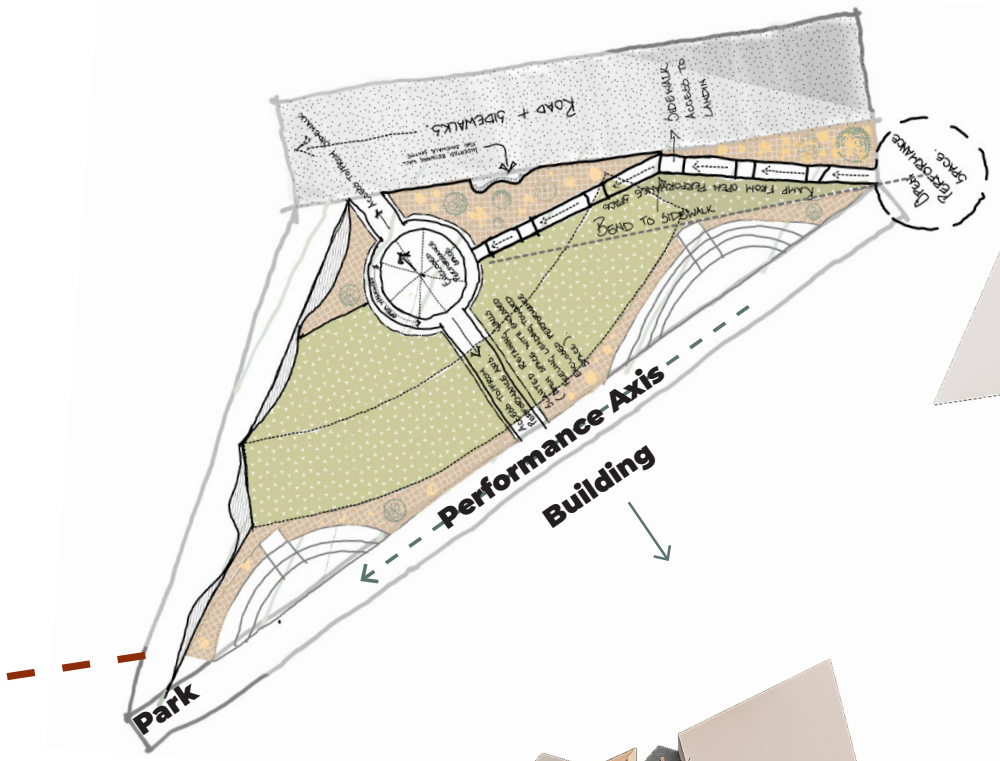
Figure 51: Southwest elevation showing the mural and park approach appliction in the design (Author, 2022)

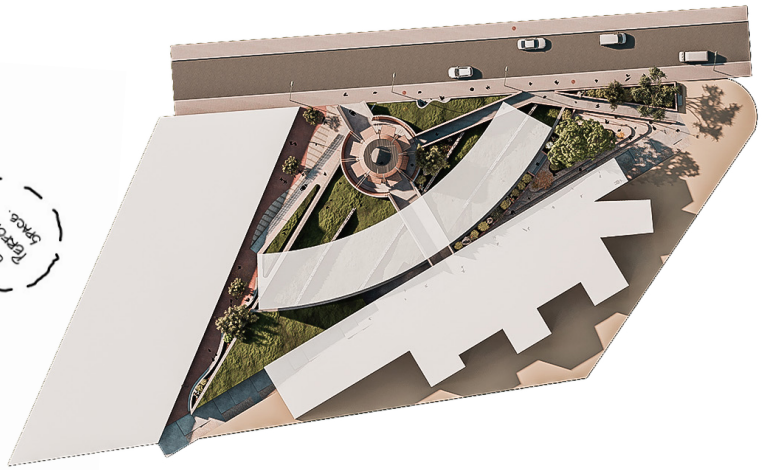


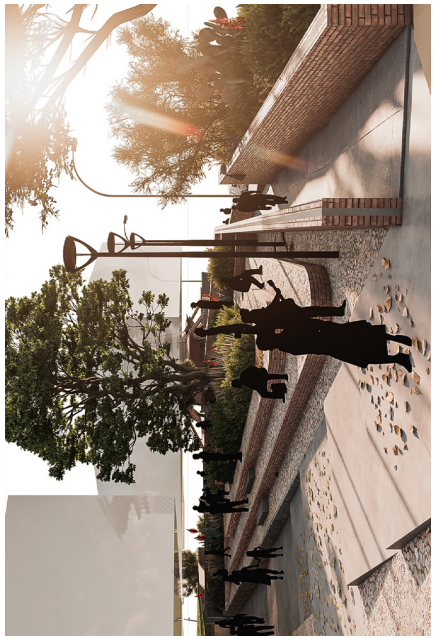
Proposal for Trafalgar Park Development

Figure 52: Master Plan (Square One Landscape Architects, 2016: online)

Figure 53: An initial sketch for the landscape master planning for the northern section of the site (Author, 2022)







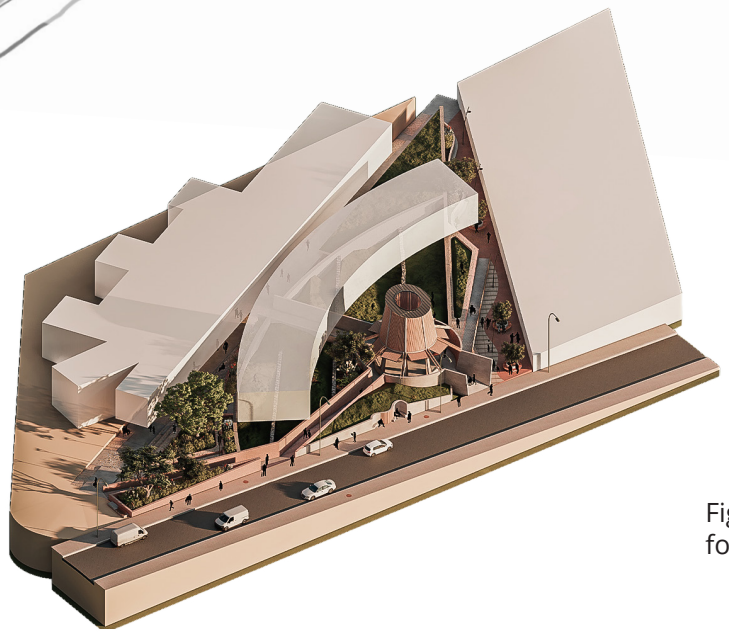


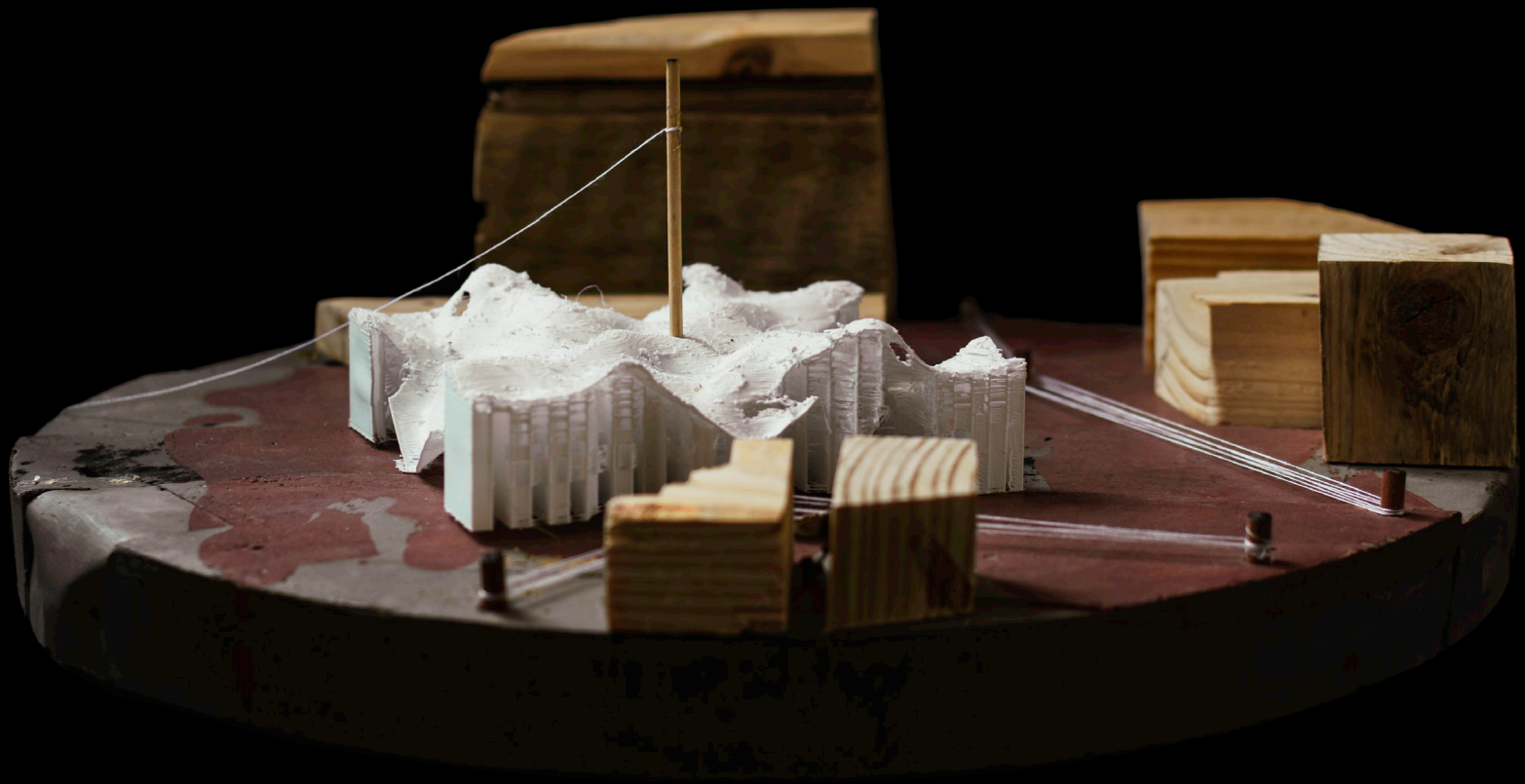




Figure 54: Axonometric views of one of the initial proposals for the landscaping (Author, 2022)

Without a Touch

Concept 3



Figures 55 & 56: Concept model of the 3rd concept (Author, 2022)

The third and last concept uses the idea proposed by the touchstone by using a "hands-off" approach. The concept proposes to eliminate any subjective impositions from the designer by limiting the designer's influence. This approach also proposes to eliminate any cultural appropriation or cultural misappropriation. Ultimately, the concept extends to the notion of syncretism, which allows an amalgamation of cultures, which speaks to the collective expression of the three cultures accommodated in the proposed design.

This concept finds embodiment in a model that explores generative/parametric design to approach both syncretism and a hands-off approach. The parametric system allows the designer to input a limited number of parameters while a computational device/software generates an output. Therefore, the designer can use specific cultural devices – in this case, music – and generate a design without imposing any subjective ideas or appropriation.



The model was constructed by taking three songs from each culture and combining them in layers. The new song was imported into sound software, and one second of the song was selected. The software converted the snippet of sound into a series of comma-separated values. These values were exported to parametric design software, where the software generated a 3D waveform shape from the mathematical parameters.

The model then made use of a 3D printer to produce the exact waveform shape. The waveform was then placed on the model, which indicates its relation to the site and context.

Metastaseis

The drawing of sound/

A theoretical/conceptual precedent

Iannis Xenakis & Le Corbusier
Brussels, Belgium
1958

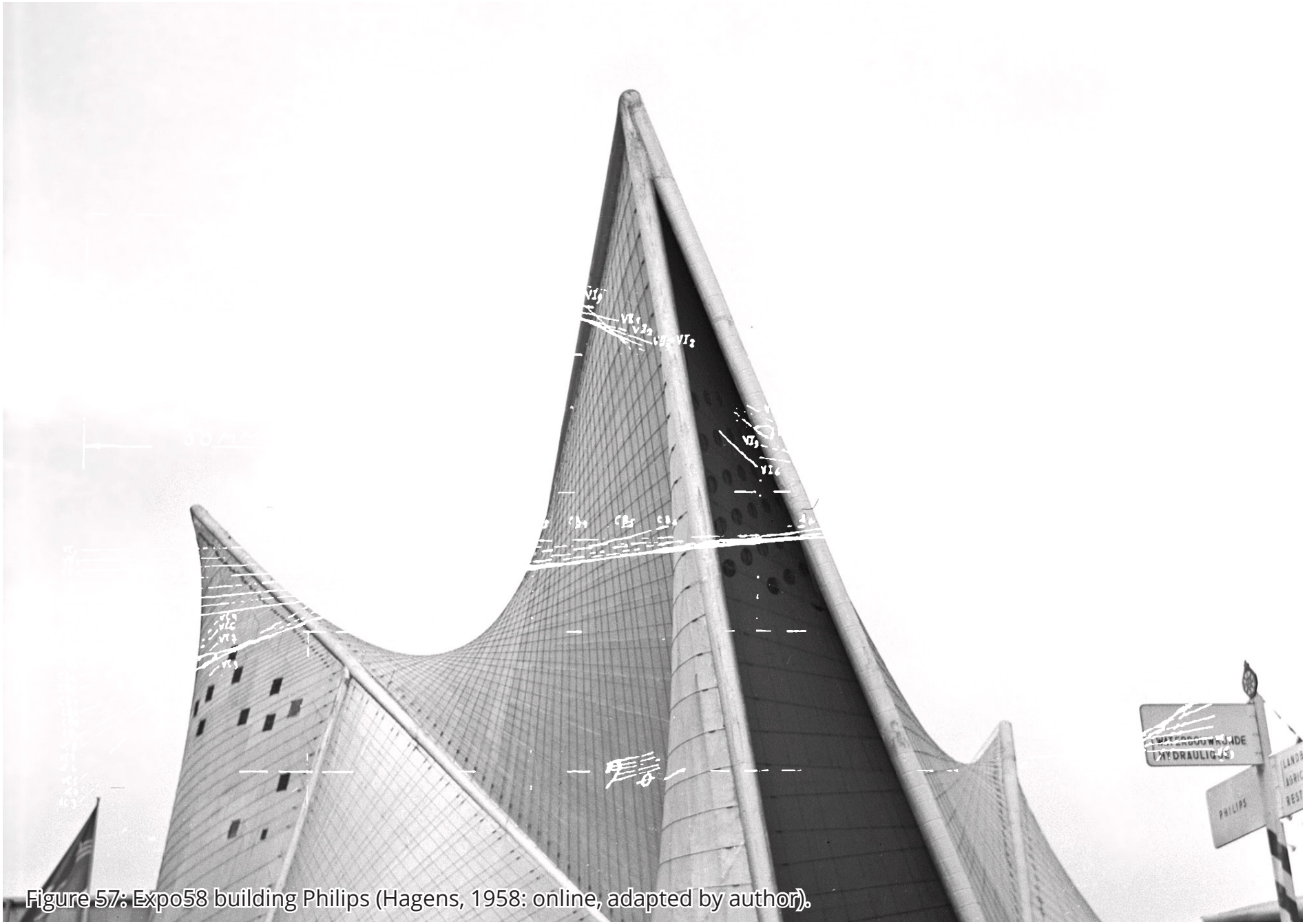


Figure 57: Expo58 building Philips (Hagens, 1958: online, adapted by author).

The following precedent analyses the possible translation of music into architecture or 3D form.

Xenakis, a musician, architect and engineer, sought a new approach to Western music. He conceptualised a breakthrough orchestral work, Metastaseis. The music was composed on architects' graph paper by drawing ruled parabolas. Xenakis drew lines at right-angles, which curved at intersecting points. The process assigned each of the 46 curved lines to different string instruments. The lines served as transcription of sound as sustained tones (Lovelace, 2010: 40). The notion of the music was to cover all frequencies and not just those covered in the chromatic scale of Western music (Lovelace, 2010: 45). The coverage of in-between frequencies relates to the characteristics found in indigenous music where notes used frequently fall between chromatic frequencies. The notion of in-between frequencies leads to the composition's name, which translates to "beyond-stasis" (Lovelace, 2010: 45).

Xenakis, who worked for Le Corbusier, was assigned the project of designing the Philips Pavilion. Xenakis started using the parabolas drawn for the composition of Metastaseis. The straight ruled lines became tensile wire cables that supported the parabolas further (Lovelace, 2010: 49). The initial model construction consisted of piano wires used to prove its feasibility.

The structure

1. The ground profile of the left half of the somewhat circular plan produces two straight lines rising from the extremities of the curve. The lines end in the right extremity of the structure, which creates the first peak or conoid shape (e) (Xenakis, 1992: 6).

2. The right half of the curved plan produces a surface consisting of two conoids (a and d). The straight line of d passes through the first peak. The outermost part of d, together with that of side e, forms a triangular exit. A straight line drawn from a pass through a second peak joins the directrix of d by using an arc. The main challenge was establishing an aesthetic balance between the two peaks (Xenakis, 1992: 6). A small triangular opening forms the entrance channel, where two hyperbolic paraboloids (g and k) bounds it (Xenakis, 1992: 7).

3. A perpendicular line, extending from the triangular exit that connects the first and second peak, forms the point for the third peak (Xenakis, 1992: 7).
The third peak elevates to a height similar to the other peaks. Non-flat surfaces finally enclose the virtual faces that form between the lines of the structure
(Xenakis, 1992: 7).

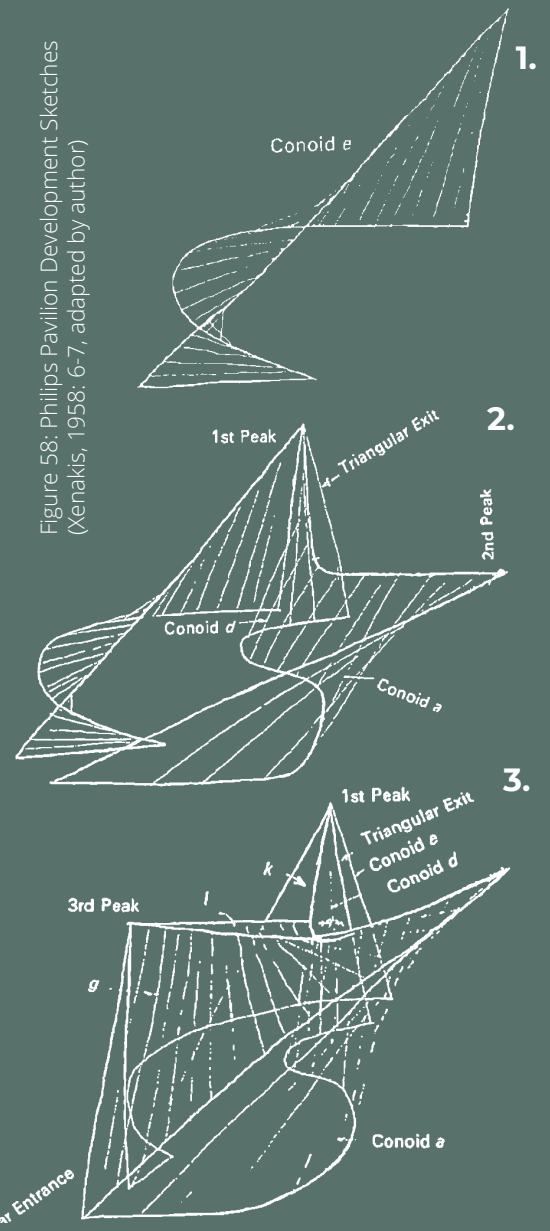


Figure 58: Philips Pavilion Development Sketches (Xenakis, 1958: 6-7, adapted by author)

Morphology

Thin-shelled concrete panels of hyperbolic paraboloids enclose the faces of the complex shape, which creates a tent-like form-giving (Lopez, 2011: online). The curved concrete panels were prestressed and cast on-site in open sand beds (Lovelace, 2010: 49, 53).
Steel posts at the ends of the tent-like structure allow for the stringing of steel cables which forms the hyperbolic paraboloids. The combination of the frame and the wires creates a tensile structure (Lopez, 2011: online). The precast concrete panels hang in tension from the wire cables.

The resulting complex structure becomes a uniform roof-wall structure. There is no distinction between roof and wall. The pavilion, therefore, encapsulates the idea of a moving performance through a space of sound, light and time.
The precedent represents a parametric approach to translating music into architecture. It also entails the use of tensile structures in a non-conventional way.

Lessons Learnt:

- Possible translations of music to architecture
- A theoretical and hypothetical design approach
- Parametric design as an architectural approach
- Interpreting musical structures as architectural structures
- Tensile structure application

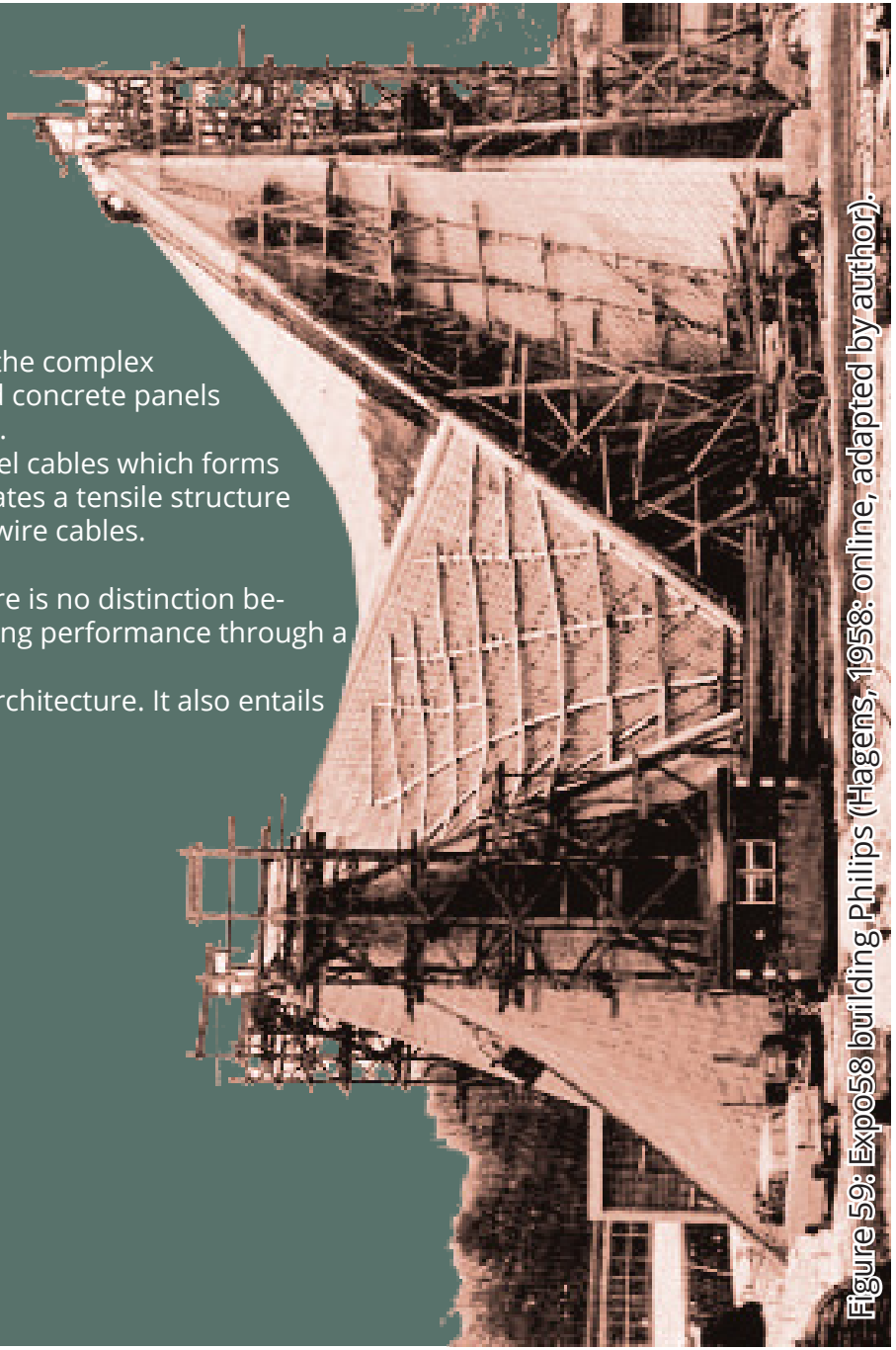


Figure 59: Expo58 building, Philips (Hagens, 1958: online, adapted by author).

Syncretism and Parametricism

According to the historian, Christopher Muscato, cultural syncretism occurs when two or more distinct cultures merge to form a new custom, idea, practice, or philosophy (Muscato, 2016: online). Syncretism also occurs in linguistics, where different languages find ways to blend, much like discussed with the “clicks” of the Xhosa and Khoisan languages. This further extends the notion to the first discussed concept.

Syncretism usually attempts to find ways to use ideas and practices from each culture in an equal manner. It usually requires the definition of differences, similarities and relations in each culture and to find a middle ground where all these cultures can coexist. The proposed design attempts to do this by using parametric design, which utilises the music of each culture.

Parametric design uses parameters that react to various inputs to produce an output. There exists, therefore, a constant relation between the input and output. According to architect and professor, Robert Woodbury, explicit consideration of the nature of a relationship is required in the act of relating when using parametric design (Woodbury, 2010: 11). This notion, therefore, associates itself with the idea of relation found in syncretism. The following understanding of parametric design is proposed by the architect, Hugh Whitehead (Woodbury, 2010: 1):

> As a concept parametrics is far more likely to be understood by a musician than by an artist. This is because the musician is dedicated to rehearsing for performance - which is an essential characteristic of a virtuoso in parametrics. To the artist on the other hand the accumulation of technique is incidental to the production of an artefact, which is the result of direct interaction with a medium. For this activity there is no written score that can be fine tuned and re-played. However, at the highest level of fluency we may yet see a generation emerge who can “sketch with code.”

Parametric design is developing into a distinctive and original design paradigm beyond just being another tool for modelling complicated shapes (Oxman, 2017:4). Concepts and theories of parametric design within designer-authored programmed computational processes, simulation, assessment, and fabrication processes have been incorporated into media and computational design systems. Pertinent principles have introduced new ways of thinking and morphogenetic processes from the fields of science and philosophy, mathematics, and computer science. Modern cognitive models of design thinking now include new ideas, techniques, and procedures as a result of the reformulation of goals and scientific underpinnings while being reflective (Oxman, 2017: 10). Being reflective in the context of algorithmic design refers to the designer’s capacity to comprehend and utilise the computational and scripting tools (ibid). Current popular computational design software includes scripting languages. Visual designers and artists, for instance, can modify the software’s structure to meet their unique artistic modes of thinking by using the processing programming language. Thus, the scripting style of creative thinking encourages solution space exploration as part of a special refining search process (ibid). To create the design object, the designer “designs” the parametric schema’s script. The parametric schema is a special kind of mathematical model that facilitates algorithmic processes of shape development (Oxman, 2017: 11). A powerful medium for design generation and innovation in all design disciplines is made possible by the parametric variability of a design (ibid).

The Design and Parametricism

The same approach was used to generate baffle ceiling and wall structures in the main circulation space in the upper ground floor, performance axis and some of the open rehearsal spaces.

The initial landscaping approach (figure) also made use of sinusoidal waves. The parametric software generated the newly introduced slopes or hill scaping in the landscape design. A fabrication proposal was made for the slopes/hills to be supported by a timber waffle structure (figure) . This, however, would have been impractical due to deterioration that would occur to the waffle structure underground. The slopes are now proposed to be constructed as on-site as estimates from the documentation drawings.

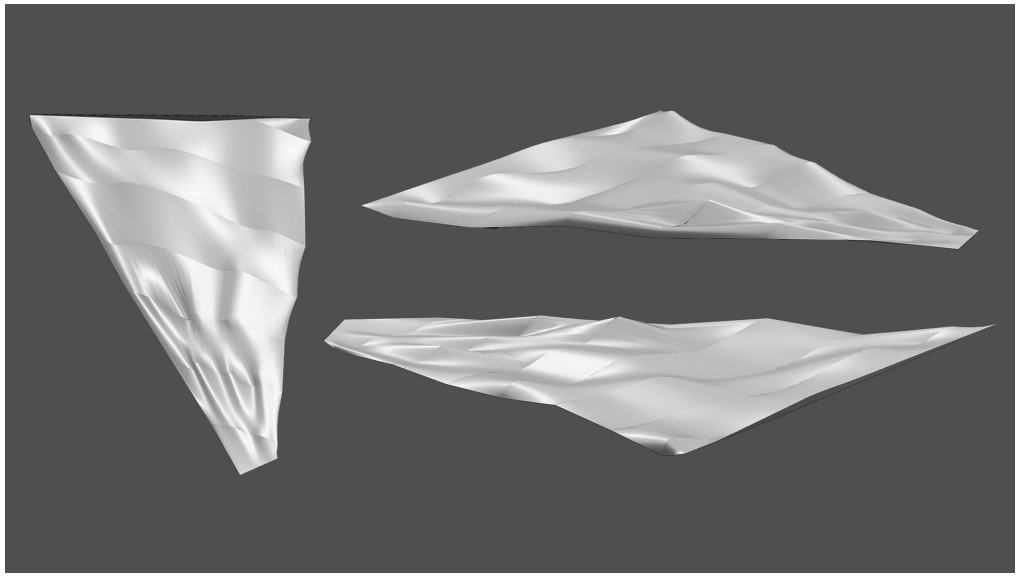


Figure 60: Parametric manipulation of the site contours as slopes/ hill scaping (Author, 2022)

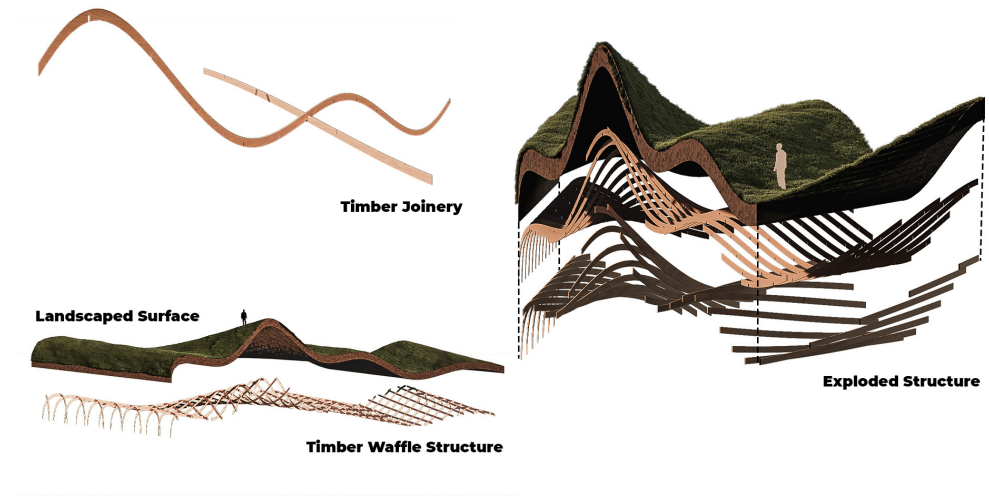
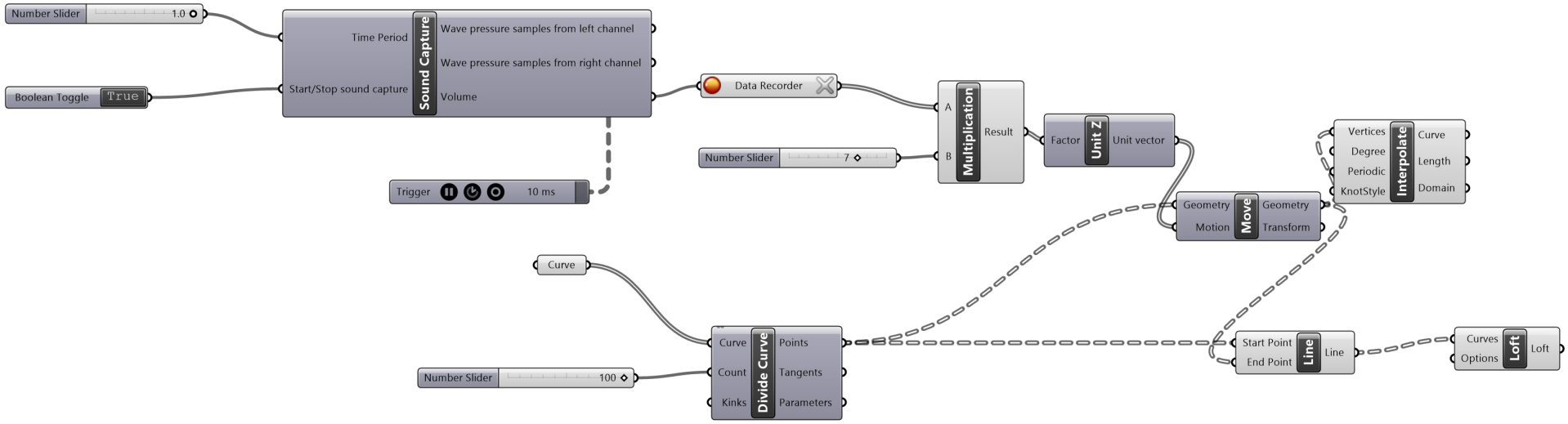


Figure 61: Parametric fabrication of the site contours as slopes/ hill scaping (Author, 2022)

Figure 62 & 63: Two parametric Script for Capturing the Music of the Indigenous Groups and turn it into 3D Form (Author, 2022)



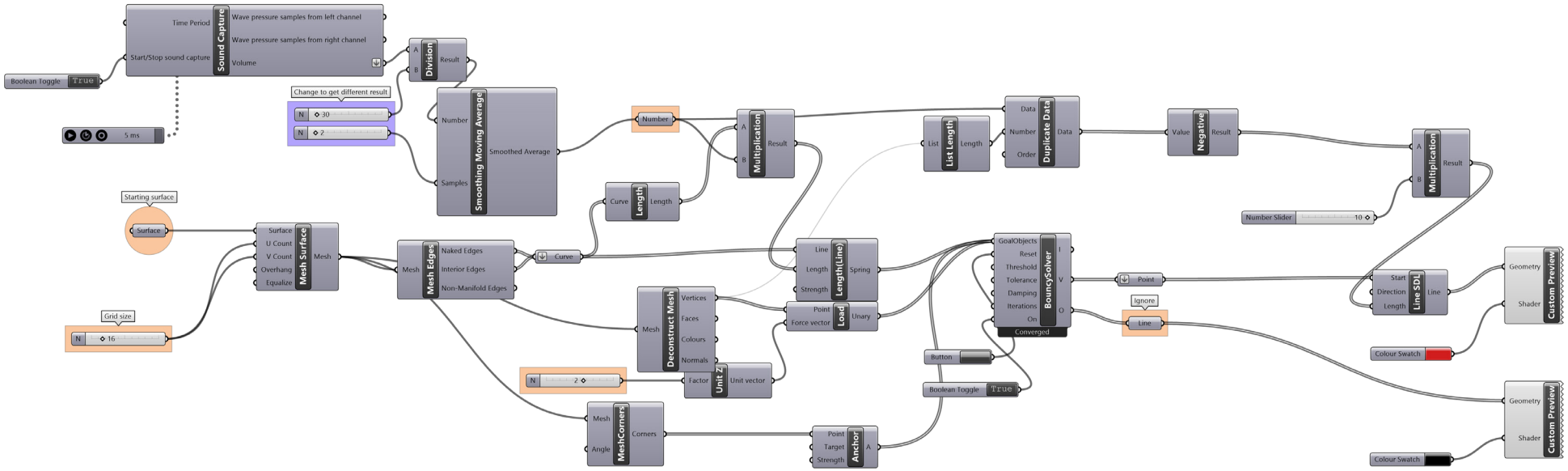
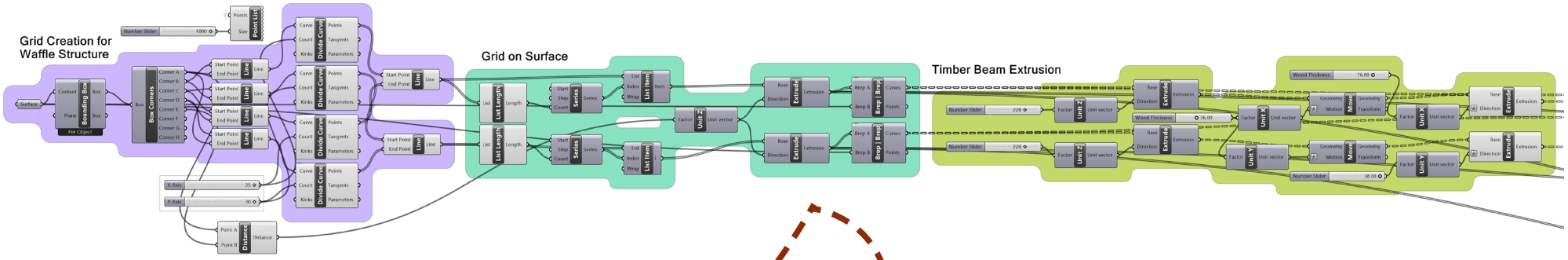

Time Period
Start/Stop sound capture
Sound Capture
Wave pressure samples from left channel
Wave pressure samples from right channel
Volume
Boolean Toggle
True
5 ms
Division
A
B
Result
Change to get different result
N 30
N 2
Number
Samples
Smoothing Moving Average
Smoothed Average
Number
Multiplication
Result
Curve
Length
List
List Length
Length
Data
Number
Order
Duplicate Data
Value
Negative
Result
Number Slider
10
Starting surface
Surface
Surface
U Count
V Count
Overhang
Equalize
Mesh Surface
Mesh
Grid size
N 16
Mesh
Mesh Edges
Naked Edges
Interior Edges
Non-Manifold Edges
Curve
Line
Length
Strength
Length(Line)
Spring
Mesh
Deconstruct Mesh
Vertices
Faces
Colours
Normals
Point
Force vector
Load
Unary
N 2
Factor
Unit Z
Unit vector
Mesh
Angle
MeshCorners
Corners
Point
Target
Strength
Anchor
A
GoalObjects
Reset
Threshold
Tolerance
Damping
Iterations
On
BouncySolver
I
V
O
Converged
Button
Boolean Toggle
True
Point
Ignore
Line
Start
Direction
Length
Line SDL
Line
Colour Swatch
Geometry
Shader
Custom Preview
Colour Swatch
Geometry
Shader
Custom Preview

Figure 64: Parametric Script for the fabrication of the Waffle/Baffle Structures produced by the Music (Author, 2022)



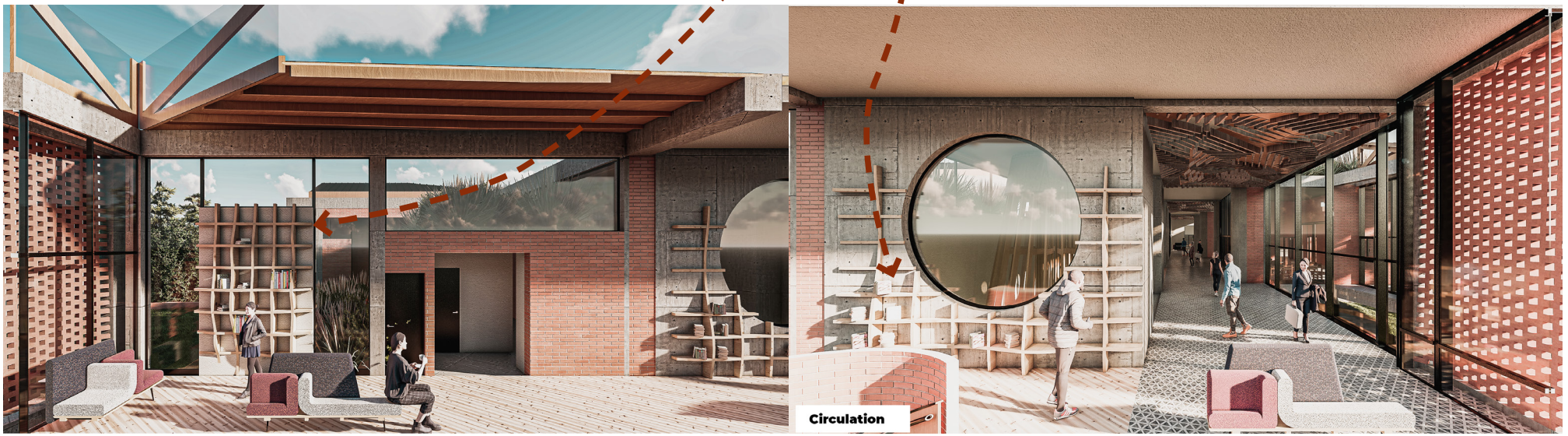


Figure 65: Waffle structure library book shelves produced by the music and fabrication scripts (Author, 2022)

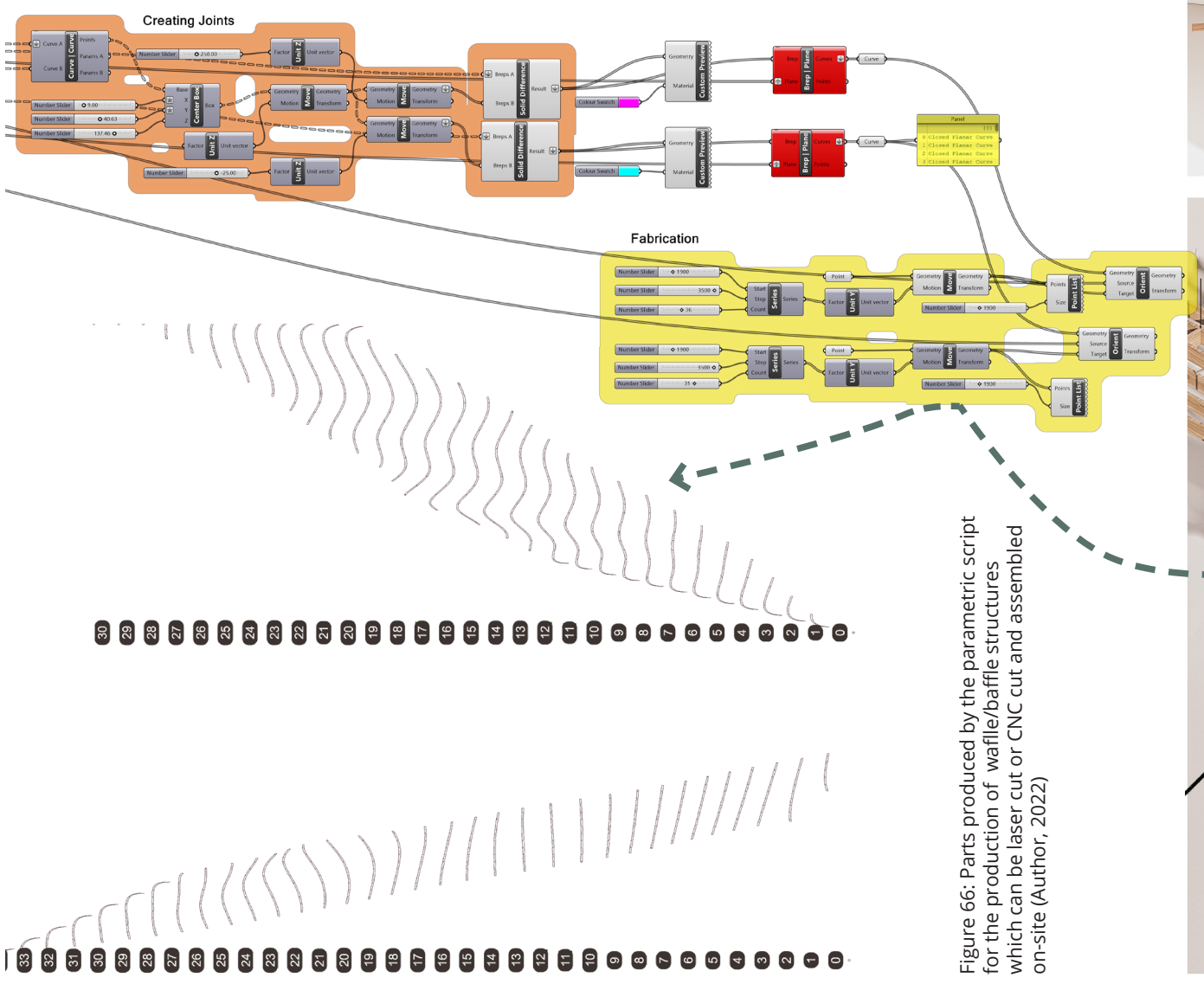


Figure 66: Parts produced by the parametric script for the production of waffle/baffle structures which can be laser cut or CNC cut and assembled on-site (Author, 2022)

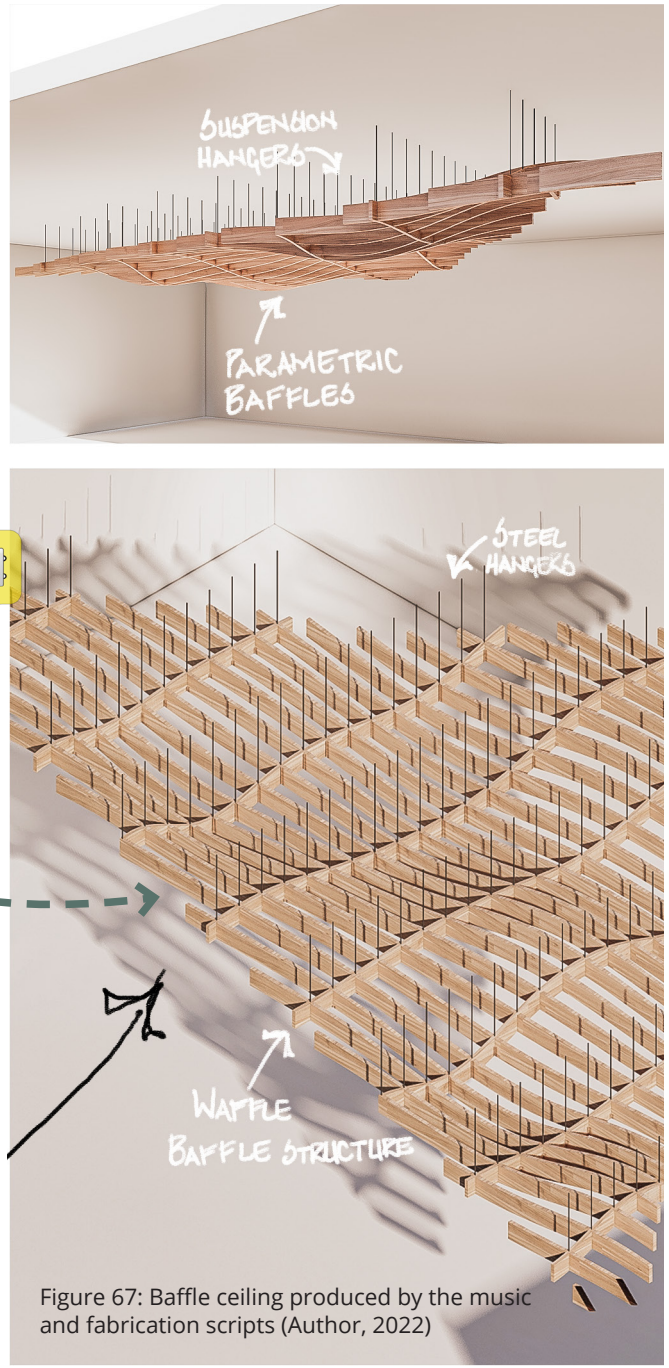


Figure 67: Baffle ceiling produced by the music and fabrication scripts (Author, 2022)



Figure 68: Solar screens created by the music with parametric scripts (Author, 2022)

Conclusion

Ultimately, the three conceptual approaches and the precedents propose a unique way to approach the three cultures and their music in the design while avoiding any form of misappropriation or subjective imposition.

As discussed, the first interpretation uses rhythms and performance in linguistics as the foundation of the morphological and typological approach to the design. Furthermore, the spatial layouts and design orientation are also grounded in this concept by referring to the narratives of performance and that of the site. Essentially, parts of the structure of the cultures' music form the dialogue and translation of the architecture.

The second interpretation serves as an approach to urbanism in the form of thresholds or liminal space. The concept proposes a permeable approach that allows the site of the design to extend to the park. This also ensures a transition between the industrial and residential contexts, which is split under current condition, by the site.

The third and last conceptual approach proposes a parametric and "handsfree" method to directly use the music of the cultures in elements of the design. This method relates itself to a syncretic approach of cultural amalgamation which exchanges practices of similarity and differences among cultures.

V while avoiding unwanted appropriation or wrongful subjective interpretation. Ultimately, the three concepts serve as possible answers to the research question posed by the theory.

Design Development
PART 4

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DESIGN FINALISATION - 98

Design Development

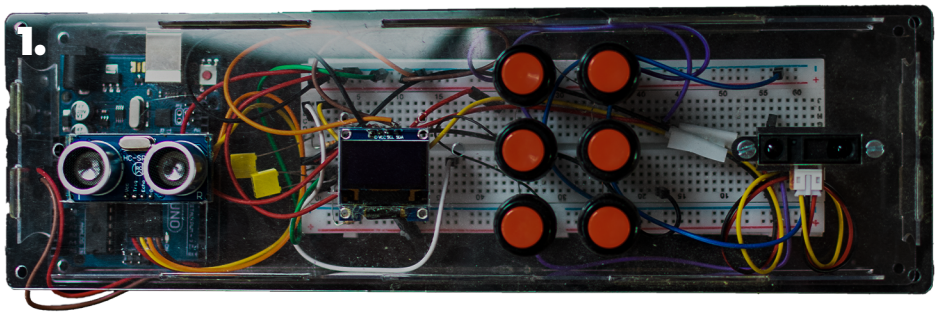


Figure 69: Touchstone and concept models (Author, 2022)







The initial design response was in the form of a touchstone and three concept models as discussed in the theory section.

The touchstone informed the approach of avoiding cultural misappropriation and the three concept models interpreted this approach in three different ways. One or all of the concept models informed the later design iterations

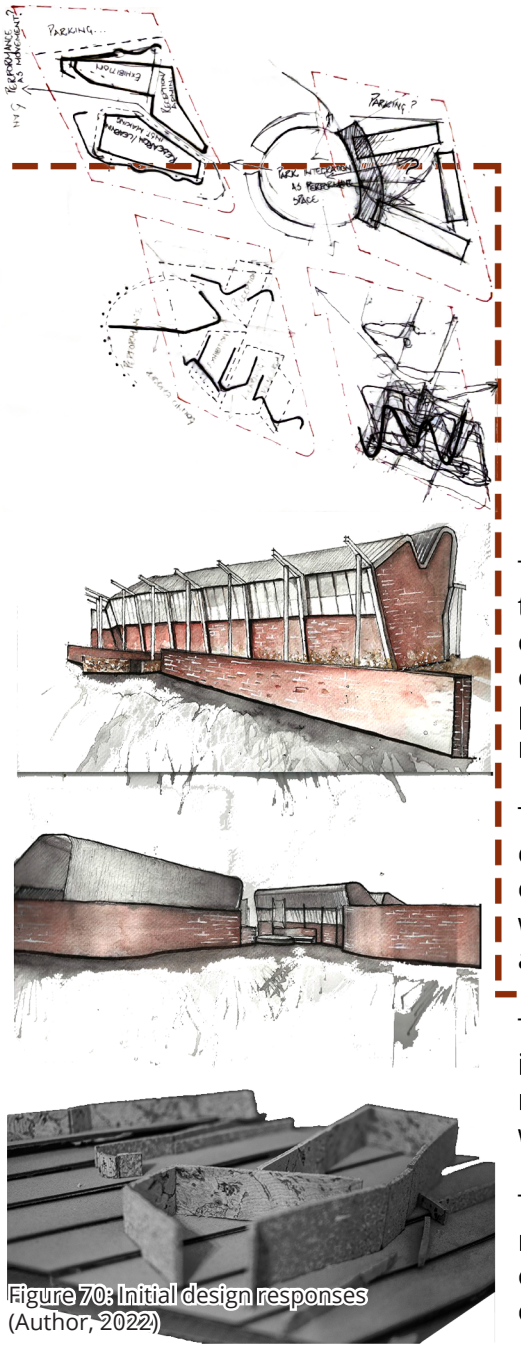
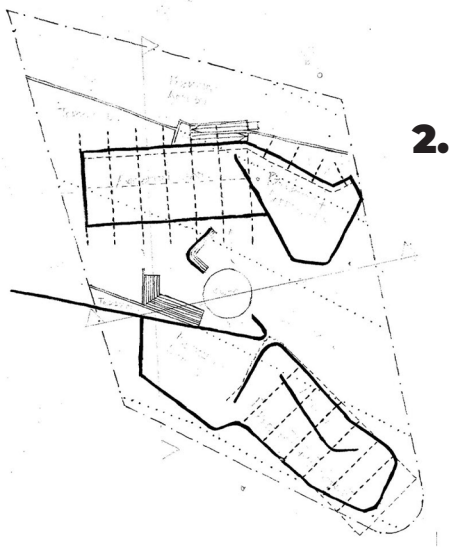


Figure 70: Initial design responses (Author, 2022)



The initial placing of the design on the site primarily focused on the concept presented in the first concept model, namely the polyrhythmic structure of the music.

The design was primarily concerned with form finding in the context by taking rhythms found within the context and going against that rhythm.

This might have resulted in interesting morphologies, but it resulted in design iterations that were out of touch with its context.

Therefore, the initial design responses on the site only took one of the proposed concepts into consideration.

3.

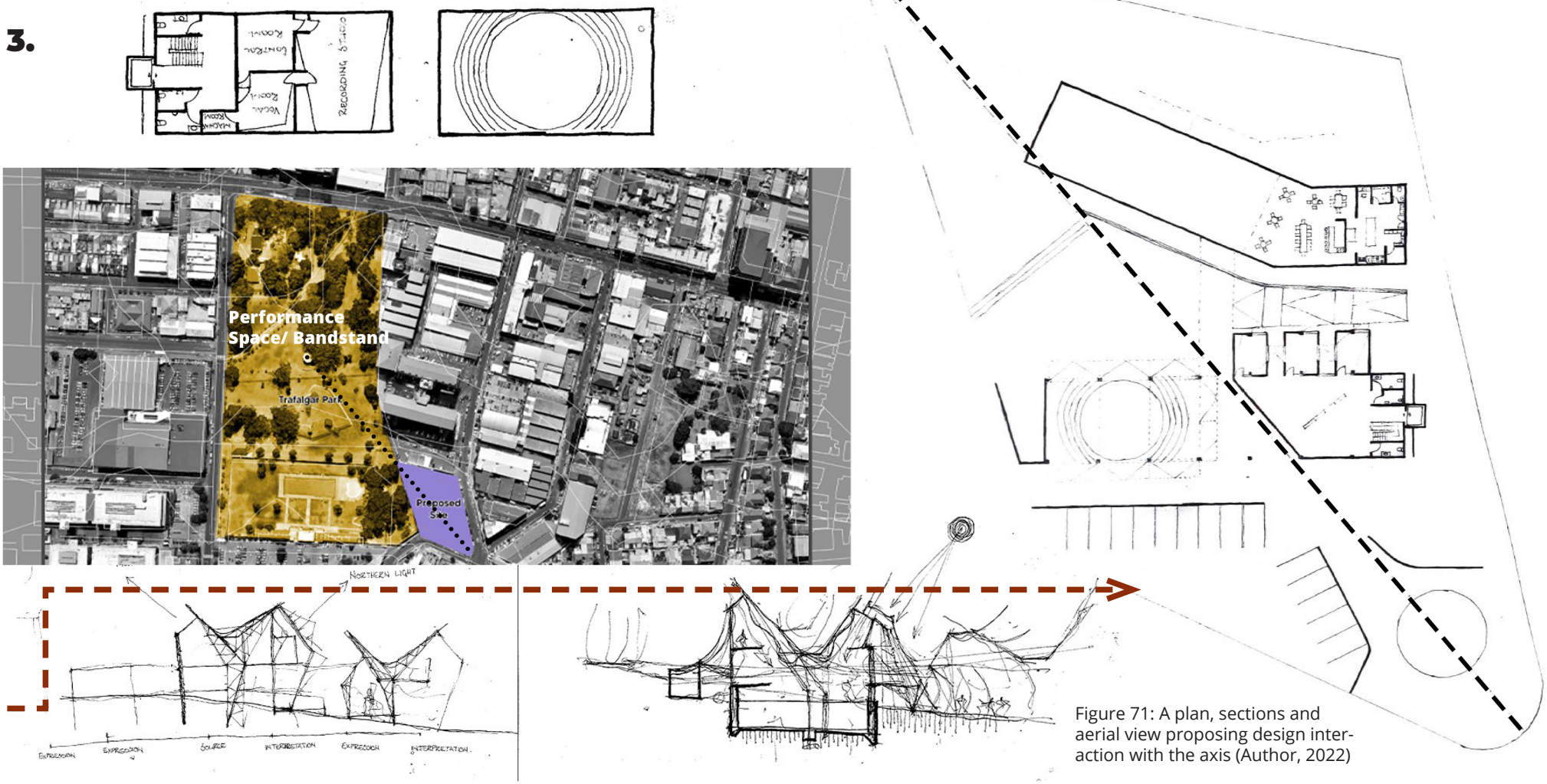


Figure 71: A plan, sections and aerial view proposing design interaction with the axis (Author, 2022)

The design response that followed started investigating applications of the other concept models. The design proposed to react to the axis formed by the existing performance space/ bandstand in Trafalgar Park. Several sections explored possible spatial experiences while the plan investigated a design proposal where the axis splits the plan into two separate buildings. One building (south) being concerned with the rehearsal and music spaces in the design and the other (north) being concerned with admin and public functions.

The design response, however, created a very fragmented approach to the site which poses several issues such as access, reception and security.



Figure 72: Plan proposal that aligns with the “performance axis” (Author, 2022)

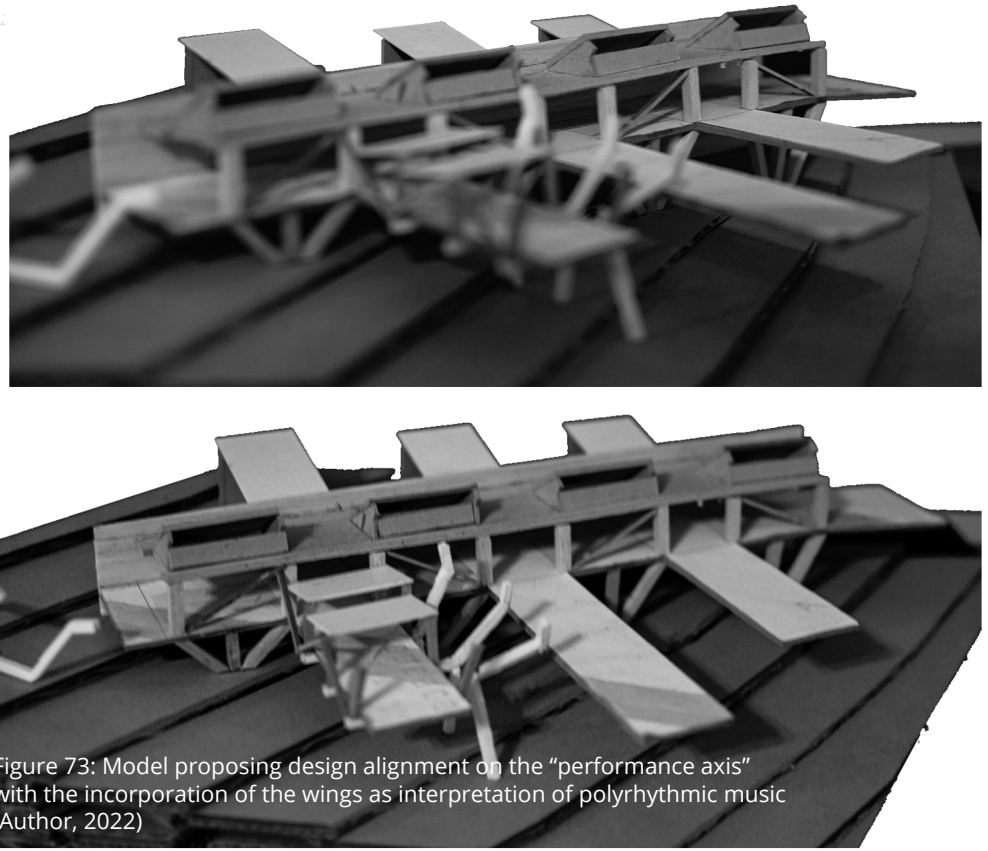


Figure 73: Model proposing design alignment on the “performance axis” with the incorporation of the wings as interpretation of polyrhythmic music (Author, 2022)

The following design approach proposes to align the design as one unified building on the axis of the bandstand/performance space in the park. This proposal results in the plan of the building not being split into separate buildings while taking advantage of the longest possible line on the site without covering the entire site with a large enclosed structure.

This approach also opened up large parts of the site to the public which links with the park on ground floor. The design iteration also proposes to make use of the polyrhytmic concept by creating a winged design with four intersecting boxes.

Therefore, the design iteration proposes to use both the concept of polyrhytms as well as microtonality as liminal device.















Figure 74 : Digital 3D model exploring the possible incorporation of all three initial concepts in the design (Author, 2022)

The next design iteration proposes to extend on the notion of the design rotated on the "performance axis" that aligns with the existing bandstand/performance space in the park.

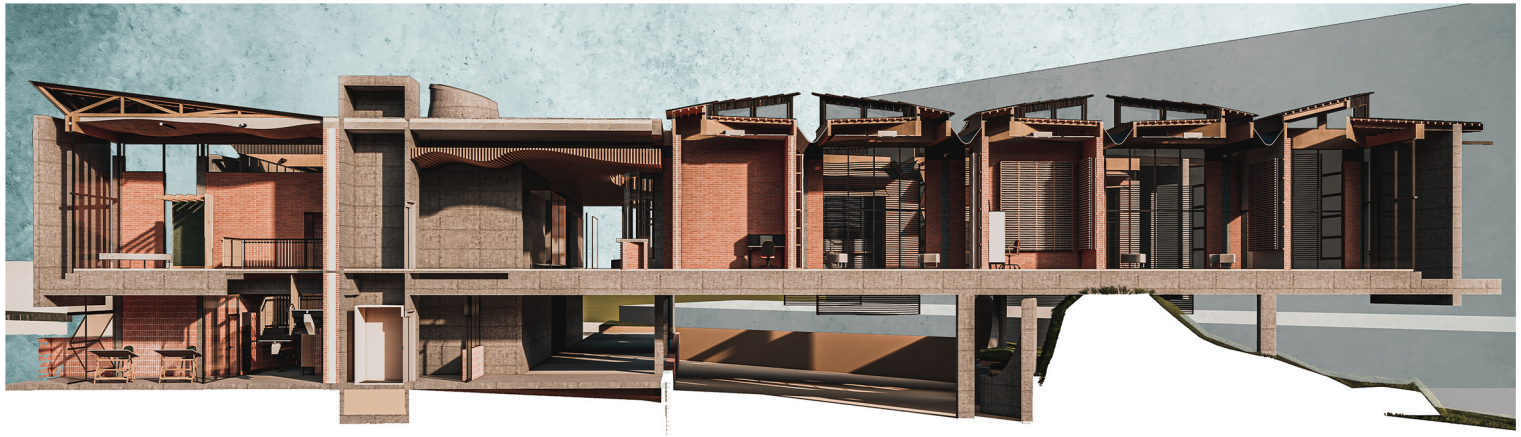
The design was spatially developed by placing experiential exhibition spaces in the concrete boxes on the first floor/ upper ground floor while the wings that intersect the design houses a sheet music and literature library while the second and third wing houses multi-media libraries to the south

The wings in the north facade houses the music rehearsal spaces, a performance rehearsal space and administrative functions.

The design also proposes a semi-enclosed outside performance space on the corner of the site which is inspired by the French redoubt in the park. The design, however, seemed very rigid and too institutional.







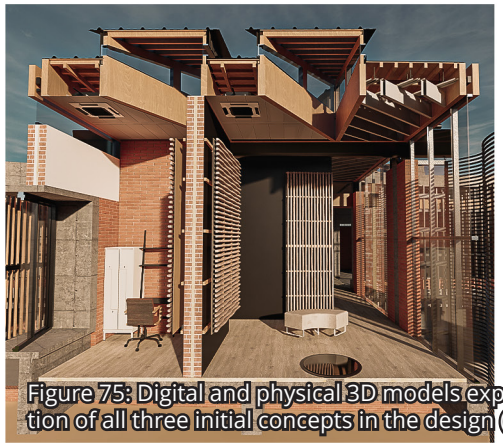
The following design iteration followed the previous proposal while further developing the internal spaces. The internal spaces were refined and made more function specific. Investigations were made into acoustic solutions for performance and rehearsal spaces while maximising the performance areas.

Roofing explorations were also done to investigate possible ways of allowing indirect northern light into spaces that don't face directly north.

The roofs also investigated a rhythmic approach and reinterpretation of the sawtooth roofing found in the industrial area surrounding the design.

The design iteration also investigates possible ways of using parametric approaches in the design with screening devices, acoustic panels, ceiling designs, and landscaping interventions.

The design, therefore, attempted to apply all three initially proposed concepts by allowing all the musical concepts to manifest in the built form while attempting to avoid cultural appropriation.



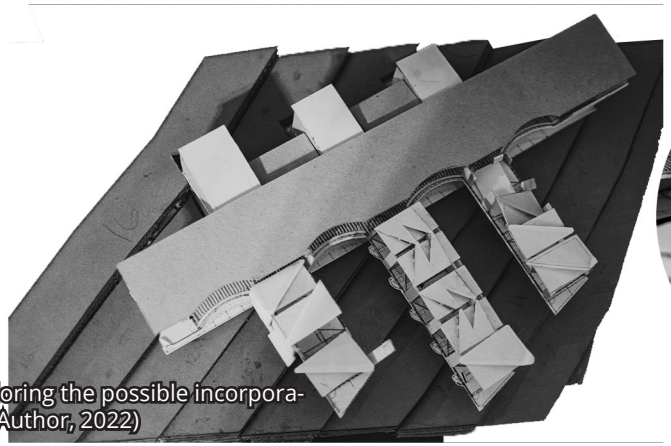
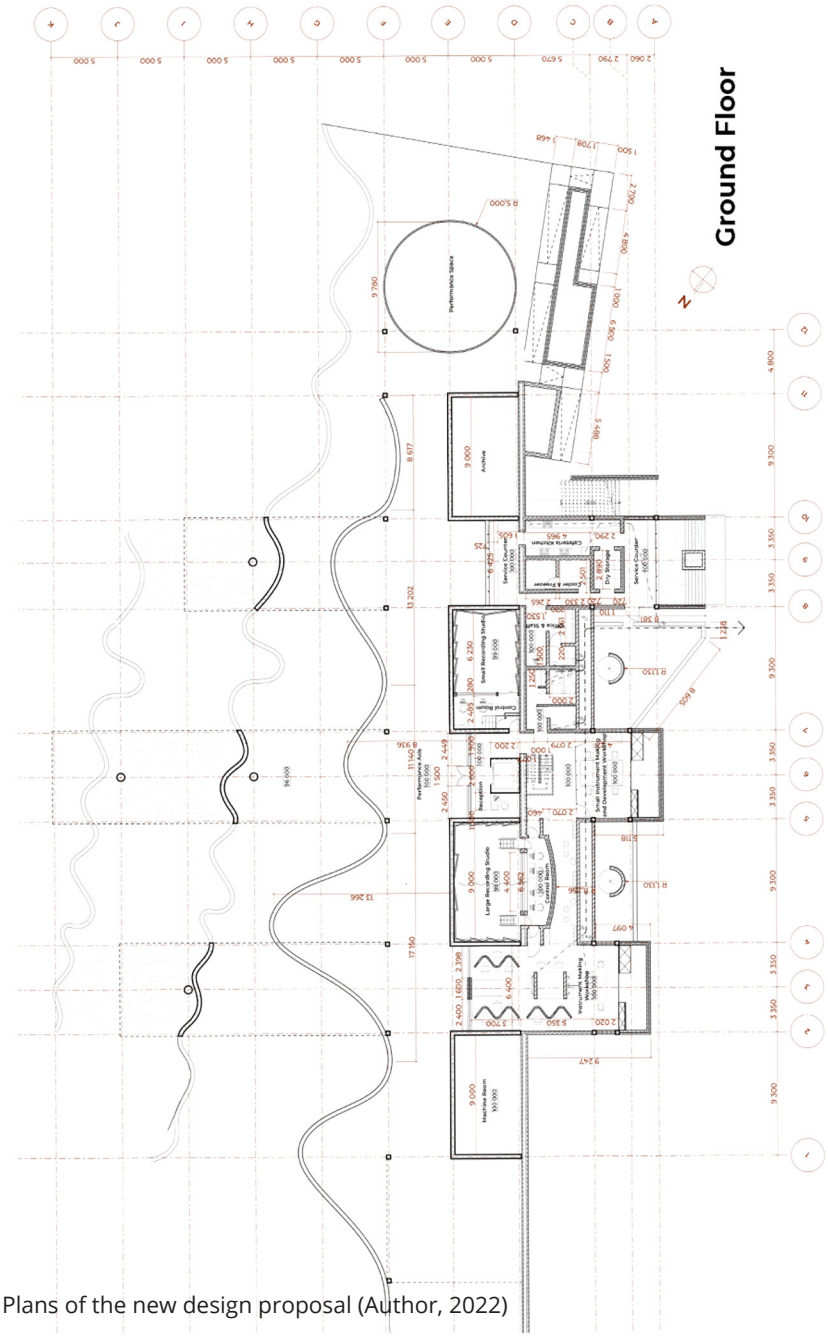




Figure 75: Digital and physical 3D models exploring the possible incorporation of all three initial concepts in the design (Author, 2022)



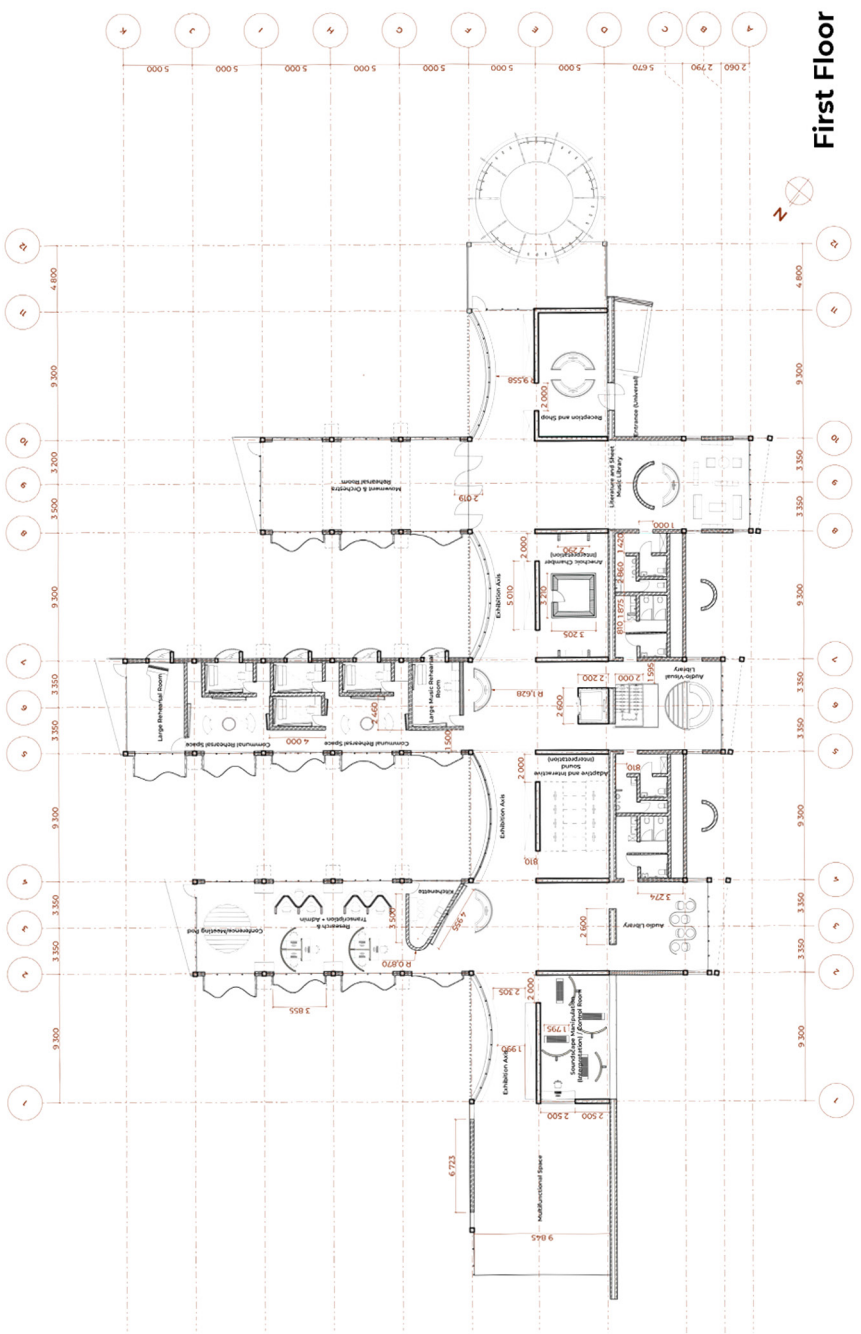


Figure 76: Plans of the new design proposal (Author, 2022)

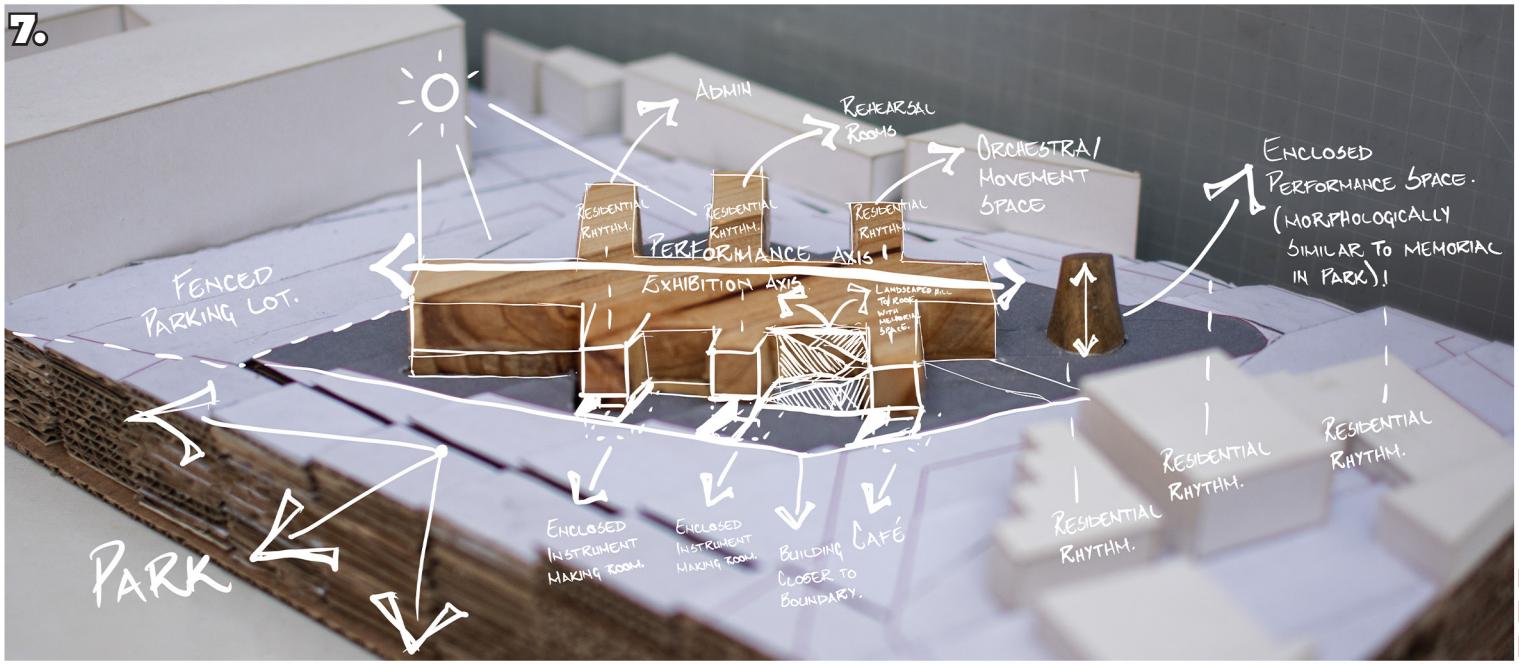




Figure 78 & 79: Models analysing site interaction and new semi-circular plan addition (Author, 2022)

The following design iteration analysed the previous proposals and its interaction with the park and the built environment surrounding it.

Upon analysis and crit sessions it was decided that the design might be too rigid which creates an overall institutional feeling and not necessarily a cultural one.

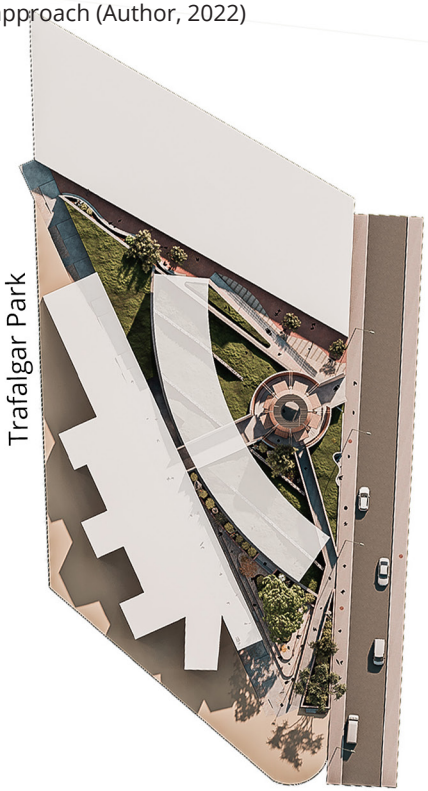
The iteration seemed, however, to fit into the context but lacked a character of uniqueness in its environment.

The next design iteration then proposed to explore a new interpretation of the wings in the previous design by making it intersect with a semi-circular plan that wraps around the outdoor performance space.

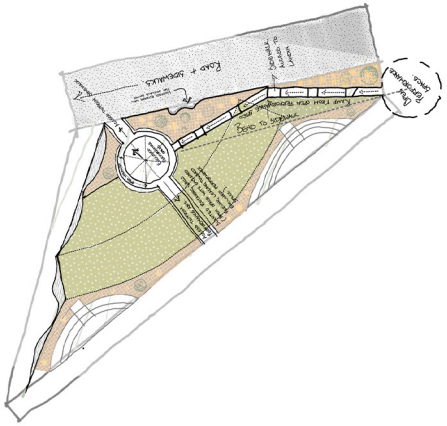
The primary outdoor performance space was therefore moved to a different corner on the site while maintaining its circular morphology and reference to the Devil's Peak and the French Redoubt in the park.

The design also proposed to be sunken into the site on the southern side towards the residential area, to be less intrusive and to create a humble interaction with the residential built form.

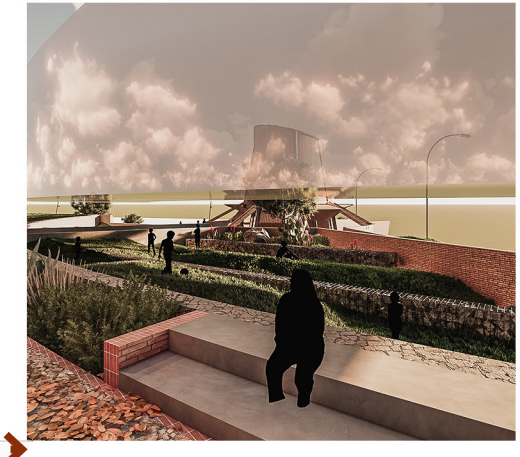
Figure 80: Digital model and plan exploring semi-circular and landscaping approach (Author, 2022)

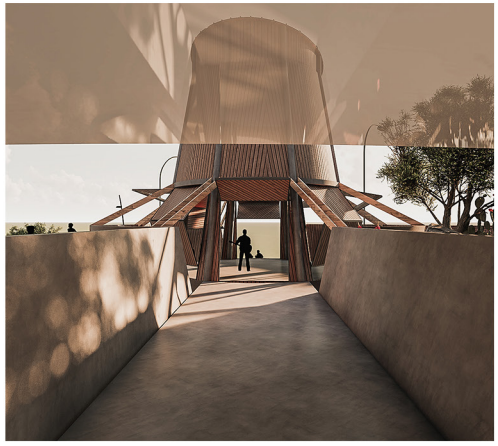




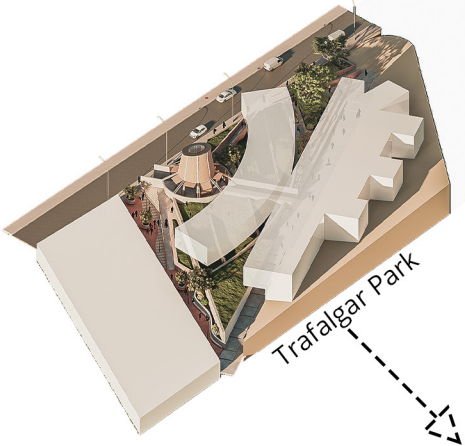














The design further investigated the integration of the semi-circular plan addition as well as possible landscaping interventions to link the site to the park and the public.

The design also developed a new approach to the enclosed outside performance space which becomes a focal point on the site and in the context in general while maintainign its original references to the cultures' circular perfonaces and the French redoubt in the park

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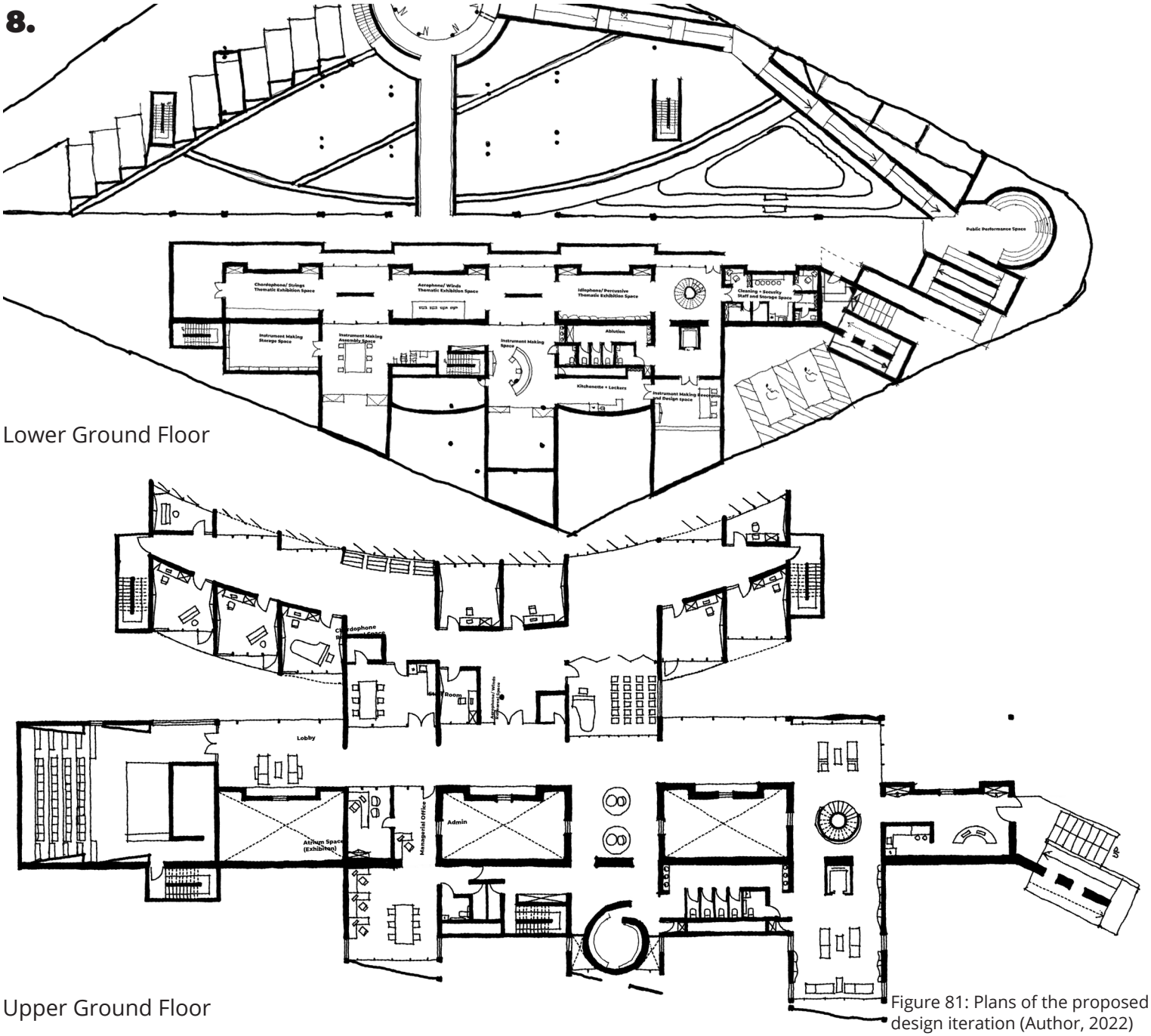


Figure 81: Plans of the proposed design iteration (Author, 2022)

The following design iteration explored the semicircular plan addition while developing the internal spaces.

The design proposes to move all the performance related spaces to the northeast facade that wraps around the outside performance space. This allows all the performance and circulation spaces on this facade to constantly have a view of the outside performance space.

Therefore the design is split into three divisions. The first on the northeast corner of the site being concerned with performance in the outdoor performance space.

The second is the music rehearsal spaces that wrap around the performance space.

The third is the library, admin, auditorium and reception spaces in the rectilinear spaces to the south of the site.

The design proposes to place the instrument-making spaces also in the rectilinear southern spaces of the design but on the lower ground floor in the sunken spaces. This notion stems from the idea of some of the indigenous bow instruments that are usually made by placing a stick in the soil as support for bending it into a stringed bow.

The sunken nature of the instrument making spaces finds its origin in the way that these cultures make their instruments. Usually reeds or stick are placed in the soil to stabilise it while cutting or preparing it.

Landscaping is used in the sunken spaces on ground floor of the instrument making spaces to act as a sound barrier towards the residential areas.

Audio Visual Space

Landscaping as sound barrier



Figure 82: Audio-visual space at !KHWA TTU San Heritage Centre (Letch, 2019: online)

Auditorium

Figure 83: Interior space development of the proposed to design (Author, 2022)



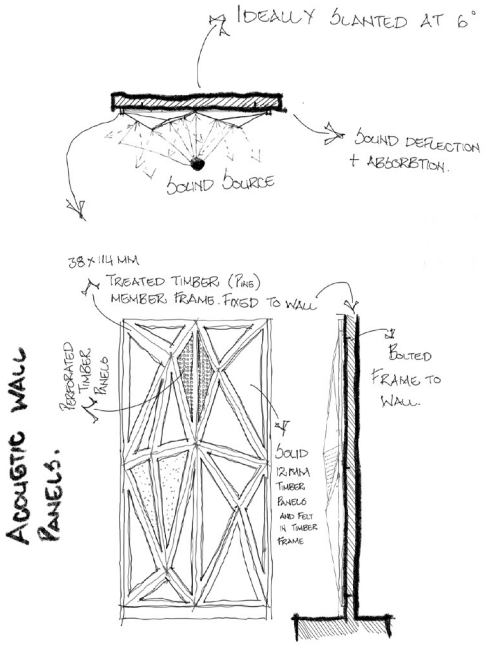


Figure 83: Sections through spaces and proposed acoustic panelling (Author, 2022)











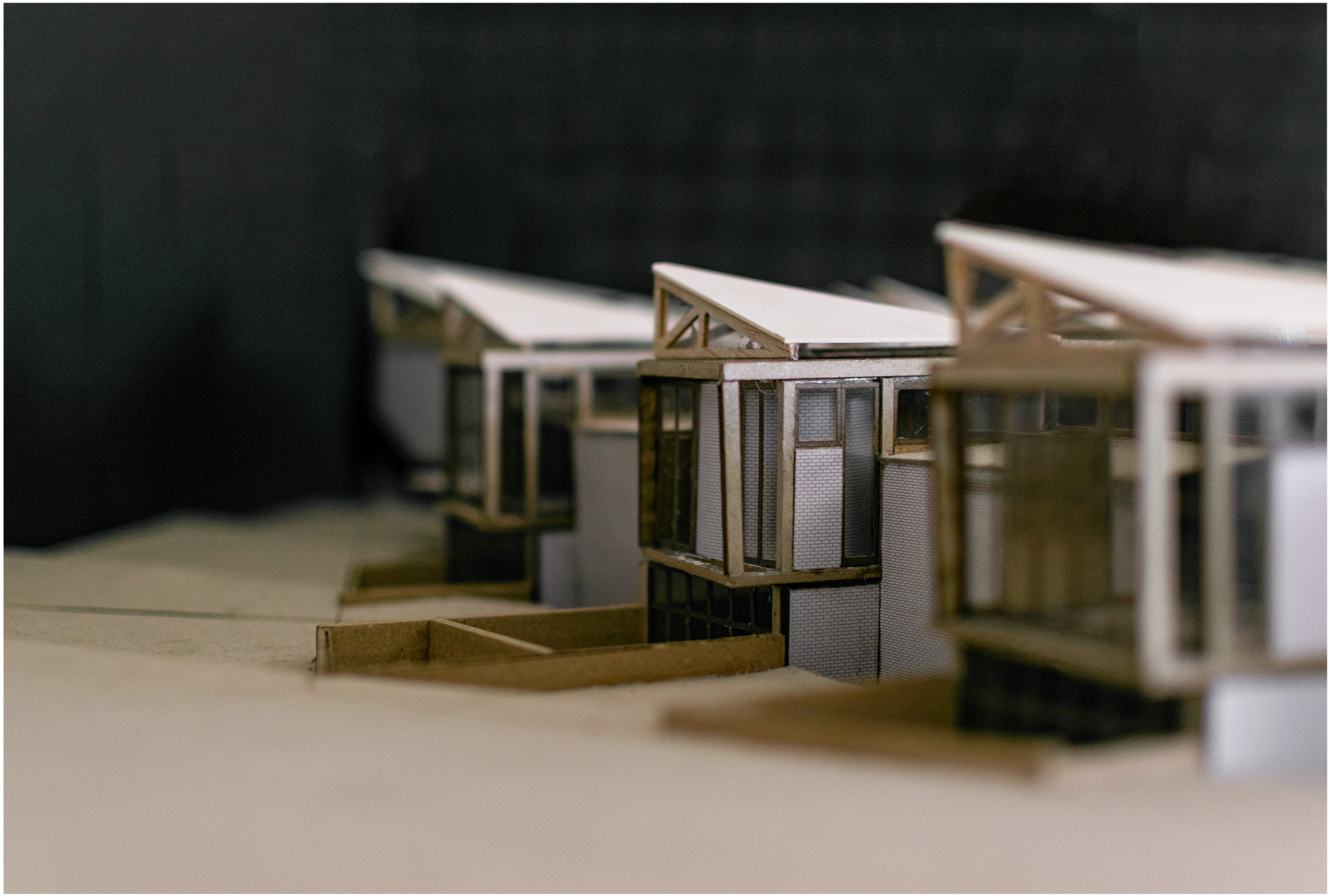


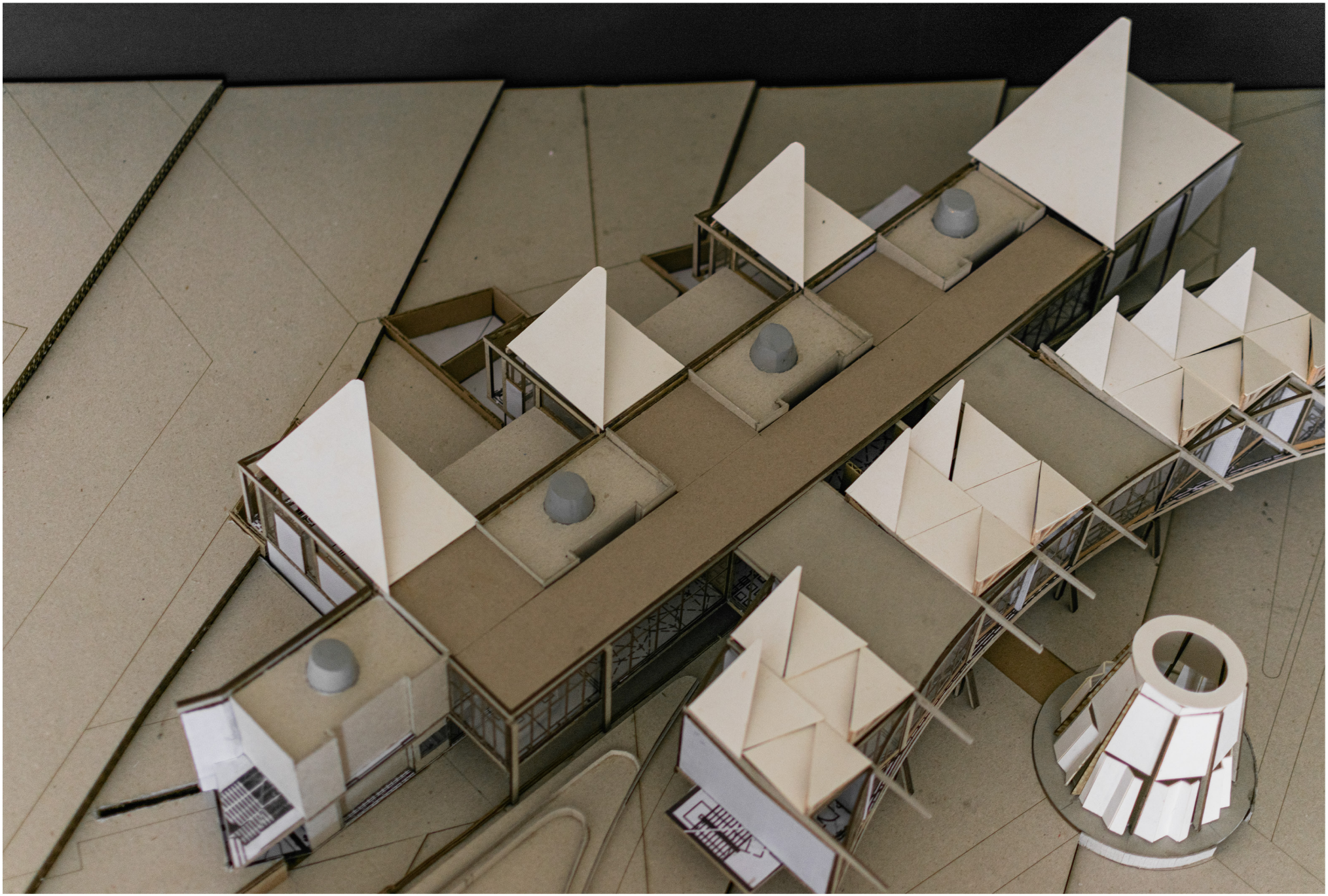


Figure 84: Renders of Interior Spaces and elevations of the proposed iteration (Author, 2022)



Figure 85, 86, 87 & 88: Physical model exploring design iteration (Author, 2022)





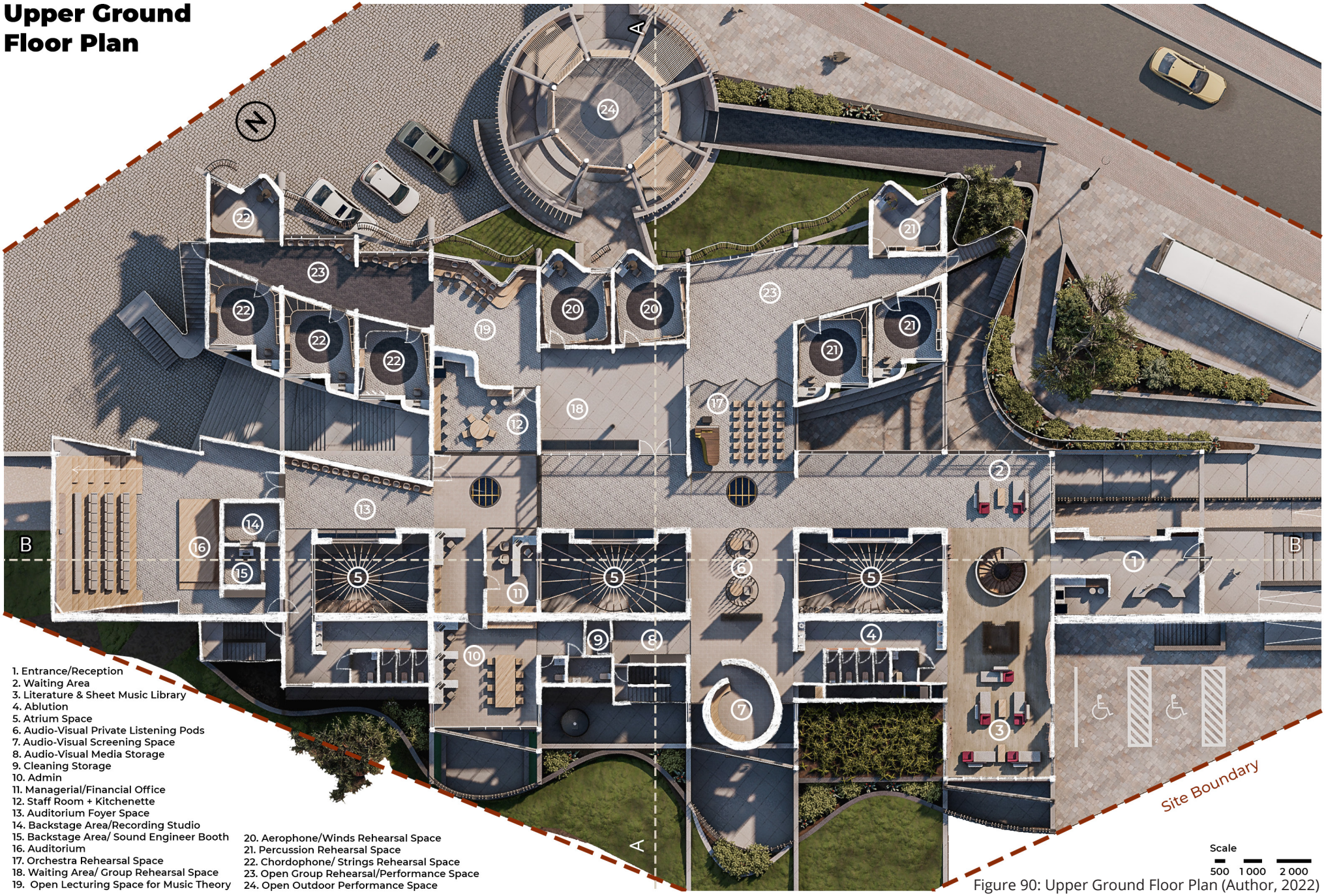


Design Finalisation



Figure 89: Site Plan (Author, 2022)

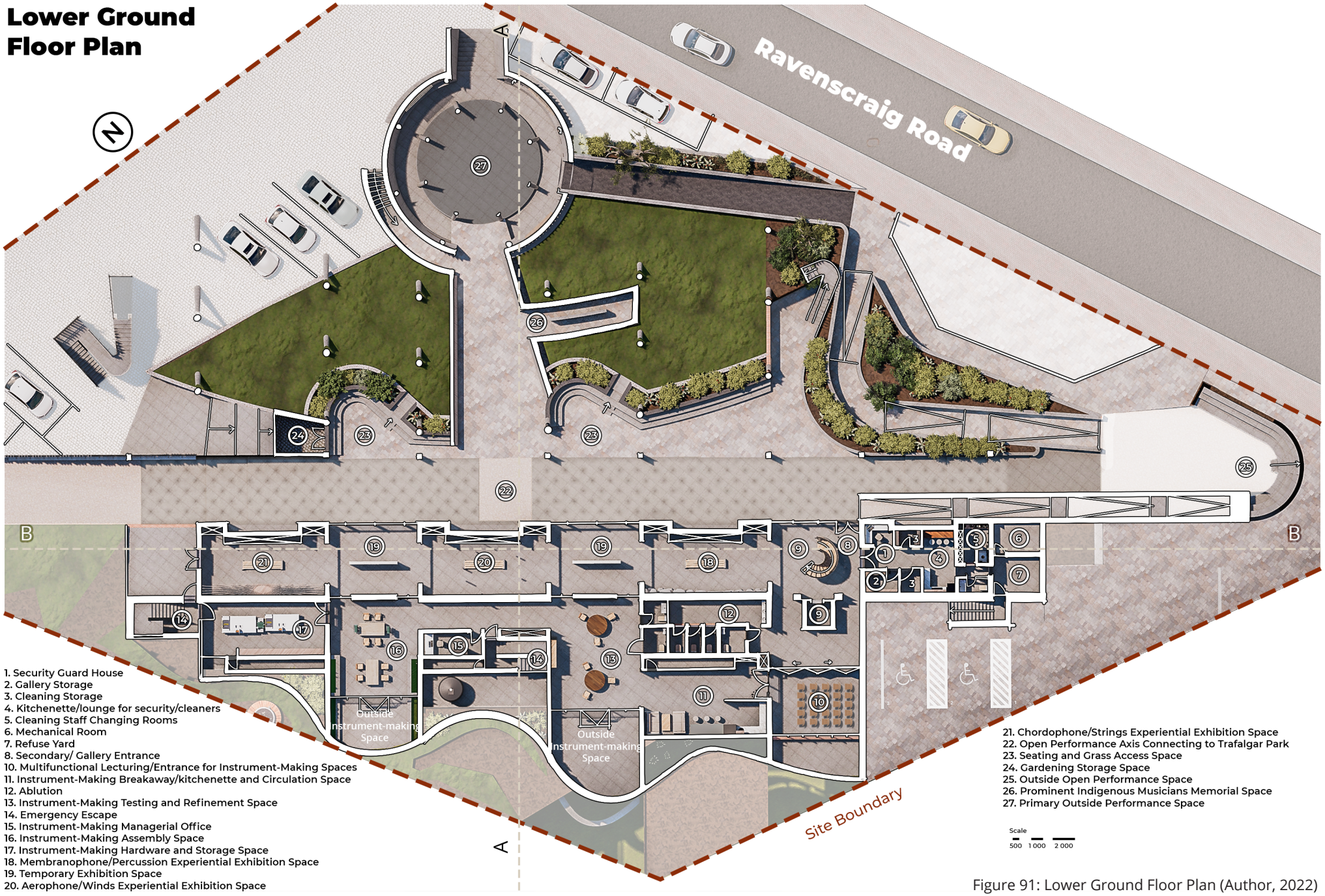
Upper Ground Floor Plan



1. Entrance/Reception
2. Waiting Area
3. Literature & Sheet Music Library
4. Ablution
5. Atrium Space
6. Audio-Visual Private Listening Pods
7. Audio-Visual Screening Space
8. Audio-Visual Media Storage
9. Cleaning Storage
10. Admin
11. Managerial/Financial Office
12. Staff Room + Kitchenette
13. Auditorium Foyer Space
14. Backstage Area/Recording Studio
15. Backstage Area/ Sound Engineer Booth
16. Auditorium
17. Orchestra Rehearsal Space
18. Waiting Area/ Group Rehearsal Space
19. Open Lecturing Space for Music Theory
20. Aerophone/Winds Rehearsal Space
21. Percussion Rehearsal Space
22. Chordophone/ Strings Rehearsal Space
23. Open Group Rehearsal/Performance Space
24. Open Outdoor Performance Space

Figure 90: Upper Ground Floor Plan (Author, 2022)

Lower Ground Floor Plan



1. Security Guard House
2. Gallery Storage
3. Cleaning Storage
4. Kitchenette/lounge for security/cleaners
5. Cleaning Staff Changing Rooms
6. Mechanical Room
7. Refuse Yard
8. Secondary/ Gallery Entrance
10. Multifunctional Lecturing/Entrance for Instrument-Making Spaces
11. Instrument-Making Breakaway/kitchenette and Circulation Space
12. Ablution
13. Instrument-Making Testing and Refinement Space
14. Emergency Escape
15. Instrument-Making Managerial Office
16. Instrument-Making Assembly Space
17. Instrument-Making Hardware and Storage Space
18. Membranophone/Percussion Experiential Exhibition Space
19. Temporary Exhibition Space
20. Aerophone/Winds Experiential Exhibition Space
21. Chordophone/Strings Experiential Exhibition Space
22. Open Performance Axis Connecting to Trafalgar Park
23. Seating and Grass Access Space
24. Gardening Storage Space
25. Outside Open Performance Space
26. Prominent Indigenous Musicians Memorial Space
27. Primary Outside Performance Space

Figure 91: Lower Ground Floor Plan (Author, 2022)



Figure 92: Northeast Elevational Perspective (Author,



Figure 93: Entrance Perspective (Author, 2022)

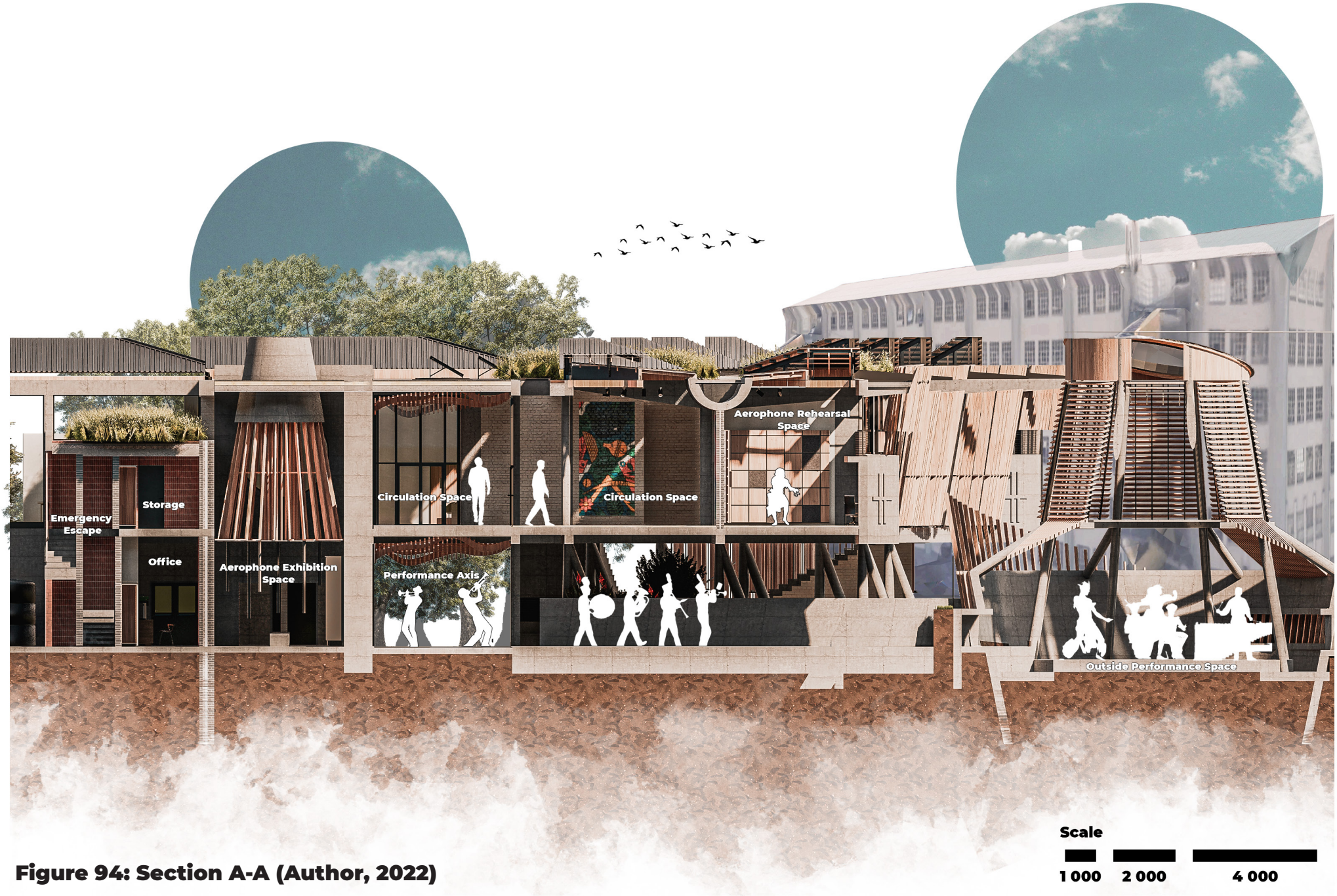


Figure 94: Section A-A (Author, 2022)

Figure 95: Sectional Perspective A-A (Author, 2022)



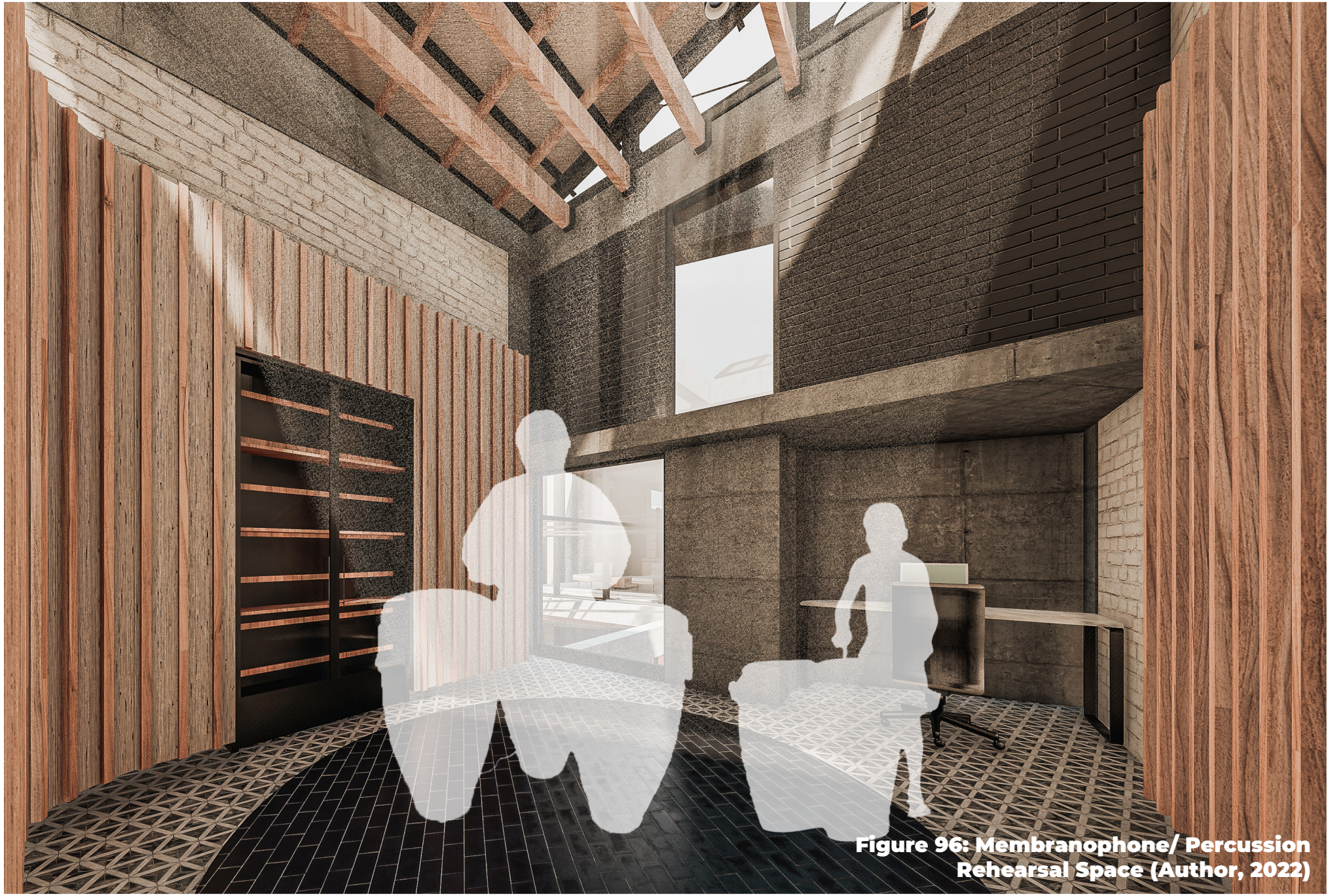


Figure 96: Membranophone/ Percussion Rehearsal Space (Author, 2022)



Figure 97: Open rehearsal/ Circulation Space (Author, 2022)



Figure 98: Open rehearsal/ Circulation Space (Author, 2022)



Figure 99: Open lecturing space(Author, 2022)



Figure 100: Outside performance space(Author, 2022)



Figure 101: Auditorium space(Author, 2022)



Figure 102: Instrument Making Outside Space(Author, 2022)

Instrument Making Process

The Uhadi: (Plaatjies, 2021: online)

Black Wattle branch (Or other suitable branches):

1. Cut the piece of wood/branch to the desired length
2. Scrape the branch
3. Sand the branch
4. Create grooves in the branch for the attachment of the string or wires

The Wire:

1. Measure the desired length of the wire and choose the appropriate wire thickness
2. Cut the wire to the desired length
3. Place the wire in the grooves created in the branch
4. Bend the branch with the attached wire
5. Fix the wire and the branch firmly with string

The Calabash: (Plaatjies, 2021: online)

The Wire:

1. Test the calabash and the wire to determine the correct wire for the correct calabash

The branch:

1. Choose an appropriate branch
2. Cut the piece of wood/branch to the desired length
3. Scrape the branch
4. Sand the branch
5. Create grooves in the branch for the attachment of the string or wires
6. Attach the calabash and branch with the wire into the created grooves

Cloth:

1. Wrap a cloth around the attachment of the calabash and the branch to soften the sound profile

The Umrhubhe: (Plaatjies, 2021: online)

1. Appropriate branches should be selected
2. The branches should then be soaked in water for 3-4 weeks to soften it
3. Same process as uhadi

The Umtshingo: (Plaatjies, 2021: online)

1. Cut a piece of reed/bamboo or PVC pipe at 45 degrees on the mouth piece end
2. Different thicknesses of reed/bamboo or PVC will produce different sounds.



Figure 103: Southwest Elevational Perspective (Author, 2022)

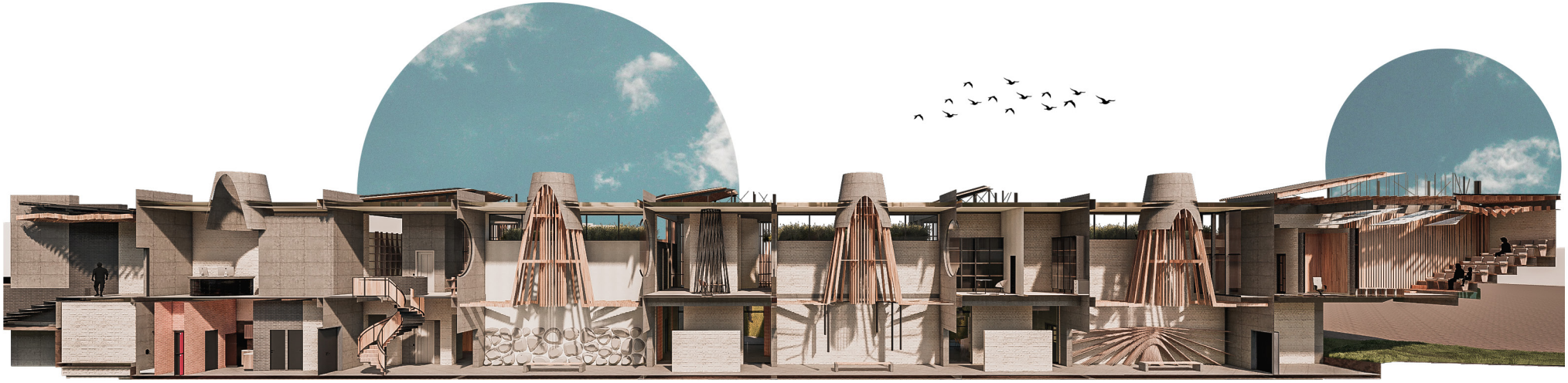


Figure 104: Section B-B (Author, 2022)

Figure 105: Section model of rehearsal space (Author, 2022)

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Technical Report
PART 5

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The Structural Resolution

Various factors were considered for the structural resolution of the proposed design. The climate, the built environment surrounding the site, and the function of the design played a crucial role in the selection of materials and structures and the internal structural applications.

Compliance with the building regulations of the proposed design's site also played a role in the technical and design resolutions. Developmental frameworks of the area and propositions regarding parking and public space by the City of Cape Town were also considered.

The following chapter explores these resolutions and possible solutions to the posed design and structural challenges.

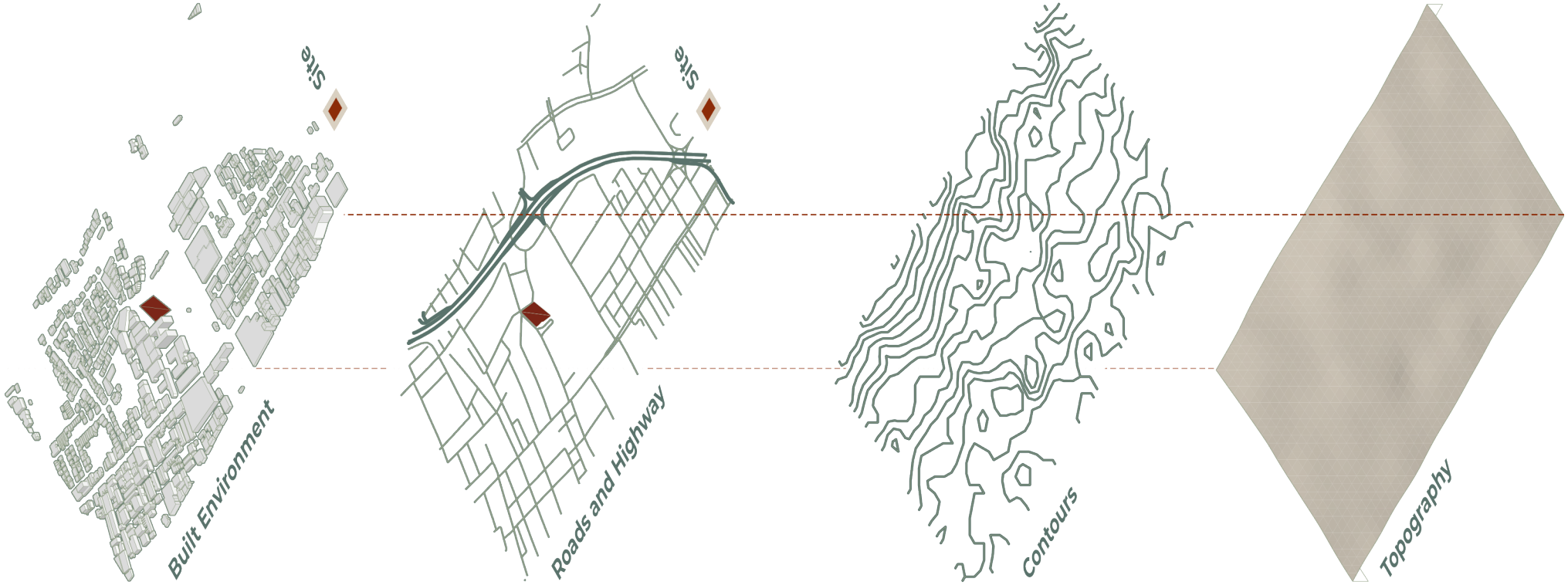


Figure 106: Axonometric view of Woodstock indicating the topography, contours, roads, and built environment surrounding the site (Author, 2022).

Soil Classification

The soil at the site can be classified as podzol, according to the City of Cape Town Open Data Portal. Pozzolans typically form in deciduous forests and are characterized by moderate leaching, causing clay build-up and, to some degree, iron transport (eluting) by water from another area. The formed humus forms structural layers (layers) less than 50 cm above the surface.

Podzolic soils may have laterite (a layer of soil held together by iron) in place of or in addition to the humus layer. It is possible to distinguish podzolic soils from podzols because the main effect of humic acid in podzolic soil is clay leaching. In podzols, iron leaching or leaching of all weathering products, or both, leaves a bleached ashy horizon (Encyclopædia Britannica, 2016: online).

Due to the soil classification, a consultation with an enineer suggested that foundtions should be at least 1 500mm deep.

The site falls 10m from south to north measured from the south west corner to the north east corner.



Figure 107: A section through the proposed site from Ravenscraig Road (Author, 2022)



Figure 108: Axonometric Section of typical podzolic soils (DK IMAGES / SCIENCE PHOTO LIBRARY, no date: online).

Climate

As discussed in the site analysis section, the design sits in what is considered a Mediterranean climate. According to the SANS 204, Cape Town has a Temperate Coastal climate (figure) (SABS Standards Division, 2011: online).

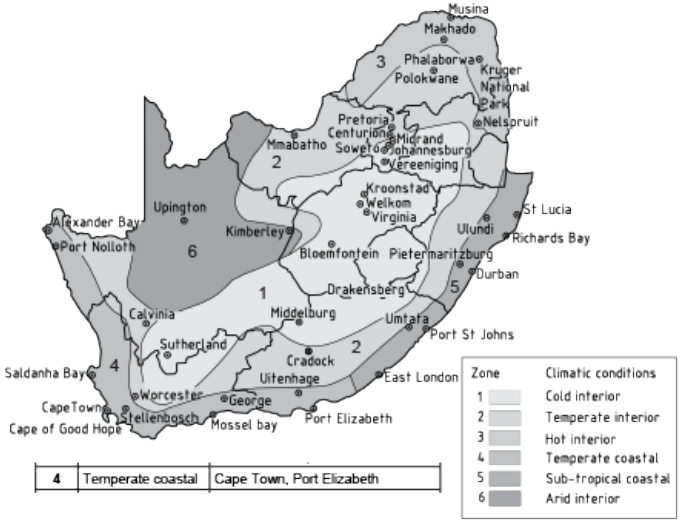


Figure 109: Climatic Zone Map (SABS Standards Division, 2011: online).

Temperature:

Cape Town has a mild temperature with little major variations during different seasons.

Record High: 41
Average Maximum: 22
Average Minimum: 11
Record Low: -1

(South African Weather Service, 2011: online)

Wind:

Cape Town is well known for its winds, which are especially prevalent in the areas under Devil's Peak. The southeaster often moves around Devil's Peak before descending into the City Bowl. The nature of the wind in the region accounts for the previous name of the Mountain, Windberg, which translates to wind mountain (Brodie, 2015: 136).

Precipitation:

Cape Town has a typical Mediterranean climate with dry summers and rainy winters.

Average Yearly: 515mm

Highest Record in 24 hours: 65mm

(South African Weather Service, 2011: online)

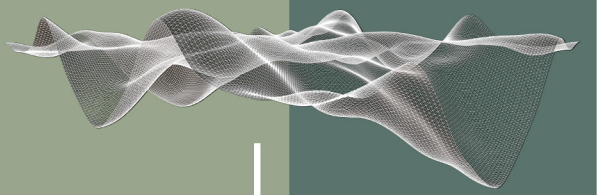
A Translator of Plural Tongues/

A Centre for Indigenous South African Music

The intended design is located in Woodstock, Cape Town. The site is located at the edge of a park that contains a national monument, known as Trafalgar Park. The design intends to act as a preservative for indigenous South African music, which is currently greatly endangered. Currently the groups/cultures considered are San, Xhosa and the Kaapse Klopse (Cape Minstrels).

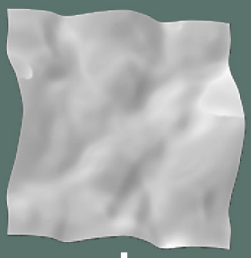
Functionally, the design will comprise of performance spaces, interactive learning/exhibition spaces and instrument making spaces.

1.



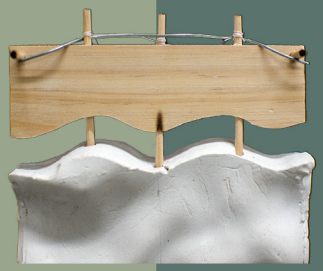
The first concept was informed by a "hands-off" approach. Three songs, from both the San, Xhosas and Cape Minstrels, were combined in a sound software. The sound was then translated into comma seperated values, according to pitch and volume. This creates a mathematical ratio which was then placed into parametric software that created a 3D waveform of the new sound. This creates a spatial embodiment of the music without appropriating the cultures.

2.



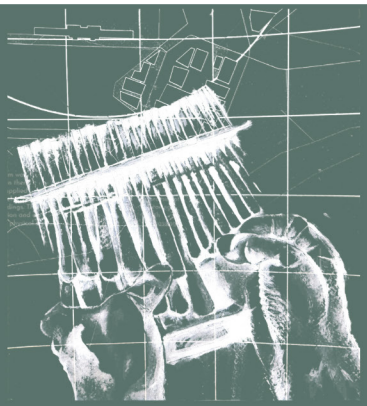
The generated form was then reinterpreted in a morphological sense and the possibilities can then be explored with various construction methods. The form can be applied as a form of cladding, screening or stereotomic massing. The model interprets it as stereotomic massing which is prominent in the site surroundings. The context is composed of mostly load-bearing masonry construction and concrete column and beam structures with masonry infill. The physical model explores these notions with the massing

3.



The model further explores the joints of the structures. The structure of the joints consult the structure of the common characteristics in the indigenous music. The music consists of displacement techniques. These are defined by polyrhythms and melodic offsets and overlapping, also known as hockets. Essentially, this entails a call and answer technique in the music, which is then interpreted as the joints and tectonics in the model. The joints are also influenced by the mbira (thumb piano), which is used by both San and Xhosa groups. The keys of the mbira are tied together by steel wires or, channels or rods.

4.



The last interpretation is that of the inharmonic nature of the music. This creates a tension in the sound. This translates into a tensile structure in the model. It further consults, once again, the notion of the mbira. The mbira consists of a stereotomic wooden box which acts as a resonator with tectonic steel keys over it. In the model it also becomes clear with the one side being concerned with stereotomics and the other with tectonics.

5.



Figure 110 & 111: An initial conceptual approach to a structural resolution for the proposed design (Author,

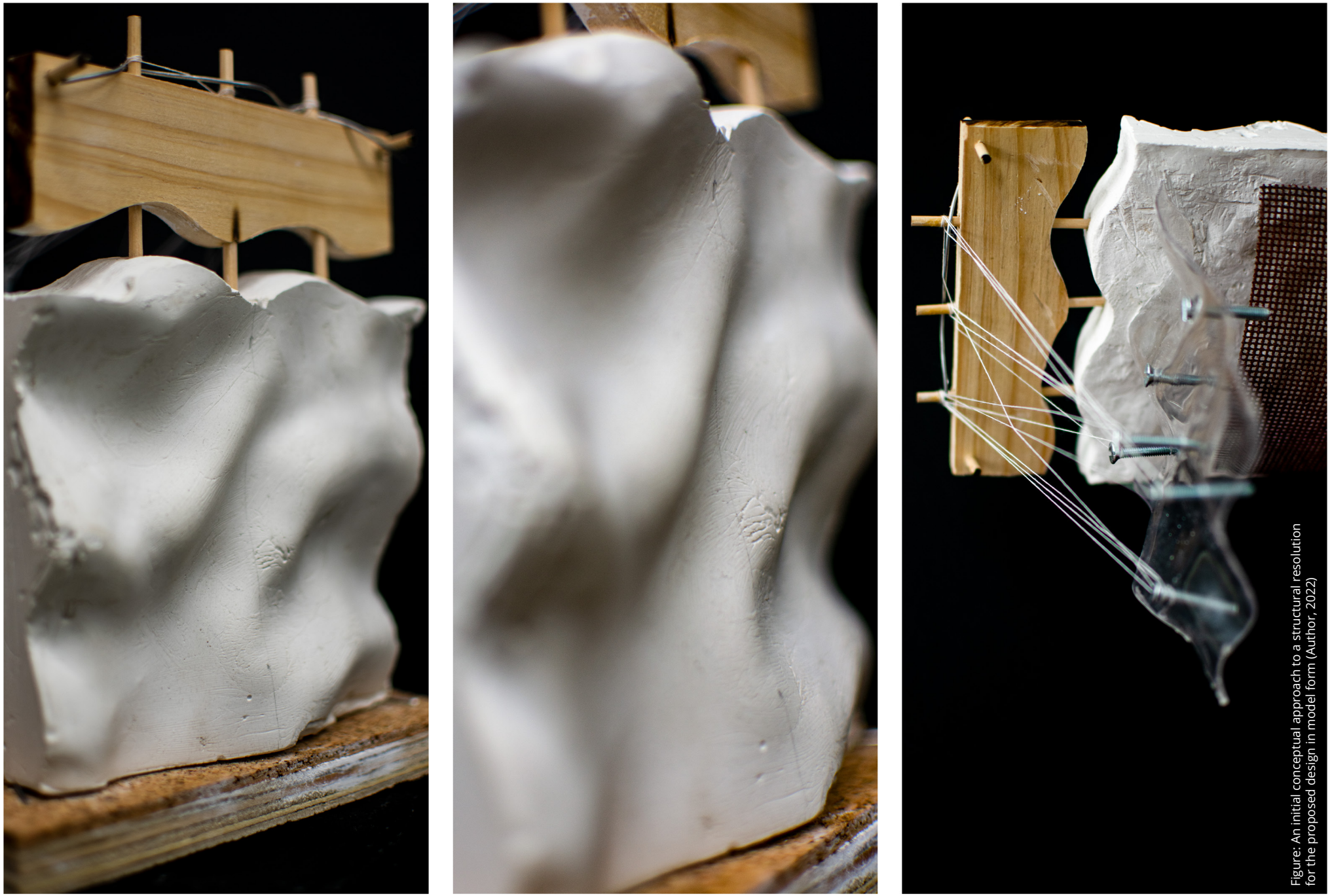


Figure: An initial conceptual approach to a structural resolution for the proposed design in model form (Author, 2022)

User Behaviour and Requirements

A1	Entertainment and public assembly occupancy where persons gather to eat, drink, dance or participate in other recreation.
A2	Theatrical and indoor occupancy where persons gather to view theatrical, operatic, orchestral, choral, cinematographic, or sports performances.
C1	Exhibition hall occupancy, where goods are displayed primarily for viewing by the public
C2	Museum occupancy comprising a museum, art gallery or library.

Table of floor factor, coverage and height in Mixed Use Zone

Subzone	Floor Factor	Coverage	Maximum height above base level to top of roof
MU1	1,57	5%	15m
MU2	4,0	100%	25m
MU3	6,0	100%	38m

Information: (City of Cape Town, 2015: 97)

Site Spesifications

Zoning: Mixed Use 2(MU2)

Primary use: Industry, place of instruction, institution, place of entertainment

Table of building lines in Mixed Use Zones

Subzone	Street building line and common building line		
	Points on a building above base level		
	up to 10m	over 10m up to 25m	over 25m up to 38m
MU1	0m	4,5m	n/a
MU2	0m	4,5m	n/a
MU3	0m	0m	(Height minus 25m) ÷ 2

Information: (City of Cape Town, 2015: 97)

Mixed Use Zoning:

In terms of land use, entirely mixed areas are appropriate for industrial, commercial, and residential development.

To minimize conflicts between residential and industrial expansion, such mixed-use zonings must be applied and administered carefully (City of Cape Town, 2016: online).

Programme/ Functions

Upper Ground Floor:

Main Entrance: 41m²
- Reception/ Circulation Space: 32,4m²
- Kitchenette: 7m²
- Storage: 2m²

Waiting Area: 29m²

Literature and Sheet Music Library: 73,6m²

Audio-Visual Library: 97m²
- Screening Space: 52m²
- Private Listening Pods: 34m²
- Media Storage/Library: 11m²

Administrative Spaces: 91m²
- Admin/ Auditorium Reception Space: 16m²
- Open Office and Boardroom: 42m²
- Managerial/Financial Office: 16m²
- Aministrative Staff Ablution: 17m²

Auditorium: 145m²
- Backstage/ Recording Studios: 18m²
- Storage: 1,3m²
- Circulation: 25m²
- Stage: 14m²
- Performance Space between Stage and Audience members: 15m²
- Audience Seating: 48,5m²

Foyer Space for Auditorium: 33m²

Chordophone/ Strings Rehearsal Spaces: 74m²
- 3 x 18m² Main Rehearsal Spaces with Desk Space (2m²): 60m²
- 1x Small Rehearsal Space: 14m²

Aerophone/ Winds Rehearsal Space: 42m²
- 2x 19m² Main Rehearsal Spaces with Desk Space (2m²): 42m²

Membranophone/Percussive Space: 56m²
- 2x 19m² Main Rehearsal Spaces with Desk Space (2m²): 42m²
- 1x Small Rehearsal Space: 14m²

Adaptable Orchestral Rehearsal Space: 37m²

Circulation Space/ Open Performance/ Lecturing Space: 221m²

Music Staff + Admin Staff Kitchenette and Staff Room: 32m²

User and Public Ablution: 70m²

Internal Emergency Escape Staircases: 17,4m²

Main Circulation Space: 134m²

Total: 1 193m²

Lower Ground Floor:

Secondary Entrance and Circulation Space: 68m²

Cleaning Staff/ Security Staff and Storage Space: 44m²
- Security Booth: 4m²
- Dressing Room: 6m²
- Temporary Exhibition Space Storage: 4m²
- Cleaning Equipment/ Cleaning Supply Storage: 5m²
- Kitchenette/ Staff Room: 11m²
- Ablution: 2m²
- Circulation: 12m²

Membranophone/Percussive Experiential Exhibition: 42m²

Aerophone/Winds Experiential Exhibition: 42m²

Chordophone/Strings Experiential Exhibition: 42m²

Instrument-Making Space: 295m²
- Adaptable Lecture Space/ Entrance to Instrument-Making Space: 31,5m²
- Kitchenette/ Break-Away Space: 22m²
- Circulation Space: 38m²
- Workers/Attendee Storage: 1,5m²
- Ablution: 7m²
- Instrument Testing and Refinement Space: 51m²
- Instrument Testing Outside Space: 36m²
- Managerial Office Space: 5m²
- Instrument Assembly Space: 45m²
- Instrument Assembly Outside Space: 23m²
- Instrument-Making Hardware and Material Storage Space: 35m²

Internal Emergency Escape Staircases: 17,4m²

Enclosed Outside Performance Space: 64m²

Refuse Yard: 9m²

Mechanical Room: 7m²

Total: 630m²

Total Combined Internal Area: 1 823m²



Context



Context



Context



Concrete Frame Structure

White Bagged Walls

Brick Infill

Sheet Metal Cladding and Roofing

Material and Structural Selection as a Result of the Context

Figure 112: Contextual references applied in the design (Author, 2022)

Concrete Frame Structure

White Bagged Walls

Corobrik Black Satin FBX

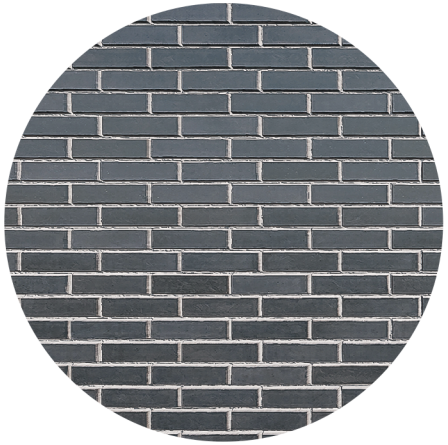
Sheet Metal Cladding and Roofing



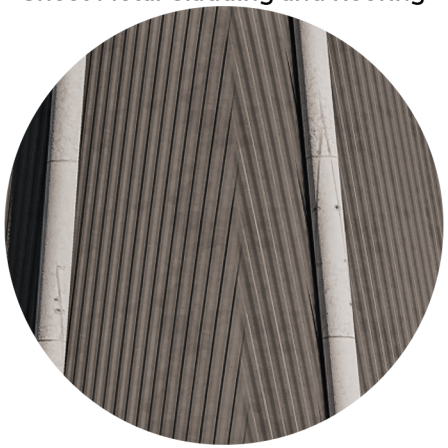
Design



Design



Design



Substructure and Super Structure

Upon consultation with a structural engineer, it was advised that the design should make use of deep foundations due to the nature of the soil. The foundation's minimum depth should be at least 1 500mm below the natural ground line. Pad foundations are to be used for the concrete column structures, while the infill and load-bearing walls that touch the ground should rest on strip foundations. These strip foundations are to rest and connect on the top surface of the pad foundations. This acts as a continuous reinforcement for the sub-structure.

The superstructure relies primarily on a concrete column and beam structure. The design proposes a beam depth of 500mm with a width of 300mm that rests on a column grid that varies between 9 300mm and 6 700mm in one direction and 5 000mm in a second direction. The structural engineer approved the beam dimensions and column grid as the design proposes.

The northeast facade uses a split column structure instead of a standard vertical column structure. This draws inspiration from the musical instruments of the housed cultures. The Vigo University Campus Structures in Spain by Enric Miralles and Benedetta Tagliabue also inspires the structural approach to the design.

Four concrete boxes also act as central support structures in the design instead of a concrete column and beam structure. These boxes house the experiential and permanent exhibition spaces on the lower ground floor and push through the upper ground floor as atrium spaces.

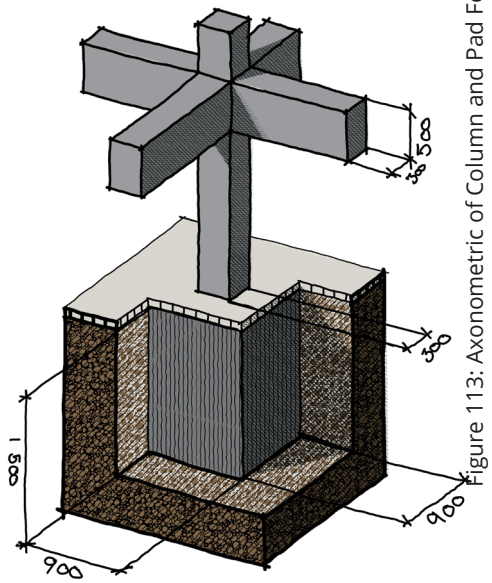


Figure 113: Axonometric of Column and Pad Foundation (Author, 2022)

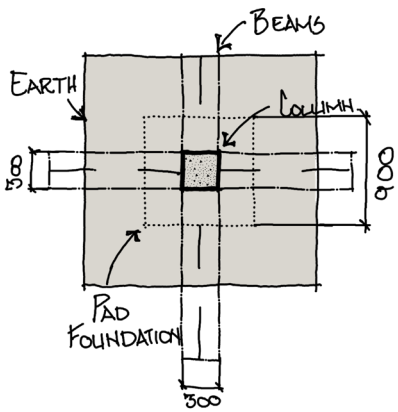


Figure 114: Deep Pad Fondation Plan (Author, 2022)

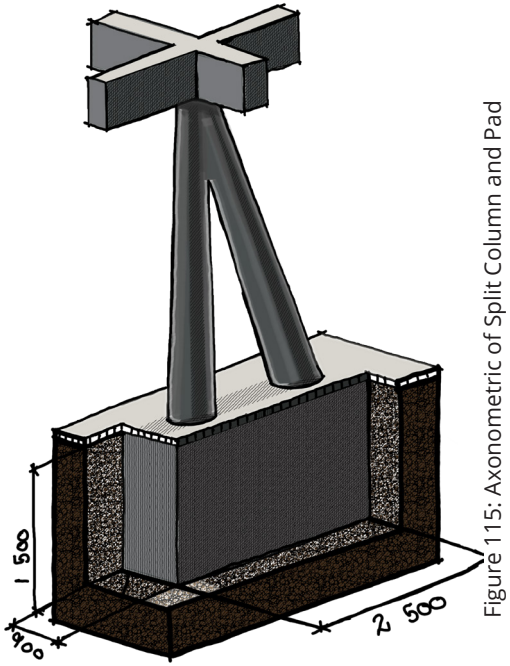


Figure 115: Axonometric of Split Column and Pad Foundation (Author, 2022)

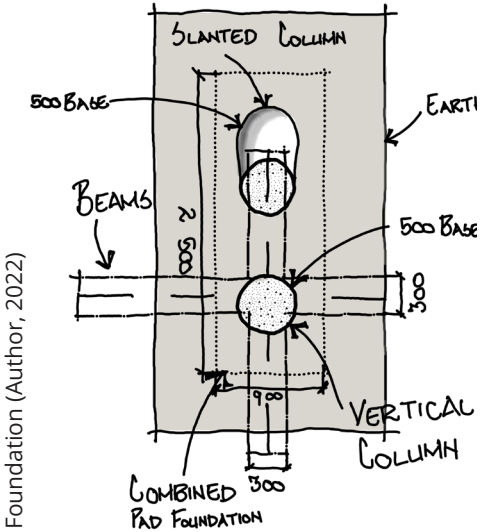


Figure 116: Combined Pad Fondation Plan (Author, 2022)

VIGO UNIVERSITY CAMPUS

Structural precedent

Miralles Tagliabue EMBT
Vigo, Spain
2003



Figure 117: Exterior perspective of Vigo University Campus (Gaultier, 2003: online).

The design of the Vigo University Campus primarily uses a concrete column and beam structure. The structure lifts the first floor on pilotis, opening the ground floor area. These pilotis are constructed as split concrete columns. This allows the design to become part of the more extensive landscape and parks surrounding the campus and the structures to form a unified constructed landscape (Miralles Tagliabue EMBT, 2016: online).

This is very similar to the proposed design. The design also sits on a split column and beam structure on the lower ground floor of the northeast side. This allows the upper ground floor to sit above the ground line, opens parts of the lower ground floor to the public, and extends to Trafalgar Park.

Like the Vigo University Campus, the proposed design also follows a semi-circular plan layout on the north.

Lessons learnt:

- A possible approach to the design of a place of instruction
- Multifuncuinal circulation and lecture space
- A semi-circular plan layout
- A structure that sits atop the pilotis to elevate it above the ground line
- A concrete column and beam structural framework
- A split-column structural design approach for vertical supports on the ground floor



Figure 118: Perspective under the first floor of Vigo University Campus showing the concrete split column structure (Gaultier, 2003: online).

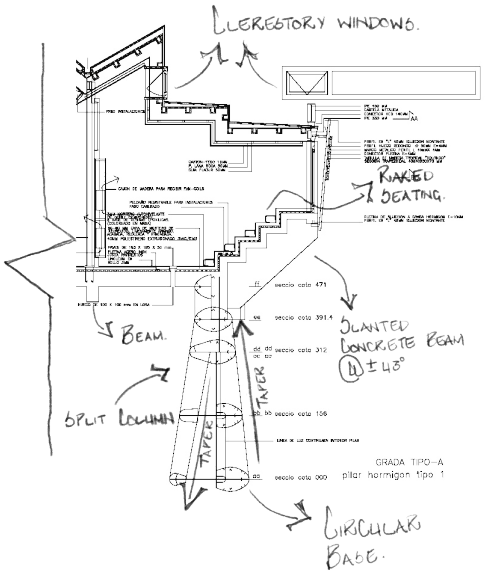


Figure 119: A detail section of a split column at Vigo University Campus (Miralles Tagliabue EMBT, 2003: online).



Figure 120: A section through the rehearsal space of the proposed design, showing the relation to the precedent (Author, 2022)

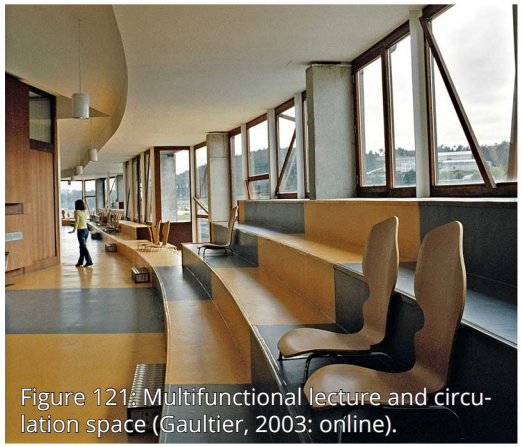


Figure 121: Multifunctional lecture and circulation space (Gaultier, 2003: online).



Figure 122: Extended landscape space between semicircular structures(Gaultier, 2003: online).

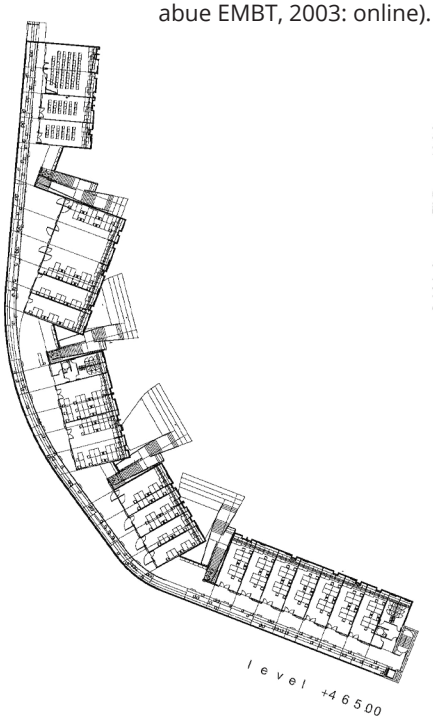


Figure 123: First floor plan of Vigo University Campus (Miralles Tagliabue EMBT, 2003: online).

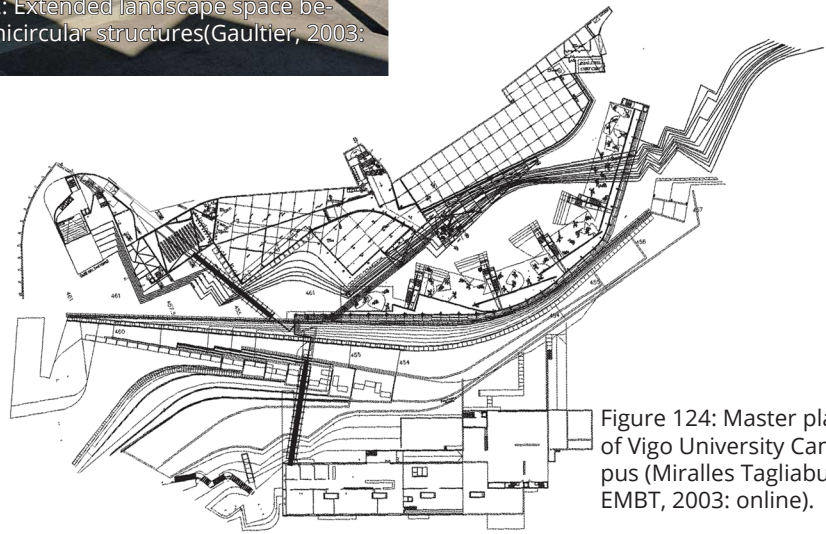


Figure 124: Master plan of Vigo University Campus (Miralles Tagliabue EMBT, 2003: online).



Figure: 125Exterior Perspective (Massimo Crivellari, 2013: online)

La Casa Della Musica

A Music Venue/
Functional and Spatial Precedent

Geza Gri e Zucchi Architetti Associati
Cervignano Del Friuli, Italy
2010

The project entails the adaptive reuse of an old bus depot by constructing a new music centre on the inside, extending to outer parts (Geza Gri e Zucchi Architetti Associati, 2020: online).

The new centre incorporates various functions related to several groups and associations and therefore intends different uses. This notion relates to the design where diverse cultures intend to use the same facilities, but in different ways.

The main functions include space for public gathering and refreshment, music practice and teaching rooms, exhibition space, performance spaces and conference spaces, and recording studios. The rehearsal rooms consist of four volumes on the first floor and are the only completely enclosed spaces.

Deducting Size

The rehearsal rooms: 19m² x 4
Performance space/auditorium: 100m² (100 seater – not raked)
Café & Refreshment: 47m²
Exhibition space: 80m² (doubles as circulation space)
Backstage: 36m² (includes equipment storage)
Recording room: 17m²
Office space: 11m²
[Calculation of areas from the plan. Source: (ArchDaily, 2013: online).]

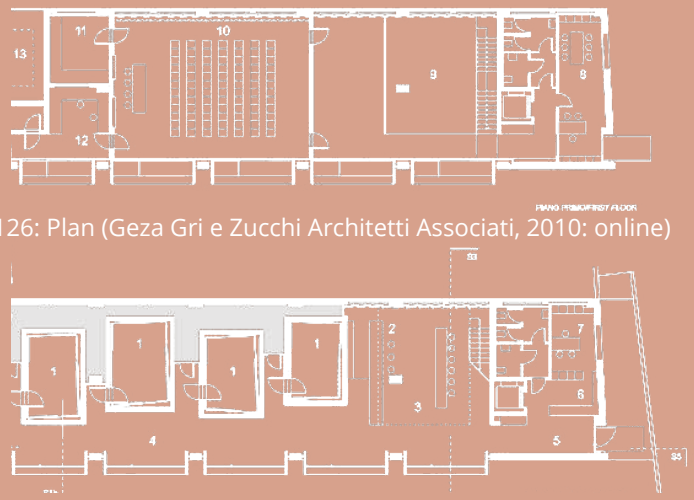


Figure 126: Plan (Geza Gri e Zucchi Architetti Associati, 2010: online)

Structure and Acoustic Treatment

The existing brick structure remains intact and supports the new roof structure (ArchDaily, 2013: online). The introduction of a new, independent, concrete volume outlines the new areas inside the building. This concrete volume also ensures soundproofing (ArchDaily, 2013: online).

A new saddle roof of timber beams, at a greater pitch, allows for a higher roof, which is beneficial for the acoustic qualities of the auditorium and double volume spaces (ArchDaily, 2013: online).

The new addition also utilises a ventilated floor and foundation system. Ventilated foundation systems allow for increased acoustic insulation (Geoplast, 2021: online). Therefore, the functions on the ground floor, such as the rehearsal rooms, benefit from superior acoustic insulation.

Lessons Learnt:

- Function and integration of the programme
- Dimensions/area size of applicable functions
- Structure and acoustic implications
- Circulation as multifunctional exhibition space



Figure 127: Elevation (Geza Gri e Zucchi Architetti Associati, 2010: online)

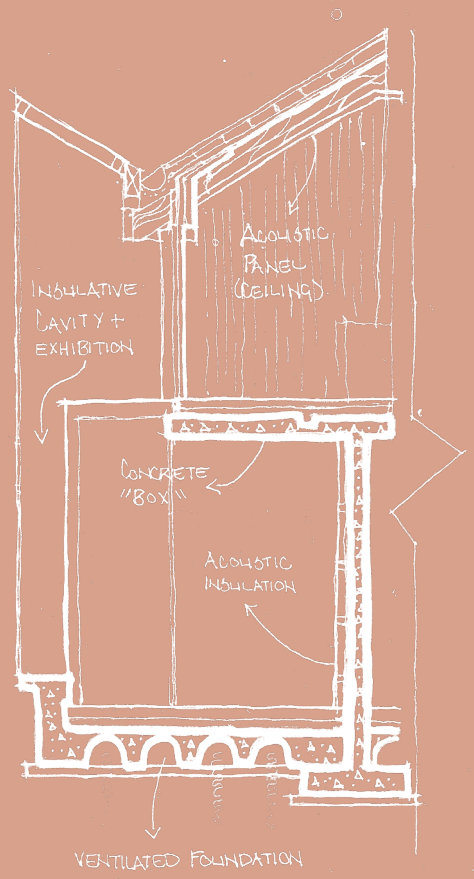


Figure 128: Parttial Section Adaption (Author, 2021)

Acoustic Performance

Material Selection and Acoustic Performance

The material selection for the proposed design references its physical context but also considers acoustics. As previously mentioned, the proposed design primarily uses a concrete frame structure (column and beam) with occasional use of concrete walls as well as roofing and brick infill/load-bearing masonry construction.



Concrete:

According to the Modern Construction Handbook, concrete has high acoustic insulation properties in terms of airborne and structure-borne sound transfer (Watts, 2019: 46).



Airborne sound transfer occurs in the proposed design in spaces that house musical performances and rehearsals. Therefore, concrete is an appropriate material use in terms of insulation. The acoustic performance, however, can be enhanced by installing additional insulation and reverberation surfaces.

Masonry/ Brick:

Compared to similar walls made of other common building materials, brick walls offer excellent levels of acoustic insulation (Watts, 2019: 58). The use of cavity walls, where the interior skin of the wall is constructed of brick or concrete block, can further increase the attenuation of airborne sound (ibid).

The proposed design uses masonry walls as infill and load-bearing structures in some instances as one of the primary building materials. As mentioned, cavity walls increase the attenuation of airborne sounds, such as music. A thick cavity wall acts as a separator in the design to split music-making functions and administrative/ library functions between the north and south façade. This prevents airborne sounds from music-making spaces to transfer to the residential areas to the south of the design. Cavity walls are also used in the music rehearsal rooms to ensure acoustic performance. Therefore, brick is an appropriate material for the proposed design in terms of insulation.

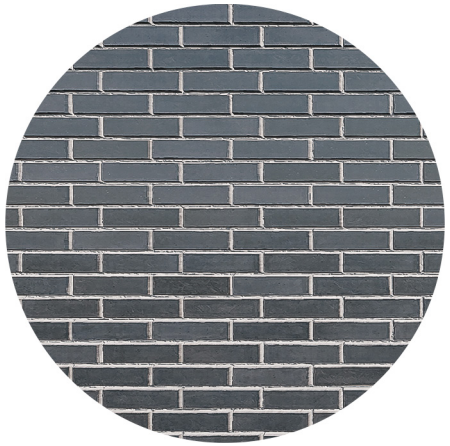
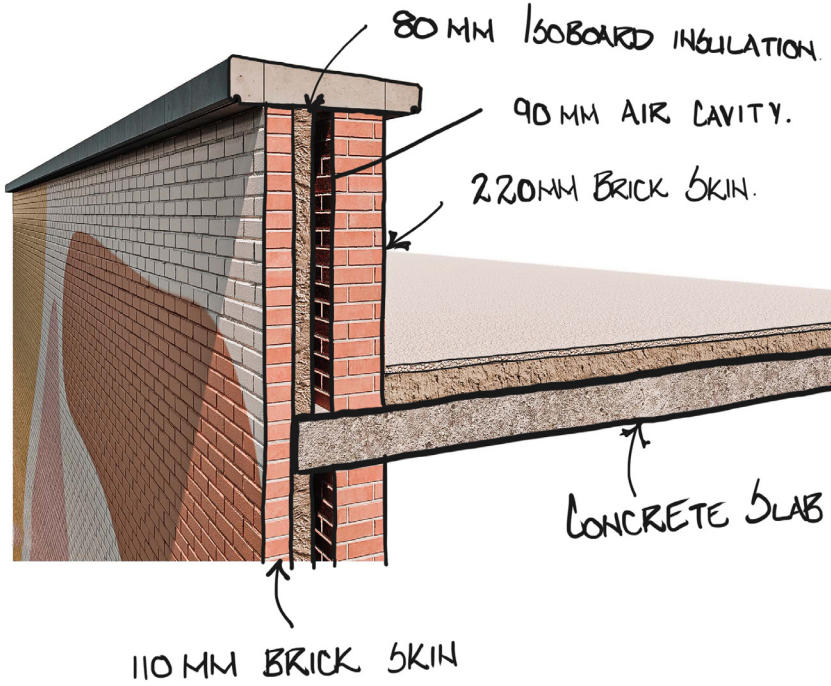


Figure 129: Concrete and Brick Use in the proposed design (Author, 2022)



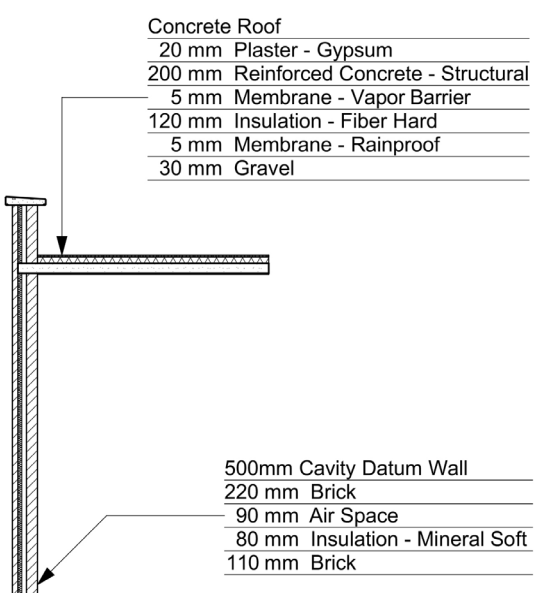




Figure 130: Thick function splitting cavity wall detail (Author, 2022)

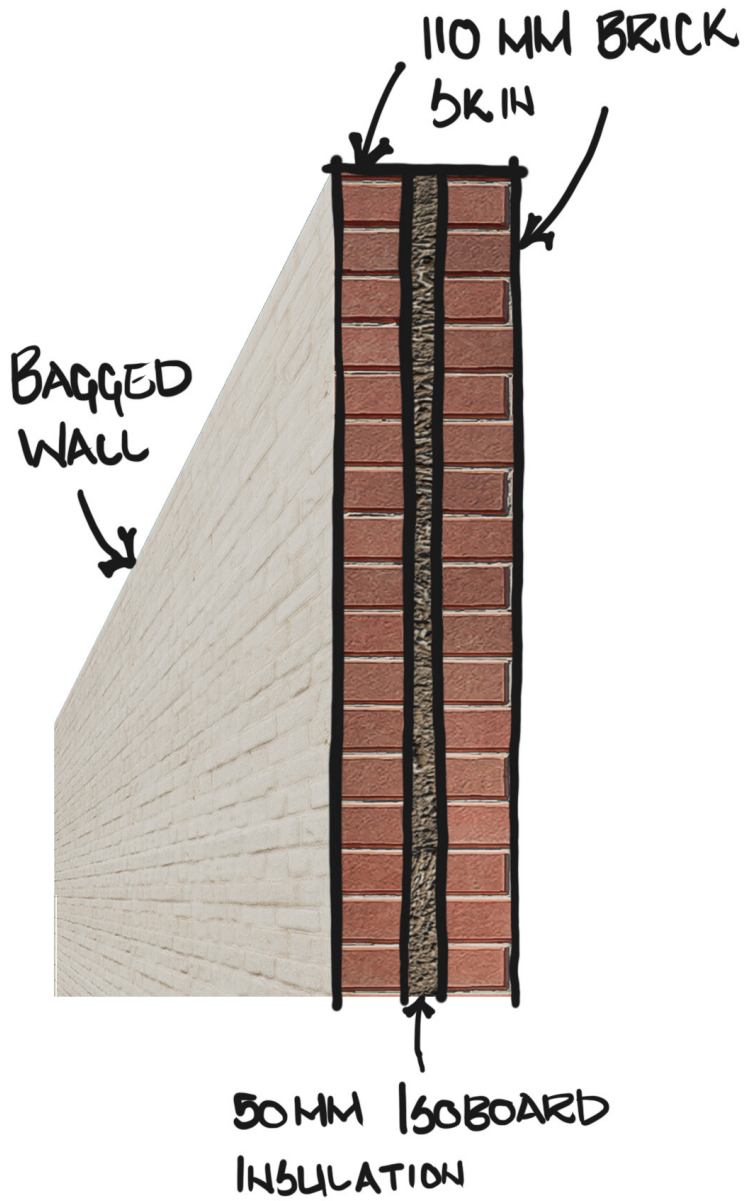


Figure 131: Rehearsal room cavity walls 3D detail (Author, 2022)

Sonorous Museum

Acoustic precedent

ADEPT + CREO ARKITEKTER
Copenhagen, Denmark
2015



Figure 132: Mixed instrument rehearsal room (Viemose, 2014: online).

The concept and execution of the museum design, which incorporates four delicately detailed sound spaces as part of the collection's educational program, was done by ADEPT architects. The museum houses historical and indigenous instruments of the country and offers space for music rehearsals.

Special consideration was taken to optimize the music/ sound quality in the rehearsal spaces by designing the acoustic walls according to the instrument groups housed in these spaces. The design features a string, brass, percussion and mixed instrument spaces (ADEPT, 2015: online).

Each of the four rooms is covered in a wood veneer and is configured to provide the ideal acoustics for a particular instrumental group (ibid)

Percussion Space: The percussive space uses vertical timber lamellae as exposed surface, backed with insulation
Brass/winds Space: The space uses cassette-like cladding of both fabric/insulation and timber, which allows for sound absorption as well as sound reverberation
Strings Space: The space uses cassette-like cladding of only timber. This enhances the reverberation and volume of the softer sounds of string instruments (ibid)

Lessons learnt:
- Acoustic approaches for different instrument groups that are also used in the proposed design
- Possible/ideal material use for acoustic performance in different spaces

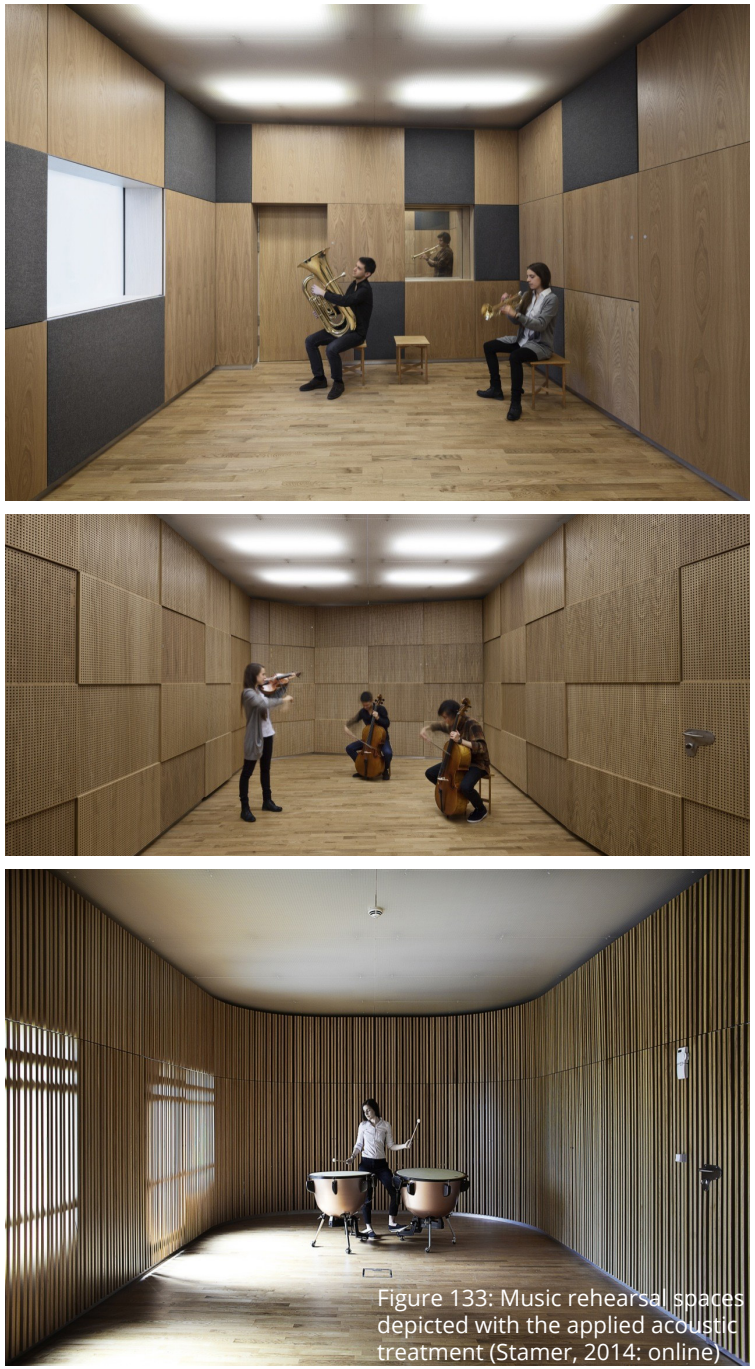


Figure 133: Music rehearsal spaces depicted with the applied acoustic treatment (Stamer, 2014: online)

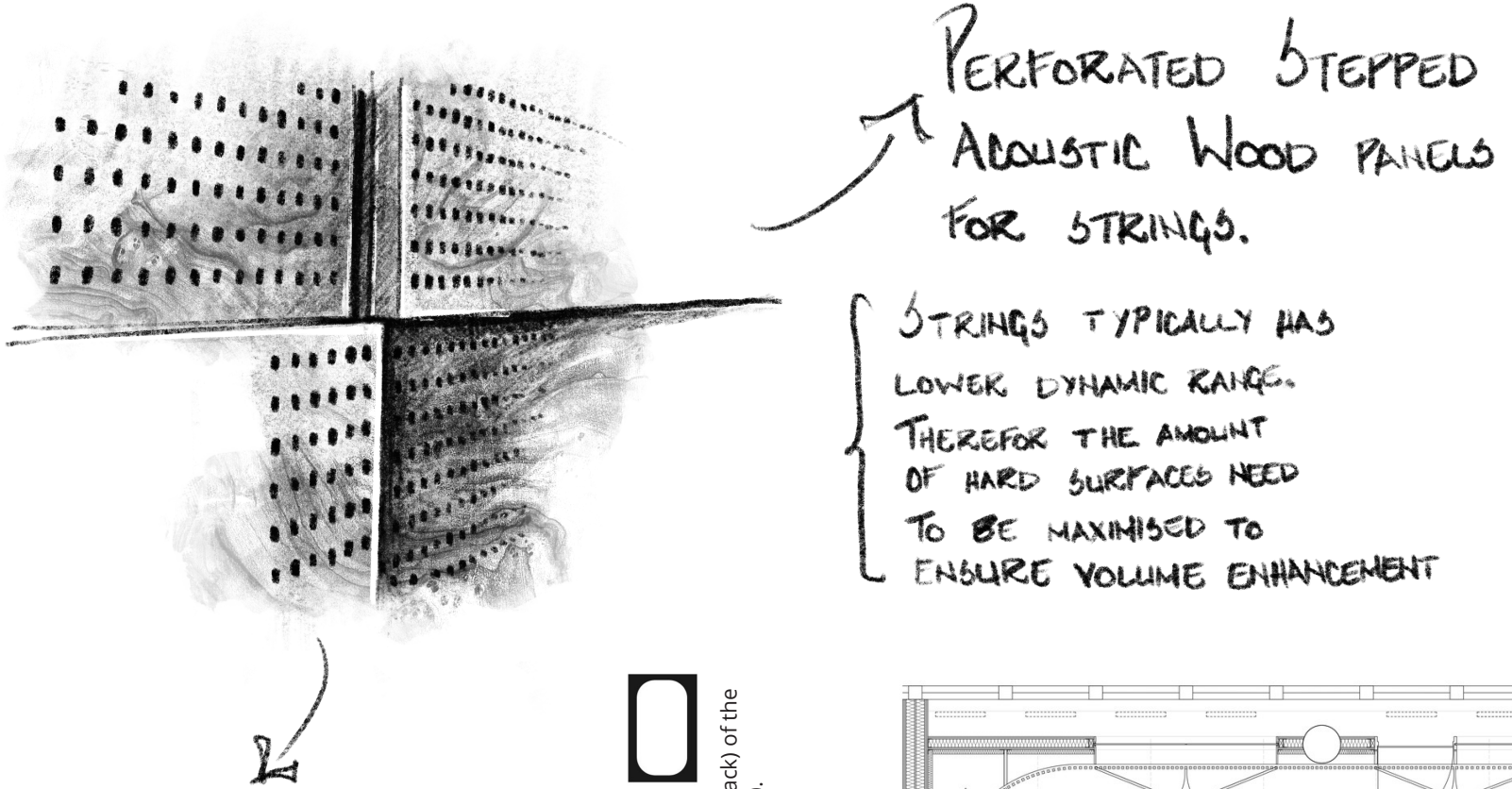


Figure 134: Analysis of the strings room acoustic treatment (Author, 2022).



Figure 135: Silhouettes of the insulation (black) of the music spaces on plan (ADEPT, 2015: online).

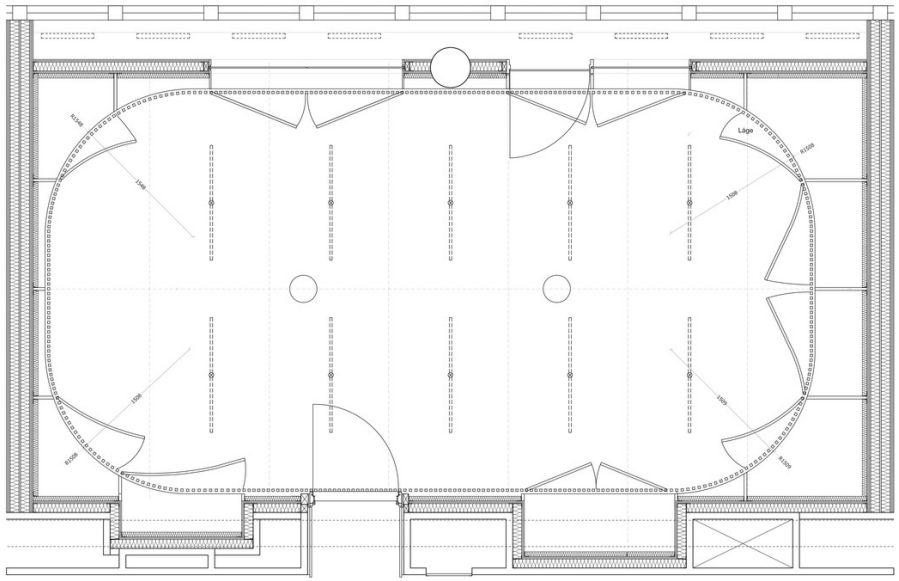
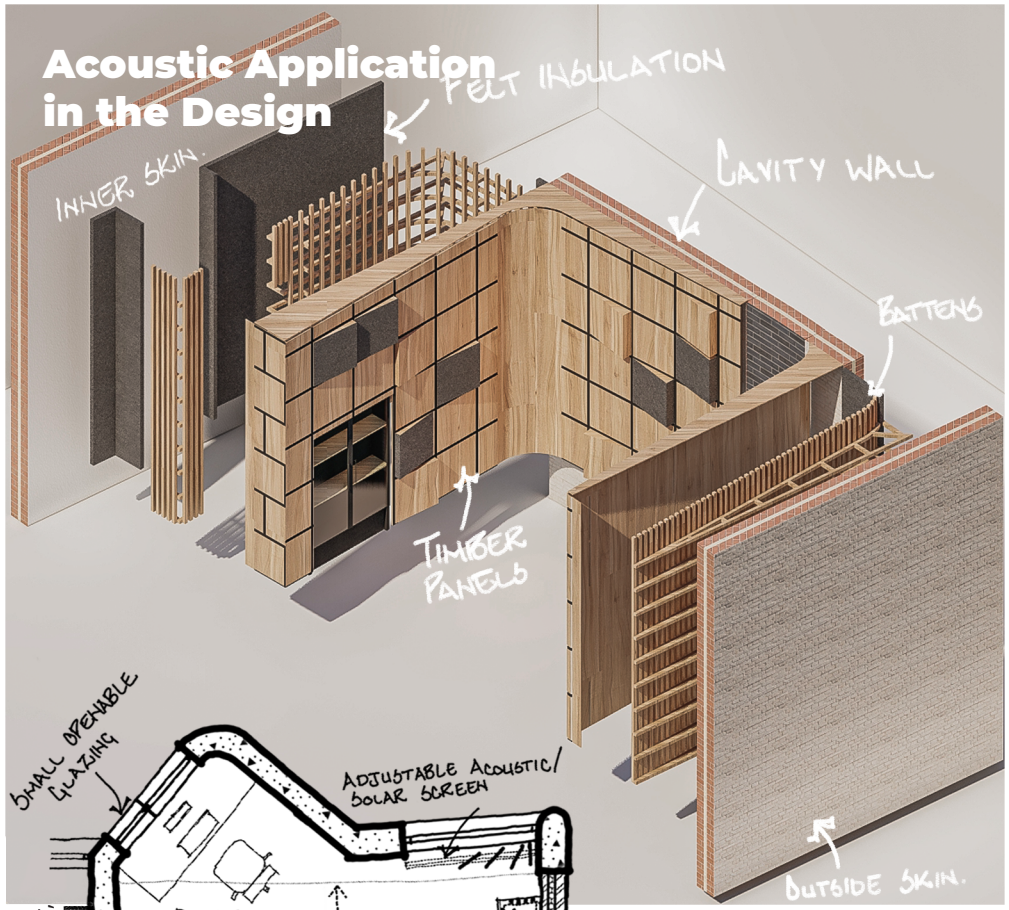


Figure 136: Floor plan of the percussive music space (ADEPT, 2015: online).



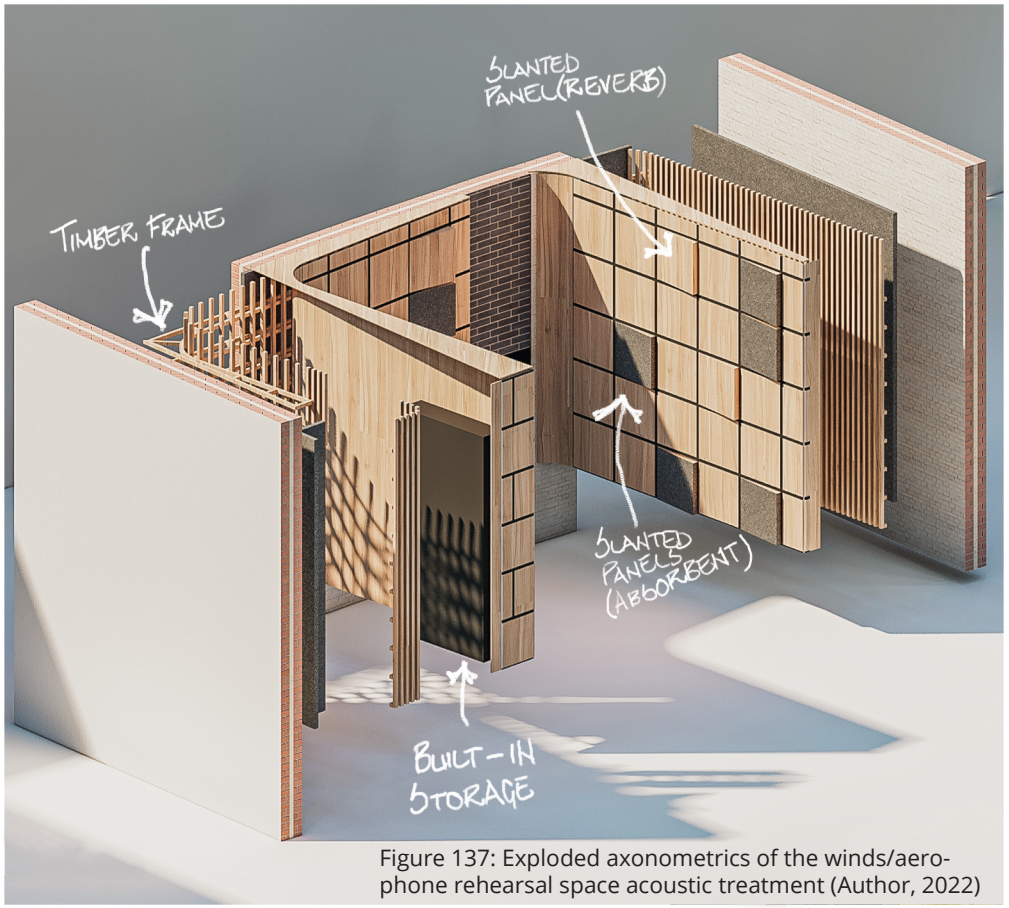


Figure 137: Exploded axonometrics of the winds/aerophone rehearsal space acoustic treatment (Author, 2022)

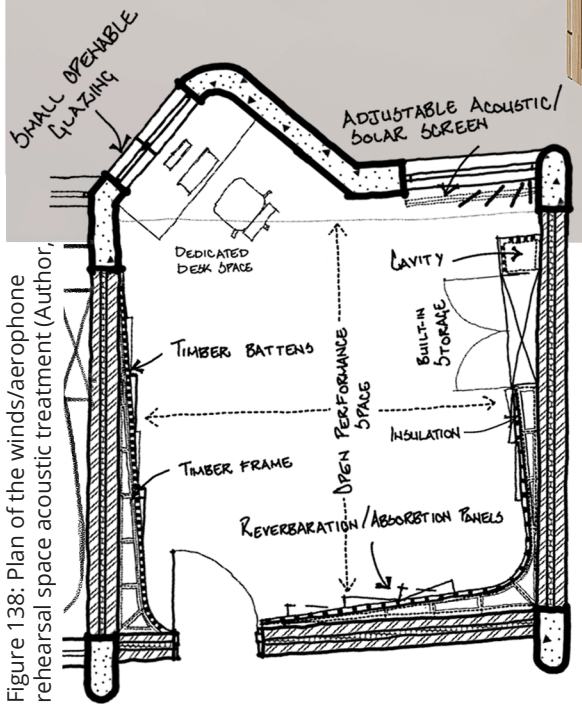


Figure 138: Plan of the winds/aerophone rehearsal space acoustic treatment (Author,

The acoustic approach of the winds/ aerophone rehearsal rooms forms the primary basis that all the other rehearsal rooms follow. Several layers compose the acoustic system, as seen in the exploded axonometric in the figures above.

The innermost layer consists of timber (pine) panels that are constructed and assembled as squares with chamfered/embossed edges. These squares guide additional panels which are slanted to either reverberate (timber) or absorb (recycled PET felt fabric) sound.

A timber frame with 38mm battens and beams carries the load of the acoustic structure and attaches it to the masonry walls. An air cavity is left between the panels and the frame's outer face to ensure a square/ rectangular internal rehearsal space.

An additional layer of insulation separates the timber frame and inner brick skin from each other. The masonry structure is composed of two 110mm brick skins separated by Isoboard wall insulation.

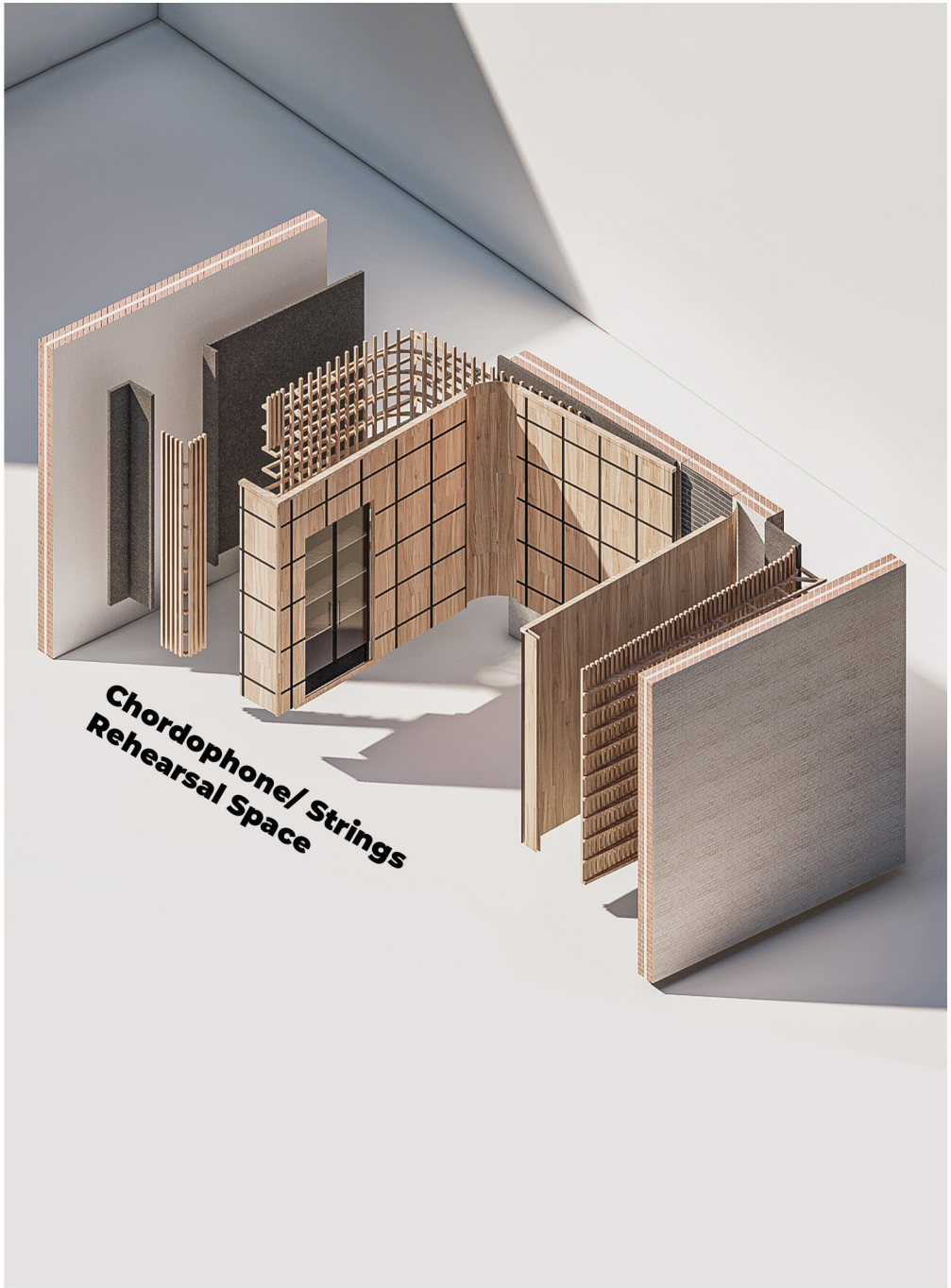




Figure 140: Exploded axonometrics of the Membranophone/Percussive rehearsal space acoustic treatment (Author, 2022)

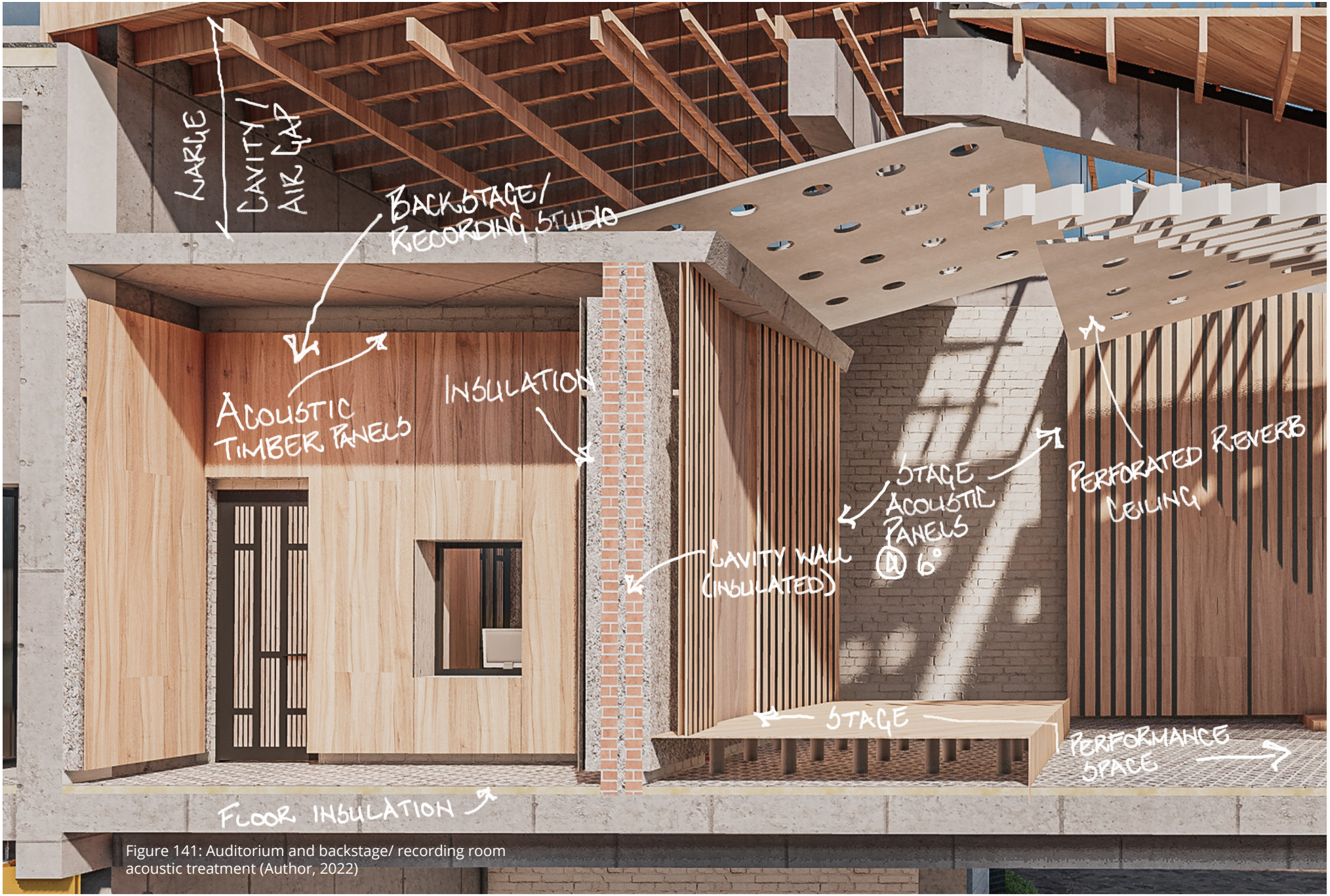


Figure 141: Auditorium and backstage/ recording room acoustic treatment (Author, 2022)

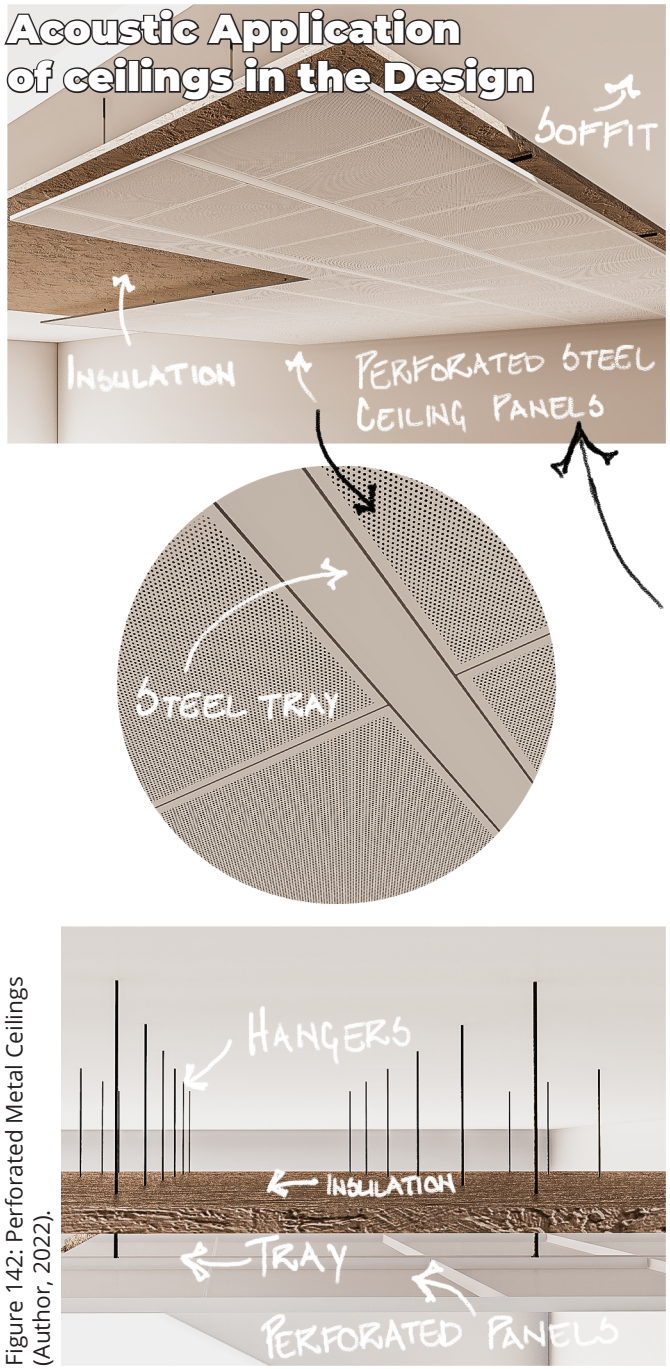


Figure 142: Perforated Metal Ceilings (Author, 2022).

Ceiling tiles are used to cover the soffit of roofing or slab materials and are designed to be lightweight. While the most economical generic tile is a mineral fiberboard or gypsum board, it has poor rigidity which limits its span. These ceilings, however, provide high acoustic performance. Larger tiles with greater spans can be made from steel (Watts, 2019: 400).

The design proposes perforated steel tiles to utilise greater spans. Steel has weak sound absorption properties; it is, therefore, perforated to improve acoustic performance. The ceilings are also lined with acoustic insulation on the upper face of panels to improve the panels' acoustic performance. It is possible to use ceiling grids up to around 2 000 x 3 000mm. The design proposes using Lindner ceilings in panels of 1 200 x 600mm laid in steel trays with a hanger system (Watts, 2019: 400).

Baffle ceilings are an efficient way to eliminate unwanted acoustic problems, such as echo and drifting sounds. They can aid in enhancing speech intelligibility, which can be crucial in settings like schools, auditoriums, and other places where sound quality is critical. Baffle ceilings are very open and allow a view of the bare roof or floor soffit because of how they are built. When used as an attempt to resolve acoustic issues in a building that have traditionally been a concern, they may also be quite successful (SAS International, 2019: online).

The design proposes using baffle ceilings that find form from music via parametric applications. The design presents the use of timber cut with CNC techniques which can easily be assembled as a waffle structure on-site. These baffles will be used in parts of the auditorium space and external spaces where acoustic performance might be necessary.

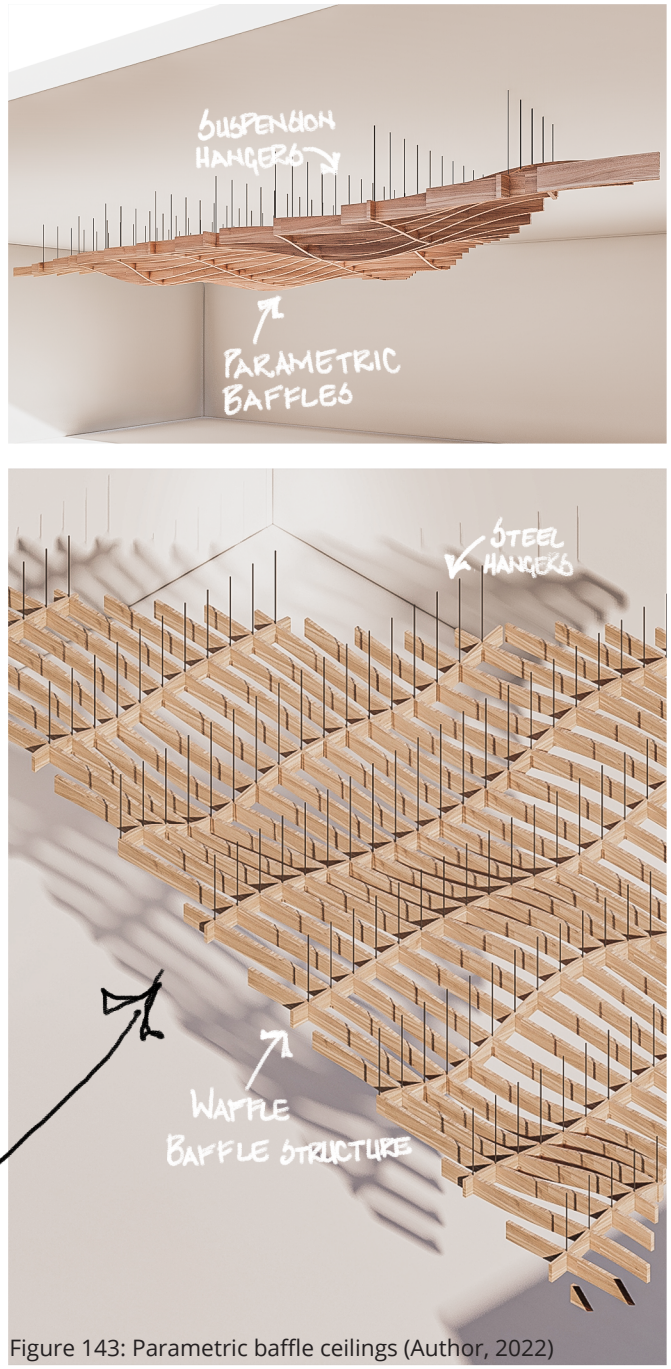


Figure 143: Parametric baffle ceilings (Author, 2022)





Figure 144: Pitched roofing in the design (Author, 2022)

The design proposes to use both monopitched roofs that slant in different directions and with different pitches; and flat roofs that are either planted or left exposed.

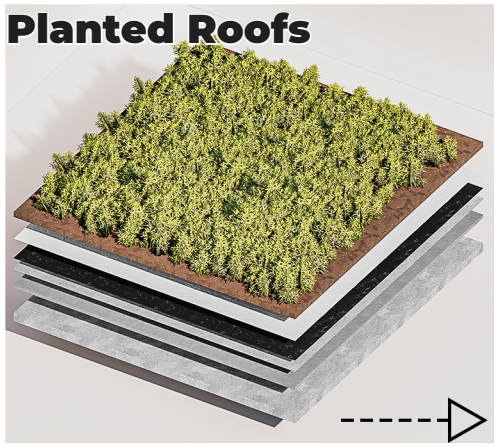
These types of roofs are recommended as the ideal types of roofing for the climate in whic the design is located.

The flat roofs are suported by the concrete frame structure while steel trusses form the monopitches that are reinterpretations of the sawtooth trusses in the context.

Timber supports in the form of battens and beams also support these roofs while a a composite roof sheet of plywood and sheet metal rests on steel c-section purlins.

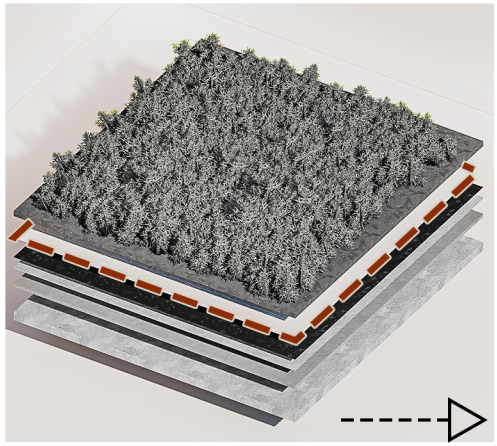
The monopitch roofs to the back of the semi-circular plan are pitched to receive a clerestory-type northern light by making the trusses face north.

Planted Roofs



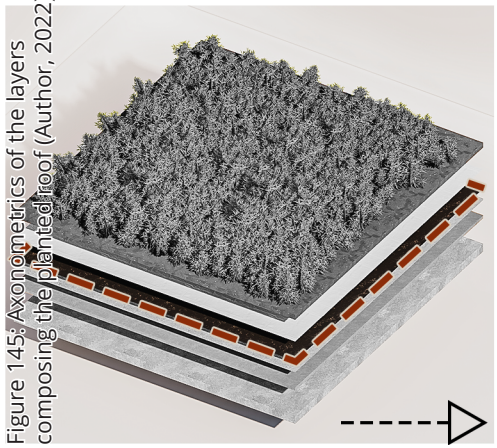
The top most layer of the planted roof consists of the growing medium/soil and the plants planted in it. The substrate shoul ideally be as lightweight as possible with good drainage, water retention and nutrient capacity.

The design proposes to use indigenous plants or grasses such as renosterbos (*Elytropappus rhinocerotis*).



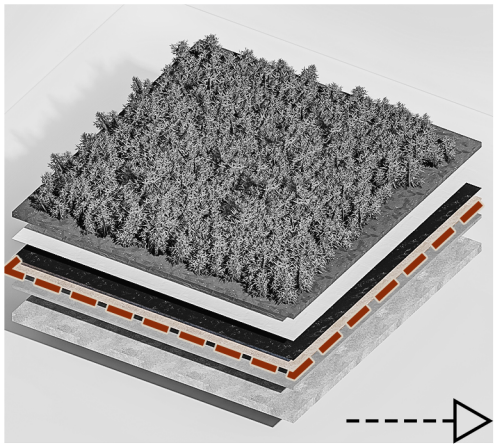
The second layer is the root barrier layer. This layer shields the substrate of the roof from damage caused by plant roots that might otherwise penetrate the underlying layers.

The layer is usually composed of geosynthetic textiles that can either be woven or non-woven. The design proposes the use of Bidim® which is a non-woven fabric.



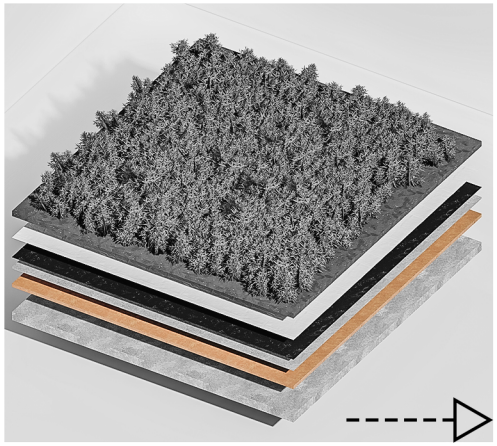
The third layer is the waterproofing layer. This layer prevents moisture from collecting and damaging the layers under the planting substrate, such as the concrete.

The waterproofing layer must be compatible with the vegetation and resist chemicals such as fertilisers used for the foliage. The design proposes a bitumen waterproofing membrane.



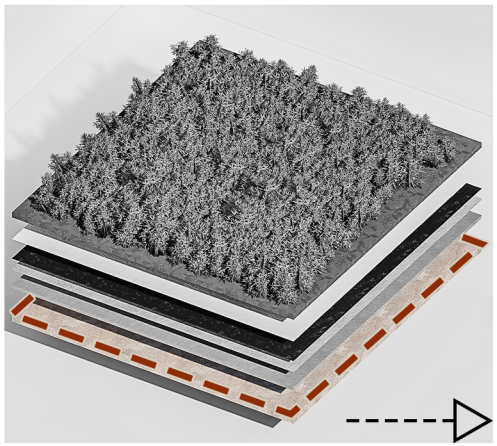
The fourth layer and first substrate is the concrete screed. The screed is cruscial in aiding water flow towards an outlet.

The screed is cast to a fall at an appropriate angle determined by a structural engineer. The screed then falls to an outlet at the edge of a slab or in a centre point of the slab. The design proposes outlets at the edges/ sides of the slabs.



The fifth layer is the insulation layer. This layer prevents heat gain in summer and heat loss during winter. Moisture stored in the green roof might extract heat during winter and cool air during summer. Insulation can either be under or over the roof deck.

The design proposes a 100mm expanded polystyrene insulation faced on both sides with bitupaper.



The sixth and final layer is the concrete slab. This the second substrate and structural layer of the planted roof.

All the layers that precede the concrete slab act in unison to protect the concrete slab and ensure the vegetation's performance on the uppermost layer. The design proposes a 250mm reinforced slab.

Figure 145: Axonometrics of the layers composing the planted roof (Author, 2022)

Stormwater Collection Proposal

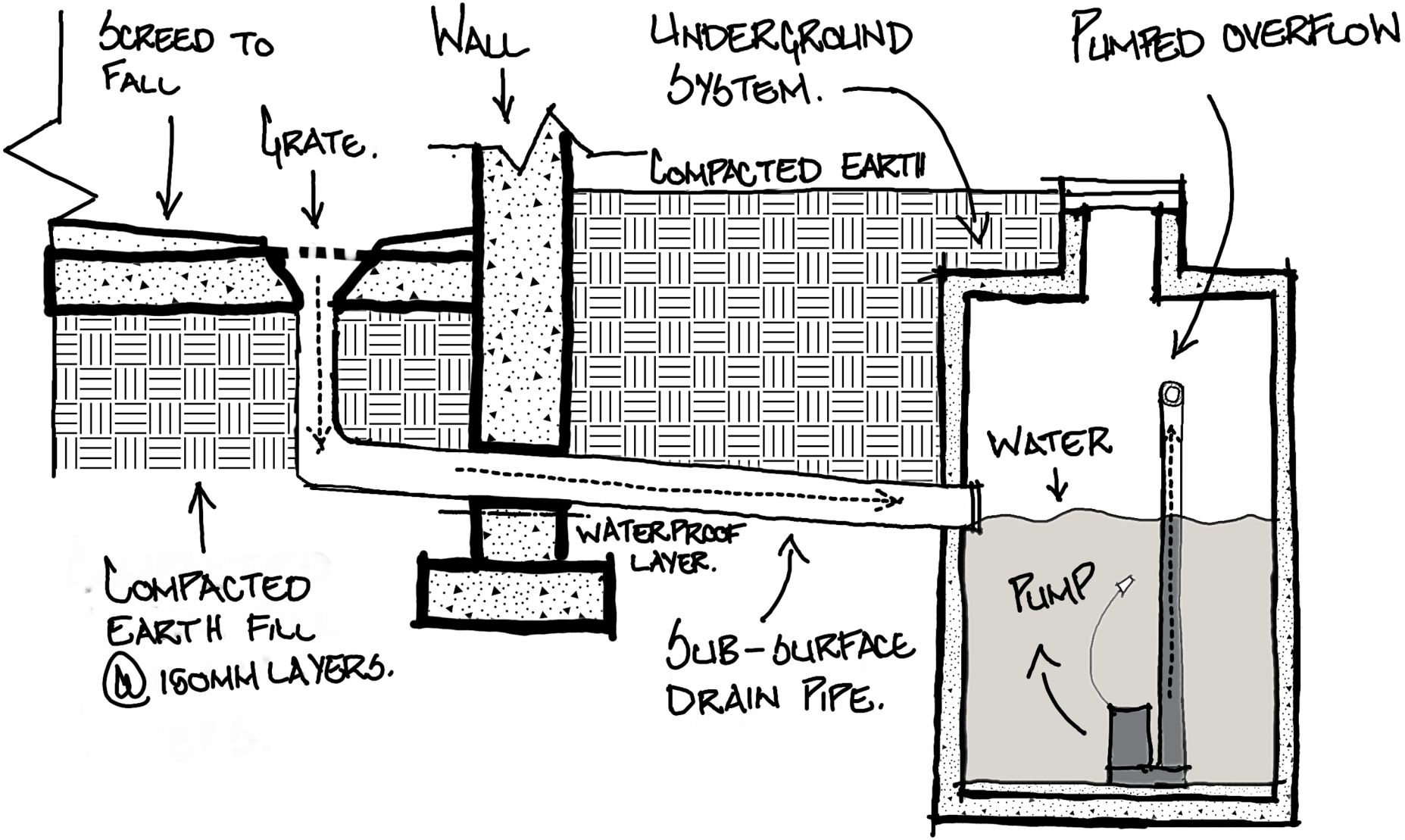
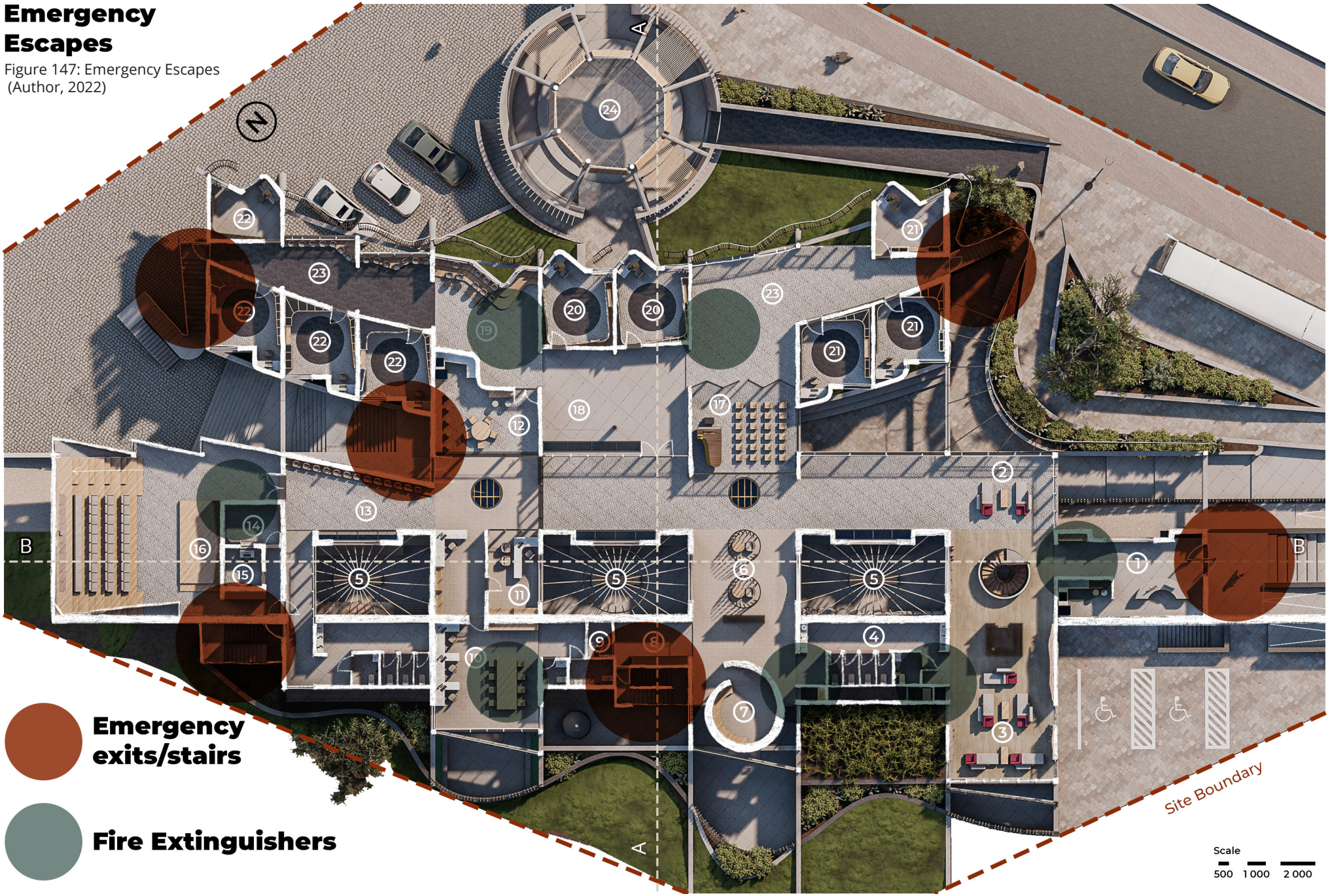


Figure 146: Stormwater collection proposal (Author, 2022)

Emergency Escapes

Figure 147: Emergency Escapes
(Author, 2022)



Parking and Parking Alternative Proposals

The site accommodates 10 parking spaces, six are for staff, two are for public use and another two are universal access parking bays (located by the main entrance). One drop-off/loading zone is also proposed on-site parallel to Ravenscraig Road. The design proposes the continuous use of street parking as is currently done in the area.

Most of the streets in Woodstock are being used as parking areas. This adheres to the proposal of the City of Cape Town's Parking Policy (POLICY NUMBER 17913). The policy aims to favour public transport in the city as an attempt to save valuable property area from becoming parking lots. According to the policy, an estimated loss to parking space of 1 128km² has already occurred in the city. As a result of this, the policy suggests that off-street parking should be provided for car driving users who tend to stay parked for longer periods of time, such as staff members or residents.

The design also proposes a potential sharing of parking with the neigbouring site to the north. A large parking space abuts the proposed site from the neighbouring site. Furthermore, a large parking lot sits at the entrance of the Trafalgar Park Public Swimming Pool. The parking lot is in close proximity to the proposed site, therefore, the public can make use of the open parking lot in case street parking is not available or an option.



Figure 148: Site plan showing parking proposals (Author, 2022)

Reflection
PART 6

Reflection

When we were first prompted to choose a topic for the thesis, we were advised to pick something we felt passionate about. I considered various possible topics, but the one that stuck with me was music.

Initially, I knew I wanted to do something with music, but I still had uncertainty as to what I specifically wanted to contribute to the topic. This was until I found a short newspaper article on the Indigenous African Music Transcription Programme.

A lot of provisions are made for western and classical music, both in research and the built environment. Many typical western style theatres and music venues or rehearsal spaces exist, while very few dedicated to indigenous music exist.

This becomes an even greater issue, seeing that indigenous music is in dire need of preservation. I, therefore, set out to dedicate the centre to indigenous groups in culturally rich Cape Town.

Seeing that I have had classical music training, the entire indigenous music system was challenging to interpret with my understanding of music. I found it much more complex and multifaceted than the music I was used to, but the challenge made it much more interesting.

Seeing that I am not part of any of the indigenous cultures this thesis and design are dedicated to, I knew I didn't want to appropriate, misappropriate, or misuse any of the music and traditions of these cultures. Therefore, I didn't want to formulate a design based on my interpretation of the music. I feel only the people from these cultures are truly capable of interpreting the music; however, anyone can enjoy listening to it.

It was from this notion that the hands-off approach of the touchstone stems. The concepts then became a way of translating the music based on its physical attributes rather than its interpreted attributes. The design followed these concepts to formulate a spatial translation of the music.

Ultimately, the design only proposes a possible way of translating these cultures' music and acknowledges that there might be several correct ways of approaching it. The most important factor to me as the designer was respecting these cultures, their music and the context in which the design is located.

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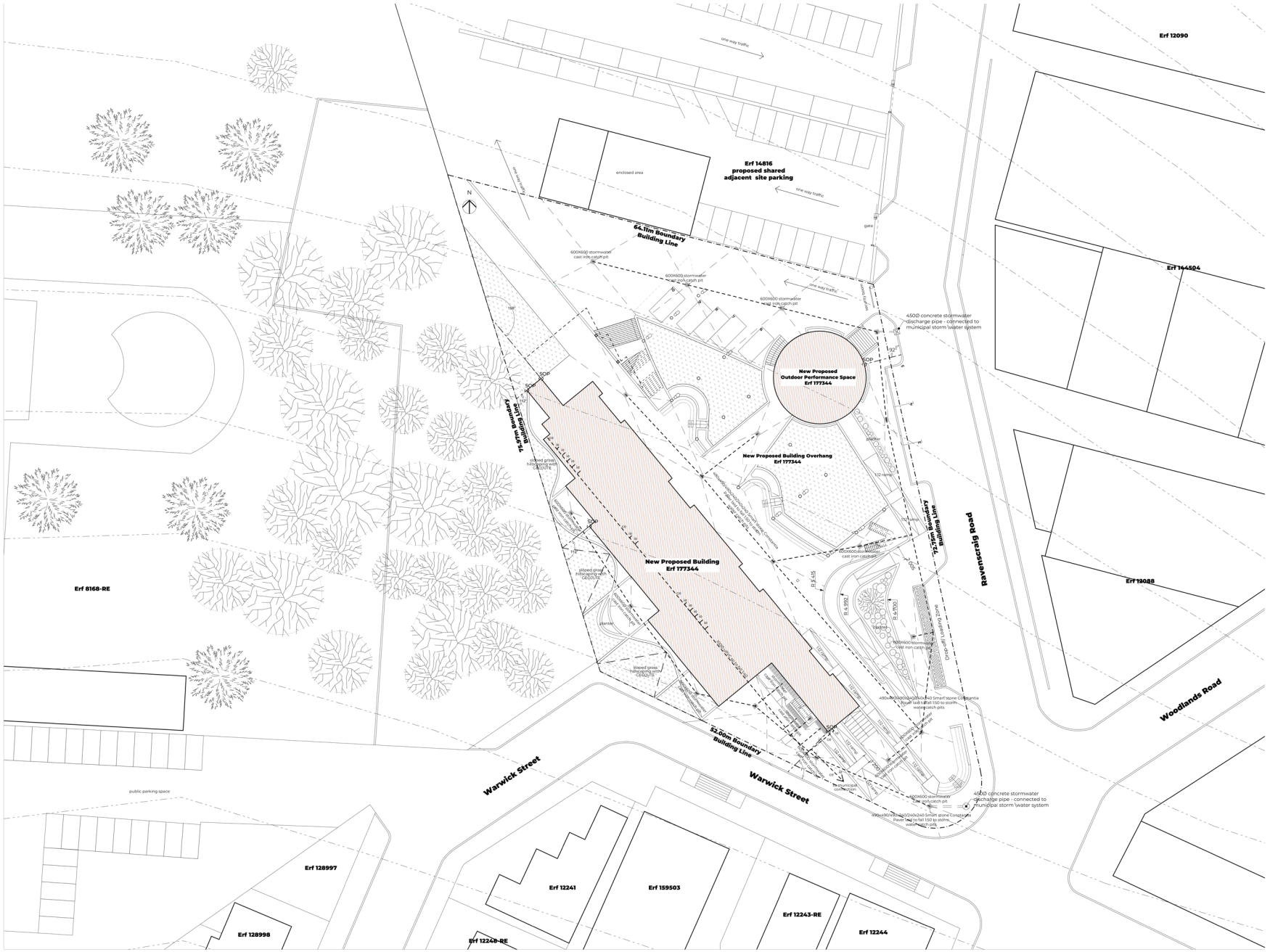
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Appendix
A

Construction Documentation

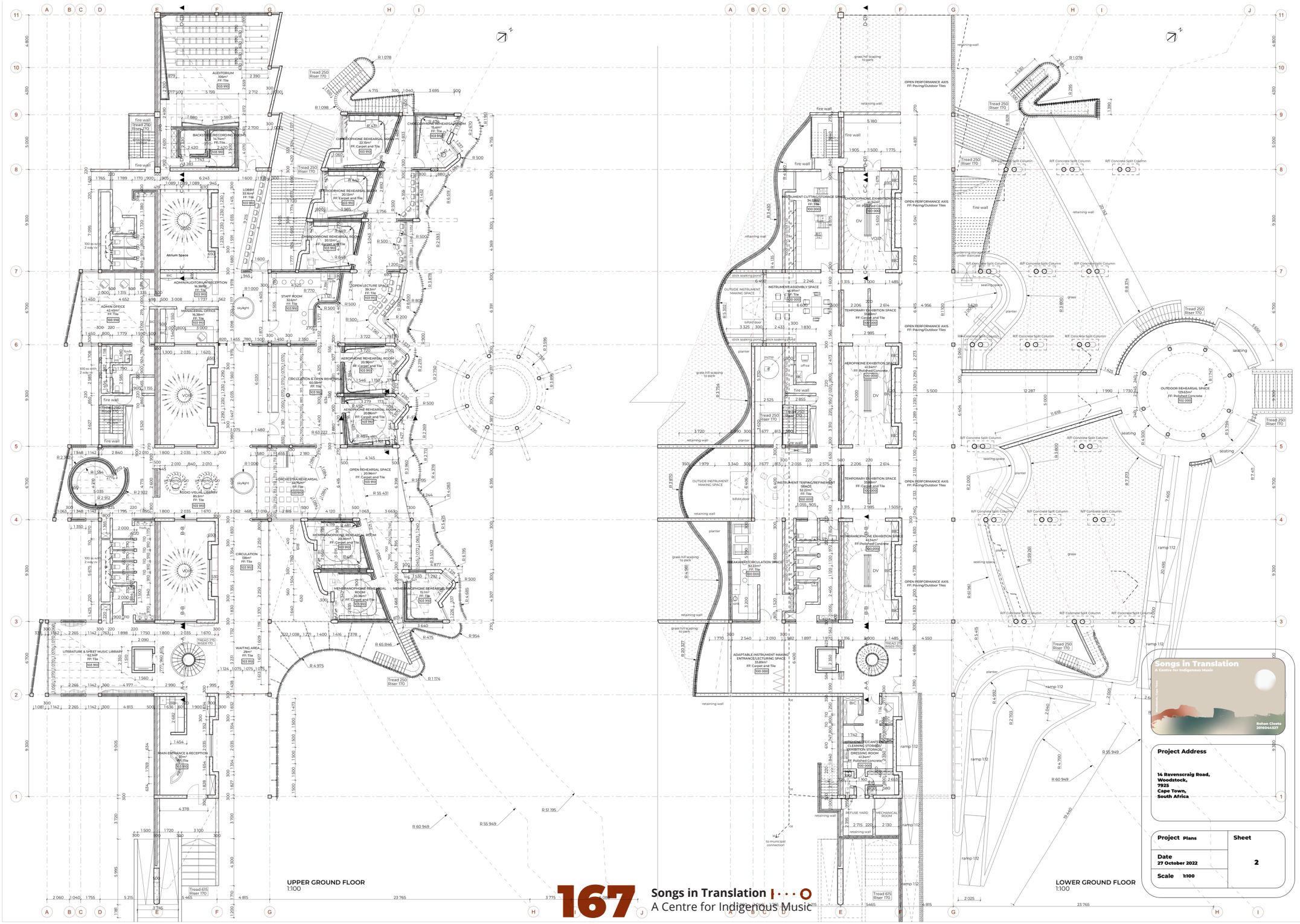


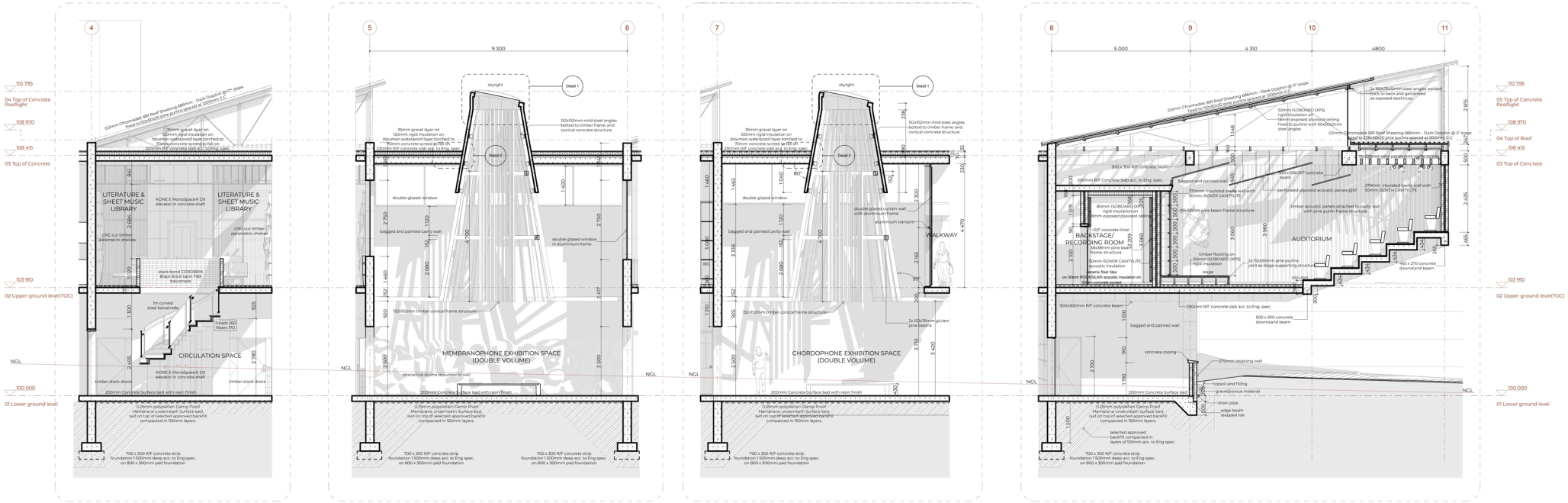


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14 Ravenscraig Road,
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7925
Cape Town,
South Africa

Project Site Plan	Sheet
Date 27 October 2022	1
Scale 1:200	


UPPER GROUND FLOOR
1:100
LOWER GROUND FLOOR
1:100
Songs in Translation
A Centre for Indigenous Music
Rohan Cloete
2016044527
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Woodstock,
7925
Cape Town,
South Africa
Project Plans
Sheet
2
Date
27 October 2022
Scale 1:100

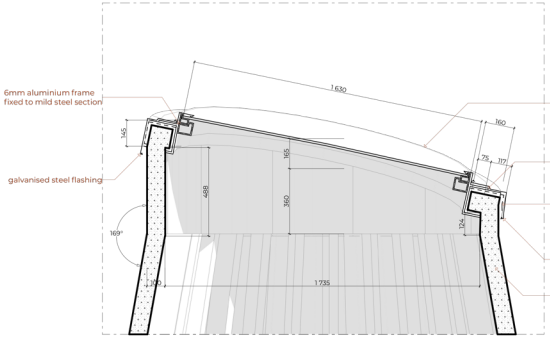


SECTION A-A
SCALE 1:50

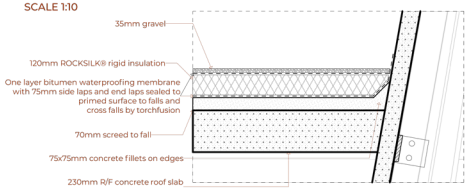
SECTION B-B
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SECTION C-C
SCALE 1:50

SECTION D-D
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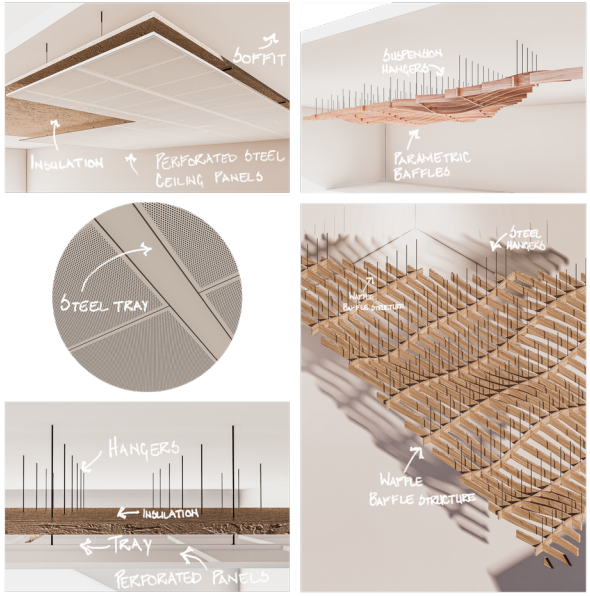
DETAIL 1: ROOFLIGHT
SCALE 1:10



DETAIL 2: ROOFLIGHT and ROOF COMPOSITION
SCALE 1:10



SECTIONAL PERSPECTIVE OF AUDITORIUM



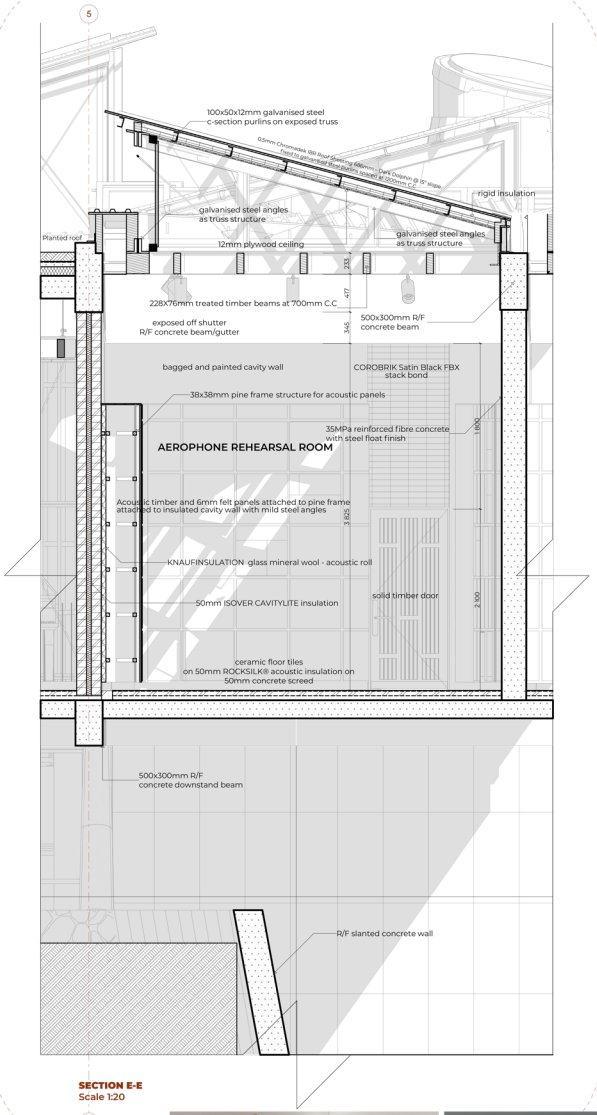
3D CEILING DETAILS OF PARAMETRIC AND METAL CEILINGS



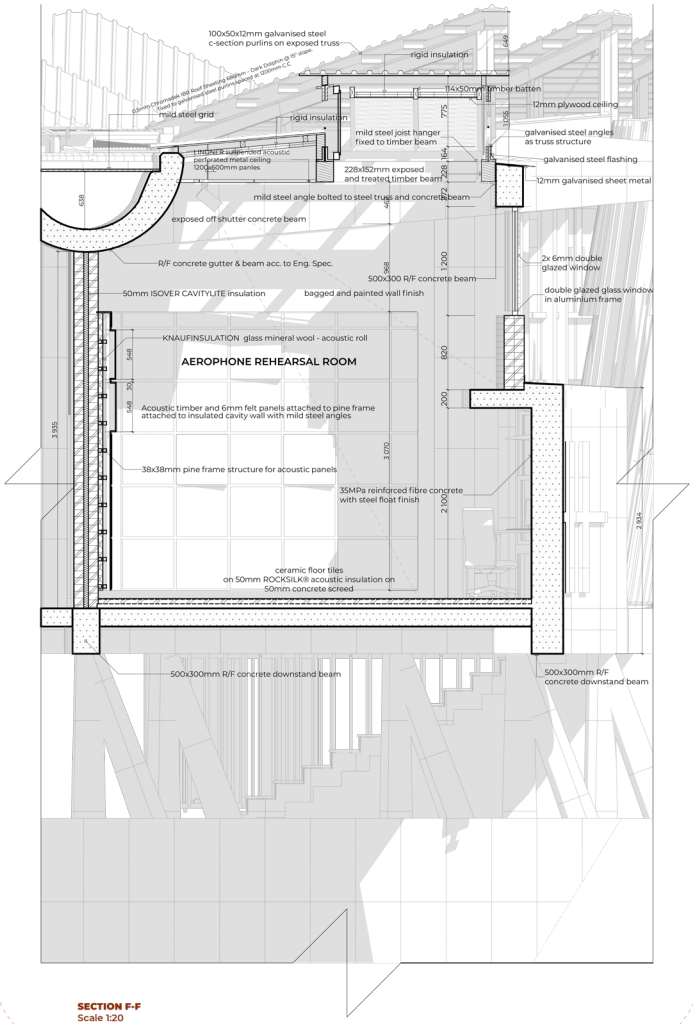
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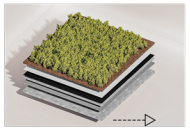
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Date	27 October 2022	3
Scale	As Indicated	



SECTION E-E
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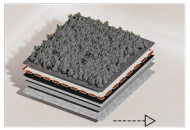


SECTION F-F
Scale 1:20



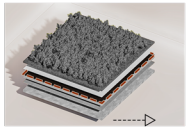
The top most layer of the planted roof consists of the growing medium/soil and the plants planted in it. The substrate shoul ideally be as lightweight as possible with good drainage, water retention and nutrient capacity.

The design proposes to use indigenous plants or grasses such as renosterbos (*Elytropappus rhinocerotis*).



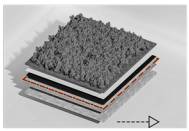
The second layer is the root barrier layer. This layer shields the substrate of the roof from damage caused by plant roots that might otherwise penetrate the underlying layers.

The layer is usually composed of geosynthetic textiles that can either be woven or non-woven. The design proposes the use of Bidim® which is a non-woven fabric.



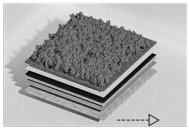
The third layer is the waterproofing layer. This layer prevents moisture from collecting and damaging the layers under the planting substrate, such as the concrete.

The waterproofing layer must be compatible with the vegetation and resist chemicals such as fertilisers used for the foliage. The design proposes a bitumen waterproofing membrane.



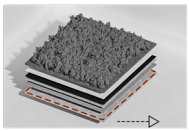
The fourth layer and first substrate is the concrete screed. The screed is crucial in aiding water flow towards an outlet.

The screed is cast to a fall at an appropriate angle determined by a structural engineer. The screed then falls to an outlet at the edge of a slab or in a centre point of the slab. The design proposes outlets at the edges/ sides of the slabs.



The fifth layer is the insulation layer. This layer prevents heat gain in summer and heat loss during winter. Moisture stored in the green roof might extract heat during winter and cool air during summer. Insulation can either be under or over the roof deck.

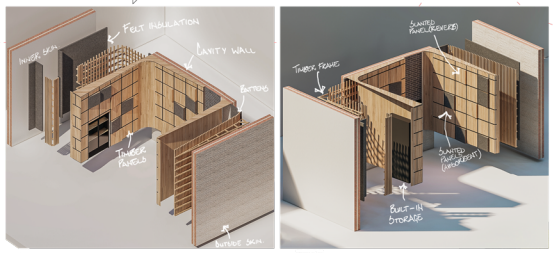
The design proposes a 100mm expanded polystyrene insulation faced on both sides with bitupaper.



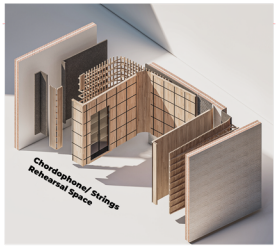
The sixth and final layer is the concrete slab. This the second substrate and structural layer of the planted roof.

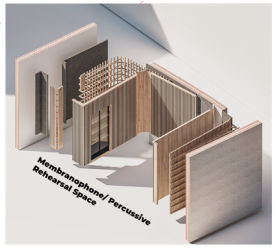
All the layers that precede the concrete slab act in unison to protect the concrete slab and ensure the vegetation's performance on the uppermost layer. The design proposes a 250mm reinforced slab.

AXONOMETRIC OF PLANTED ROOF COMPOSITION



EXPLODED AXONOMETRIC OF ACOUSTIC INSULATION





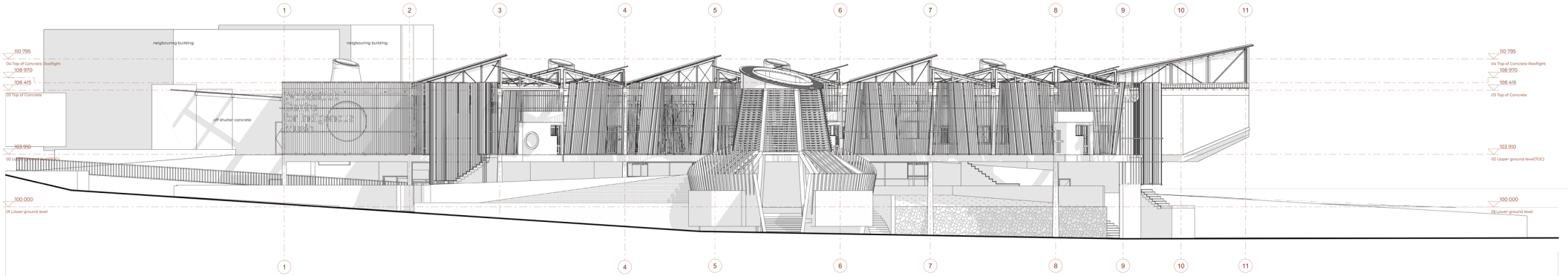
EXPLODED AXONOMETRIC OF ACOUSTIC INSULATION



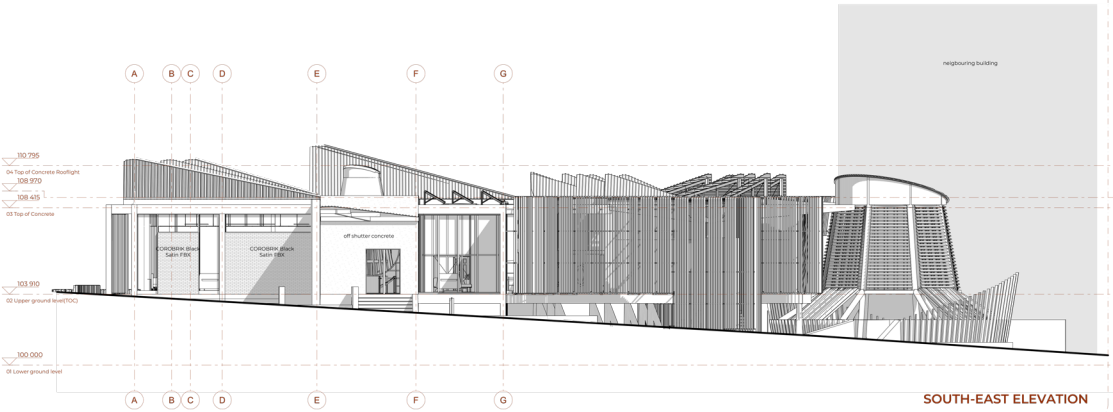
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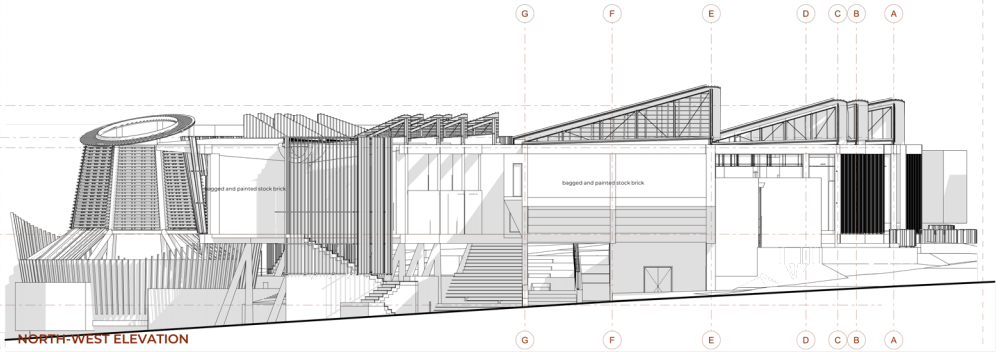
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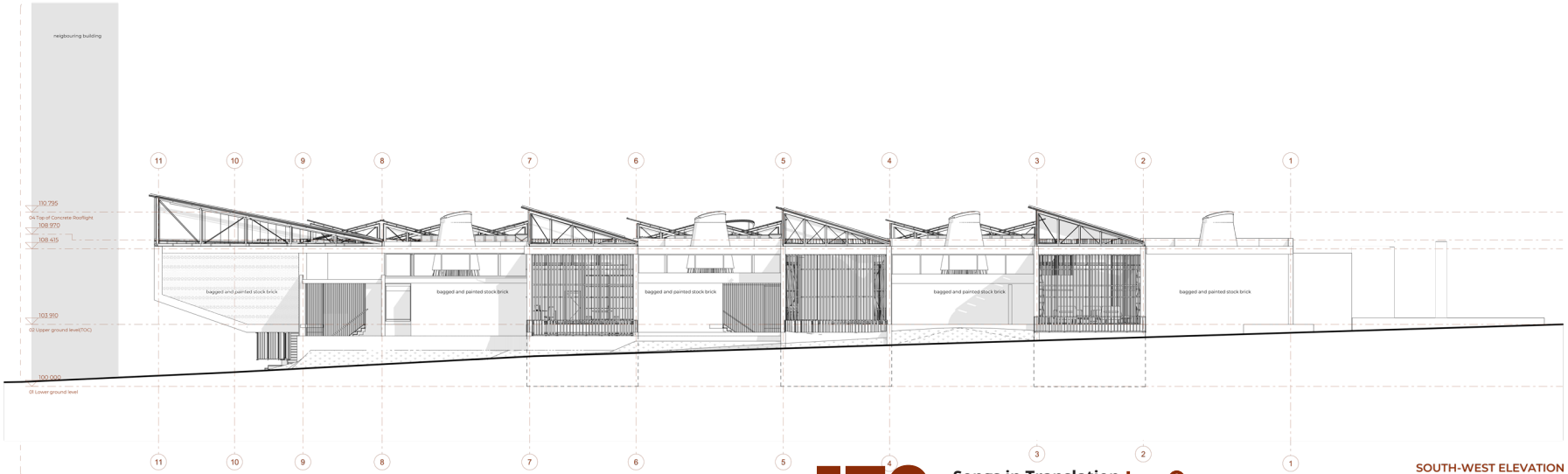
NORTH-EAST ELEVATION



SOUTH-EAST ELEVATION



NORTH-WEST ELEVATION



SOUTH-WEST ELEVATION



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Project Elevations	**Sheet** 5
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