NADIYAH MOODLEY

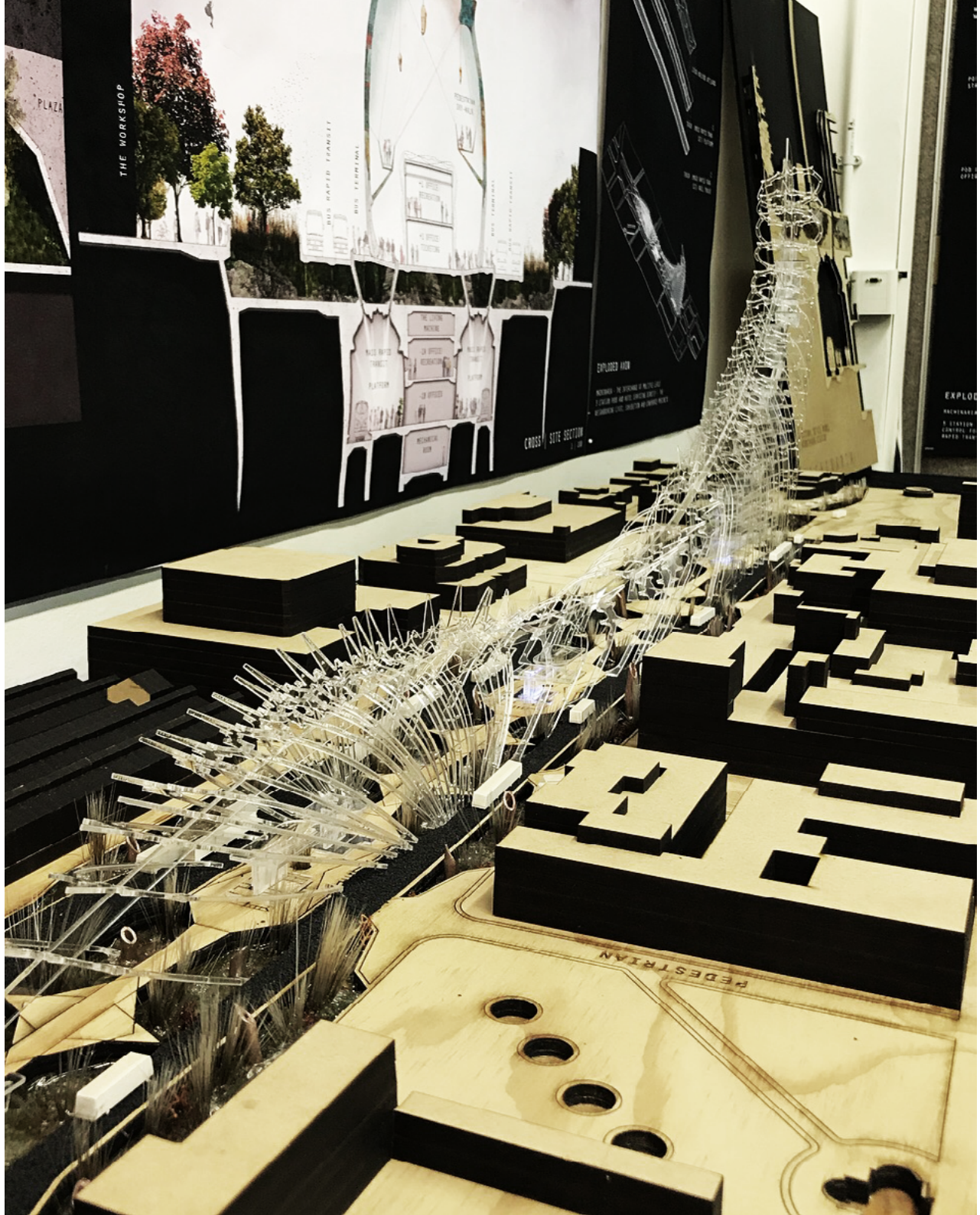
MACHINARIA – INVESTIGATING TRANSPORT ARCHITECTURE AS A KEY DRIVER FOR DURBAN PROGRESSING AS AN ECOLOGICAL CITY.

TOWARDS THE DESIGN OF AN INTER-MODAL TRANSPORT NETWORK NODE.

(Architectural dissertation for UKZN, Masters of Architecture 2017)

LANDSCAPE (LEFT) BINDING


MACHINARIA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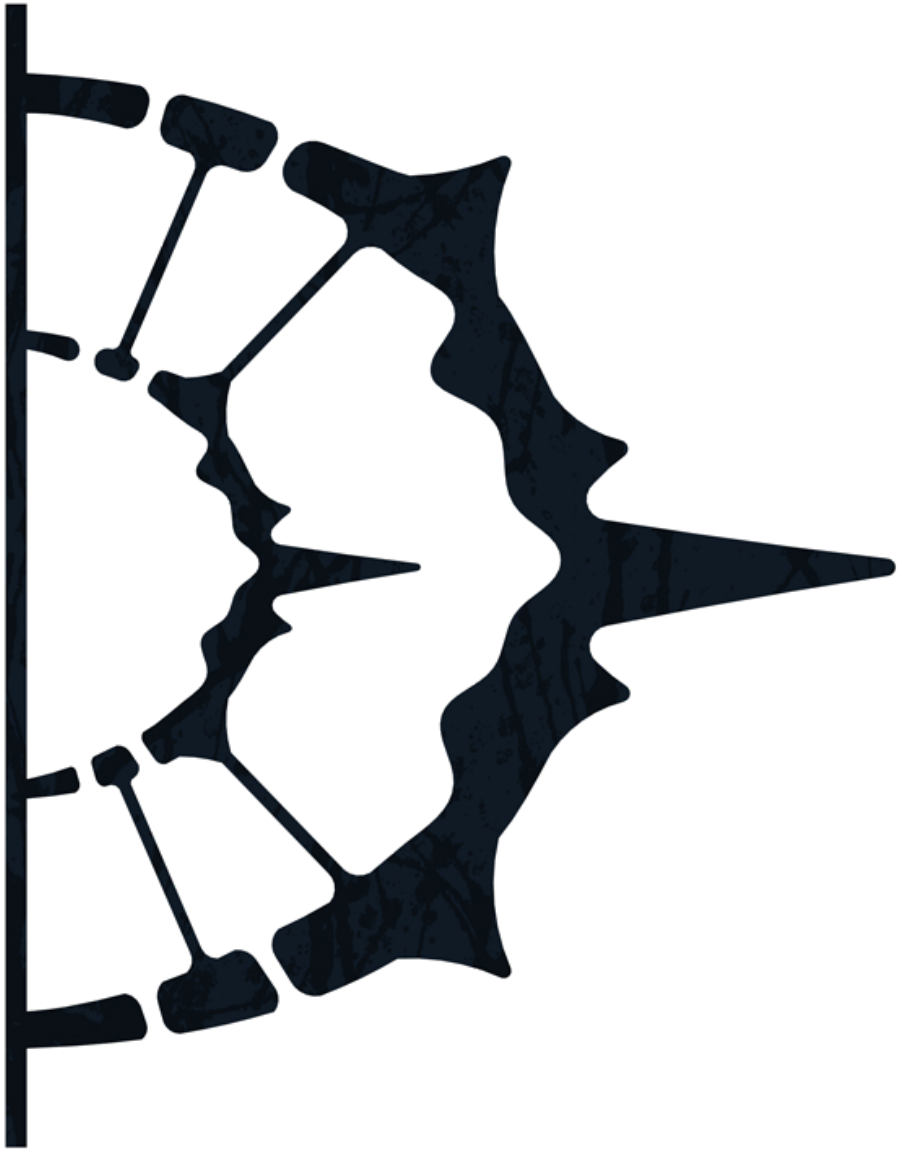

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Dissertation Document

MACHINARIA

architecture as a living machine
a 21st century transport interchange

Investigating transport architecture as a key driver for Durban progressing as an ecological city.

Towards the design of an inter-modal transport network node.

The Prophet Muhammad (peace be upon him) said: "If anyone travels on a road in search of knowledge, God will cause him to travel on one of the roads of Paradise. The angels will lower their wings in their great pleasure with one who seeks knowledge. The inhabitants of the heavens and the Earth and (even) the fish in the deep waters will ask forgiveness for the learned man. The superiority of the learned over the devout is like that of the moon, on the night when it is full, over the rest of the stars. The learned are the heirs of the Prophets, and the Prophets leave (no monetary inheritance), they leave only knowledge, and he who takes it takes an abundant portion."

- Sunan of Abu-Dawood, Hadith 1631

"In order to build the future, it is necessary to accept the fact that major changes will be taking place in the near future, due to the information revolution, and that this revolution will affect every level of humanity.

The world is [continuously] waiting to be [re]built, innovation is the source of every project; we live in a state of permanent creation. The hybridisation of cultures, natures and processes, leads to greater complexity of proposals and opens up new lines of action. We are talking of processes, rather than occurrences; of open forms, rather than closed designs; of operating strategies, rather than finished products.

Individuals are defined one by one, not as a mass. Where hierarchies exist, they produced by knowledge, rather than by norms. The world is built by the coming together of multiple individual persons; the traditional hierarchies of business and politics will disappear in the coming years.

People must be valued for their qualities, not their quantities (years, money, etc.). A city is built inwards, it does not grow indefinitely; it is re-informed and protects its own environment. Sustainable development, on a global and a local scale, calls for urban and territorial ecosystems that must function for centuries.

We have to act locally and globally at the same time; cultures have to adopt dynamics of their own and interact."

Vicente Guallart, cited in Gausa, et al (2003:35)
[author's note]

0.03

DEDICATION

For your invaluable advice and guidance, your determination and drive to mould me to be and strive for excellency, you are the fuel to my success

-

This is for you, Abbah.

0.04

DECLARATION

originality

I declare that this dissertation is all my own unaided work, and that all citations, references and borrowed ideas have been duly acknowledged. This document is submitted in partial fulfilment of the requirements for the degree of Masters in Architecture at the School of the Built Environment and Development Studies, Howard College, University of KwaZulu-Natal, Durban, South Africa. None of the work has been previously submitted for any degree or examination in any other University.

DECLARATION

plagiarism

I, Nadiyah Moodley, declare that:

The research reported in this thesis, except where otherwise indicated, is my original research.

This thesis has not been submitted for any degree of examination at any other university.

This thesis does not contain other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons.

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Their words have been re-written but the general information attributed to them has been referenced.

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This thesis does not contain text, graphics or tables copied and pasted from the internet, unless specifically acknowledged, and the source being detailed in the thesis and in the References sections.

Nadiyah Moodley

Date

0.05

ACKNOWLEDGEMENTS

To my loved ones, Abbah, Suhaydah, Zulfikar and Adi thank you for your dedication and support throughout my career.

Adi, I am immensely grateful for you, for always being by my side (day and night), your support, array of knowledge and love has helped me achieve what I thought could only be a dream. I could not have done this without you.

I would also like to thank the following people for their role in helping me accomplish my final year of architectural study:

Juan Solis, my supervisor, thank you for guidance throughout the year.

Ian van Biljon, my mentor and friend, thank you for your passion, sharing your wealth of knowledge and guidance.

ABSTRACT

Machinaria is an exploration of an architectural and bio-mechanical hybridity as part of a 21st century paradigm for architecture and environmental sustainability.

The dissertation investigates the potential of transport architecture as an urban catalyst – a mechanism with which to regenerate urban environments and re-integrate socio-economic systems through an ecological architectural lens.

In an attempt to redefine the perception of public transport and transport architecture in 21st century Durban, mitigate urban inaccessibility caused by spatial oppression through the apartheid regime and redefine Durban's identity as an African city, the investigation is based on an 'urban wasteland' which is reprogrammed as part of a new African urban ecology.

The dissertation therefore blurs the perceptions of present day distinctions between social, economical and natural space and ecologies while at the same time placing focus on the global cultural dependence of transportation.

If humankind is to survive the predicted crises of our time, a 21st century approach to design must shift the modern day understanding of architecture as 'Machines for living' but rather towards that of architecture as a living machine – a more complex approach to the ecologies within architecture, both outward and inward.

Machinaria alludes to new ways of adaptive architectural typologies in a rapidly changing world.

KEY WORDS

Ecology, transport architecture, regenerative design, bio-mechanical hybridity, 21st century, pollution, climate change, spatial apartheid, Durban Inner City.

PROGRAMME

Integrated Inter-modal Public Transport Interchange:

21st century African Transport Interchange

SITE

Durban Inner City
Centrum
Flanked by AB Xuma Street and Monty Naicker Road
Kwa-Zulu Natal
South Africa

GPS -29.856779, 31.025353

architecture as the Living Machine: embracing the technological age to create a responsive architecture (climate, pollution, light and air) through bio-mechanical systems.
the Urban Machine - an architecture that promotes urban systems. architecture as a public domain that connects, filters and responds to the urban condition.

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MACHINARIA - INVESTIGATING

KEY DRIVER FOR DURBAN PROGRE

Towards the design of an inte

a catalytic element that drives change and progress in the city

a city born of segregation and spatial oppression, Durban progressing from spatial apartheid - how it has influenced the state and value of the city to its citizens today and how it can develop beyond the scars of oppression to a truly democratic city - one that includes all races and classes in a entirely accessible city centre.

HE LIVING MACHINE:

eate a responsive architecture (climate,
-mechanical systems. An existential
he image of Man

ACHINE:

ems. architecture as a public domain that
nds to the urban condition

CHANICS

ent - movement turns to progress - the
xample of Bio-Mechanics

a public piece of architecture that harbours mechanical systems for transportation. it expresses movement and connectivity. it is a landmark responsible as a point of arrival and departure

Public realm

Welcomes a surplus of people

Harbours forms of transportation within a space

TRANSPORT ARCHITECTURE AS A ESSING AS AN ECOLOGICAL CITY.

er-modal transport network node

as a public building, environmental responsibility is placed on the design of the building. an ecological architecture that is responsive to climate, diminishes carbon emissions given off through transportation and a safe, serviceable building that is not only off grid but contributes to the urban environment.

Ecology encompasses the biological makeup of structures and how they work systematically and symbiotically, this can be observed in -

Urban Ecology

Architectural Ecology

DEFINITION

of terms

access
Absolute non-barrier. Access transcends any physical connotation to incorporate economic and psychological references as well. A place may be geographically accessible, but not socially because of psychological barriers erected and projected.

activation
"Activation is the action of excellence.
Activation proposed the most enriching reply to a request [need] it is always transforming, never inert or indifferent.
Activation is not only a direct response to an event or a provocation, but also something which implies commitment and results from the reaction, in the chemical meaning of the word, of transformation or progress.

Activation is classified as an indispensable quality if progressive architecture. The land is activated with the presence of the architecture; architecture operates though its use, use operates in relation to the new sensitivity to materials; materials are transformed in relation to the land which separates and unites us." (definition in Gausa et al, 2003:32)

adaptation
The flexible capacity of fitting and/or moulding a conceptual, abstract, strategy to specific, concrete, conditions.(definition in Gausa et al, 2003:33)

advanced architecture
"Beyond conventional iconography or the fixing of the object, it is an architecture positively bound to change: with the events and the temporal and evolutionary dimension of processes. An architecture aware of the future importance of interchange and information. An architecture which, nevertheless, seeks to speak about the present, about day-to-day life. To provide expression, joy and freshness for a new emergent ordinariness and, consequently, dignity and stimulus for life." (definition in Gausa et al, 2003:34)

african renaissance
The African Renaissance is the concept that African people and nations shall overcome the current challenges confronting the continent and achieve cultural, scientific, and economic renewal.

apartheid
Post democracy, a South African policy or system of segregation or discrimination on grounds of race.

arcology
An ideal integrated city contained within a massive vertical structure, allowing maximum conservation of the surrounding environment. Term coined by Architect: Paulo Soleri.

bio-mechanical
relating to the mechanical laws concerning the movement or structure of living organisms.

blurring
"Blurring is working with a material layer of immaterial feelings, a floating jelly fish in trees, a metaphoric filter of pollution." (definition in Gausa et al, 2003:136)

civilisation
The process of becoming civilised. One of two aspects in human life, dealing with the left-brain associations of logic, efficiency, economics, etc. One part of the dualism, the other being culture.

class
A term used to signify social divisions and inequalities based on occupation, economic standing, heredity, or other distinctions. The idea of class division is as old as human history, the most basic as a dualism of rich and poor, from classical patricians and plebeians to more contemporary bourgeoisie and proletariat classes. Since the industrial revolution, classes of people have been defined by and closely associated with their economic function and related to the system of production. Economic relations are typically the defining element of social structures and the source of social status and group identity.

culturalism (inter)
A focus on the diversity of cultures, what they share, and what they can do together; a celebration of overlaps, inter-laps, and similarities. Inter-cultural space has an underlying philosophy of cultural mixing in lieu of separation, with a sustainable means designed to make integration the priority. Key features of inter-cultural space are fluidity, energy, sensitivity to shifting demographics, relationships between various constituencies, adaption, and dynamism.
Examples of Durban's diverse cultures (each with subcultures): Zulu, Xhosa, Indian (Hindu), Indian (Muslim), White (English), White (Afrikaans), Coloured, Pan-African, etc.

culturalism (multi)
An emphasis on the difference of cultures, and how they co-exist parallel to each other.

culture
Derived from the Latin term cultura, from the Roman orator Cicero, to mean a 'cultivation of the soul'.
"The construction of the city is a cultural problem, taking culture in the broadest sense of the word - that is, the focus of intervention for economy, art, science, thought, etc. Culture is a driving force of the economy: creating products according to guidelines of the advertising market, directing them at the right people at the right time and in the right place and selling them at the highest admissible price (having invested what was needed for their production). Architecture is a product of our time. And the only way to be timeless is to be absolutely of a time: for buildings to reflect the hour and the minute in which they were designed and constructed." (definition in Gausa et al, 2003:142)

democratic space
see : space (democratic).

diversity
"Ours is a time of diversity, calling for constant simultaneity of individual events in global structures: this 'multi' - plural - condition links the local with the

global, the particular with the general, the general with the individual, evidencing the impact - and emergence - of the singular upon the collective, not as 'part of a whole', but rather as specificity 'interconnected with the whole' (as a presence at once independent - autonomous - and co-participant). Diversity speaks of combination, inter-linkage, coexistence and simultaneity. of relation and discontinuity." (definition in Gausa et al,
2003:178)

ecology (active or bold)
Instead of old, nostalgic or pseudobucolic ecology (which freezes landscapes, territories and environments), we suggest a bold ecology; requalifying by virtue of being reformulating. Based no longer upon a timid, merely defensive - resistant - non-intervention, but rather upon a non-impossitive, projective and qualifying - re-stimulating - intervention in surgery with the environment and, also, with technology. Not only possible, but (re)developmental as well.
An ecology in which sustainability is interaction.
In which nature is also artificial.
In which landscape if topography.
In which energy is information and technology is vehiclisation.
In which development is recycling and evolution is genetic.
In which environment is field.
In which to conserve implies always to intervene.
(definition in Gausa et al, 2003:187)

urban ecology
"Urban ecology is based on the adaptation of guidelines, standards and regulations of a legal, economic, organisational and technical nature, all centring on the unit 'city-environment'. The change of paradigm consists in recognising nature, endowing it with its own values. Nature thus ceases to be other, external, to become the very centre of thought, where the principle idea is recognition of this complex mesh of relationships.
The aim is to maximise the entropy recovered in the form of information (to make the urban system more efficient) and minimise the entropy exported to the environment, reducing the city's ecological footprint. The combination compact city/diverse city is the systematic model which makes the best use of entropy, transforming it into organisation of the city, increasing it complexity. This allows a drastic reduction of the entropy exported to the environment. It is also the model which allows greatest reduction in the

consumption in materials, energy, time and land, while providing regulatory and control mechanisms to and endow this system with stability." (definition in Gausa et al, 2003:187)

ekistics theory
Ekistics theory deals with the science of human settlements across all scales from dwelling design to regional planning. Developed by Constantinos Apostolos Doxiadis, the theory is more closely related to science than urban planning. As a scientific mode of study, ekistics relies on statistics and descriptions organized into five categories: nature, anthropos, society, shells, and networks. Conclusions seek to create harmony between inhabitants and their physical and socio-cultural environments.

economic development
The process of improving the economic, political, and socio-cultural well-being of people, creating competitiveness, a prerequisite condition for innovation.

energy (as potency)
"Energy is entropy. Activation of forces and efforts. Vehiclisation of (new) bits of information. Of interest are those processes, phenomena or situations capable of producing - or introducing - positive energy within the system. Energy as open - nondisciplined
- (re)information rather than as linear progress. Energy as catalysation (and fuelling) of potentials. Actions or constructions, manifestations or trajectories. Impulses: stimuli and triggers. Always reactivations - and propulsions - of the environment."
(definition in Gausa et al, 2003:194)

energy (as an impulse)
"Places have energy of their own, built up throughout their history by physical or
spiritual phenomena. Any human action should amplify the energy of a place; they
should be on the same wavelength. Any work of architecture should amplify the
conditions of a place, give the place energy, never detract from it." (definition in Gausa
et al, 2003:194)

experimental architecture
"All architecture that refuses to accept canons or codes is experimental. This does not mean that such architecture has no rules, only that it seeks to stretch and even break such constrictions in order to achieve its own constructions. Such an architecture seeks to be open." (definition in Gausa et al, 2003:208)

field
"Terrain (operative landscape), extensive (and extendable: open) outside a (between) space(s). Workable (manipulable) background under cultivation (evolutionary system), plantations (installations) and natural (and artificial) sown fields (modellings). Space that is chosen (or accepted) for a (spatial-temporal) challenge. Real (physical) or
imaginary (virtual) space. Background of a painting or scenario (now also figure). Space in which forces and energies (and relationships) manifest themselves (induce each other and interchange) in (dynamical) interaction. Place of confusion and disorder (or rather of another type of order). The notion of 'field' in reference to a place - and not that of 'context' or, at least, that of 'the contextual' - suggests a new, more open and abstract, more flexible and receptive (reactive) condition of the contemporary project vis-à-vis the environment, far removed from classical evocation or modern (im) position. The concept of 'field' defines a place as a framework for reconnaissance but also as a scenario of 'action' between tensions and forces." (definition in Gausa et al, 2003:221)

future > hybridisation
The best way to prevent the two worlds - physical and virtual - from separating is for them to become the same. Energy put into the construction of the virtual world should also be applied to the re-information of the physical world.
The industrial society brought about a transformation to produce basic quality, in the city and in the dwelling, for as many people as possible. The information society had to seek maximum quality for a maximum number of places.
More is More." (definition in Gausa et al, 2003:595)

hybrid
'The hybrid nature of the contemporary project alludes to the current simultaneity of realities and categories, relating no longer to harmonious and coherent bodies, but rather to mongrel scenarios made up of structures and identities in parasitic coexistence.
By accepting, without prejudice, a strange situation of cohabitation made up of contracts, pacts and mongrelisations between bits of information at once overlapping and interconnected (imbricated) and differentiated layers and (infra)structures is how the culture of the contemporary project can be understood today." (definition in Gausa et al, 2003:596)

infrastructure (hard)
The tangible features that operate within a city, such as buildings, transport networks, and institutions.

infrastructure (soft)
The system of associative structures and social networks that enable connections between humans to formulate.

infrastructure (as networks)
"Communication and transport infrastructures (motorways, railways, airlanes) emerge as the most evident lines of the current (urban-territorial system). Lines are converted into neutral directories for future organisation of the land. Bases of reference, independent of construction are marked by velocity and sequenciality (and no longer by continuity and contemplation) as supports for new activities, not only along their lengths but even over the latter as well: over formerly hierarchically and monofunctionally separated plots of land that have begun to absorb, progressively complex and stratified programmes, defined through a complicated superposition of vertical and horizontal sectional use of structures." (definition in Gausa et al, 2003:346)

innovation
Innovation is not linked to the arts per se, but is critical in survival and prosperity. "The capacity for innovation should be understood as being exclusive not to the most energy. In architecture, innovation is not a totally shared collective phenomenon, but a fact driven by individual forces and attitudes that are capable of correlating, that ultimately creates its own expression." (definition in Gausa et al, 2003:350)

interaction
"Interaction is (inter)change and (inter)relation.
Interaction is information transmitted, transferred and transformed among different and simultaneous energies, events and/or scenes." (definition in Gausa et al, 2003:352)

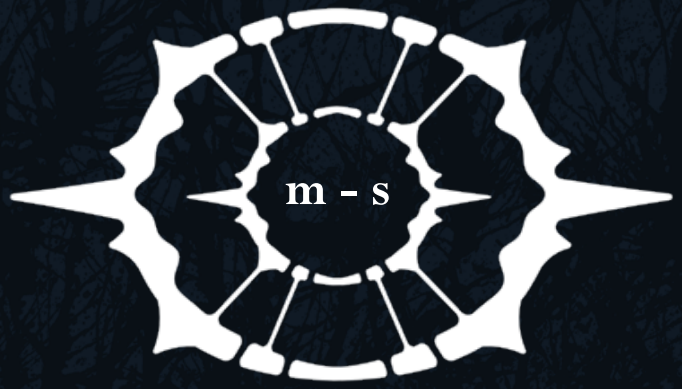
interchange
"Advanced architecture is architecture of interchange (or rather, of interchanges). It is not only within and with a reality, but also with and among many realities. Advanced architecture is capable of multiplying links and interconnections - manifold local and global relations - between the user and his/her (various) cultural environment(s); between the place and the city. Between information technology and the immediate logic of the action. Between the potentials of time and the possibilities of the context. Through spatial organisation which are more independent - of habitat or of discipline - yet, for that very reason, more attentive to the impact of the exterior: receptive, permeable, flexible and fluctuant; this is, plural, able to combine and reconcile, develop diverse and simultaneous messages; abstract and concrete, generic and specific. Digital and material.
Through action which is procession, receiving and receptive; attentive and open; generous and generative; functional and emotional; relational: aimed at interrelating freely, expressively and communicatively heterogeneous data, phenomena and events in new, more complex environments.
Accepting, without complexes or biases, different situations and conditions in order to reassess - to reactivate them - beyond themselves.
Developing assets of the place and links beyond the place in different scenes of exuberance and need, of plenitude and free precariousness, of progress and development. With rigour, and also relaxed." (definition in Gausa et al, 2003:354)

inter-modal
Involving two or more different modes of transport of the general public

machine
"The aesthetics of the machine, as a more or less figurative resource, or as a reference of this type of object referring to the first avant-garde, have stopped being of our interest a long time ago. In our opinion, an approach is not improved by its capacity of evoking working mechanisms, nor showing an apparent nakedness in which shameless inner elements are exposed. All this probably serving the pretended alternative 'composition'. All of the works we now see as machines, we are interested in automatism and indecisiveness." (definition in Gausa et al, 2003:409)

matter
"Matter in architecture is elaborated substance. Concrete, metal sheets, etc. are not only abstract choices, but physicalites that must be established throughout a process. They continue more than colours, texture and odour that decorate an abstract and unlimited space." (definition in Gausa et al, 2003:422)

membrane
"A membrane is the thin layer of organic, elastic and



resistant tissue which separates two cavities or envelops and organ." (definition in Gausa et al, 2003:427)

mobility
The ability to move or be moved freely and easily.
The ability to move between different levels in society or employment.

mode
A way or manner in which something occurs or is experienced, expressed, or done.

nature (advanced)
"(Technology and nature. Thechnonature)
It would be useful to put into crisis the more *naif* ideas that have taken shape through the growing interest in nature. Only a greater technological development and critical cultural attention can put a stop to the predatory dynamic that modern technology has unleashed on the territory. In this context, the architects work should exploit more intense forms of describing the contemporary idea of nature, understanding it as an essentially cultural construction. To manufacture a cosmogony and give it physical form. As a work resource, environmental awareness is useful when we cross it with its apparent opposite: the artificiality of all real physical experience, as a theme for creating new paradoxes and new questions." (definition in Gausa et al, 2003:449)

networks
"The idea of interchange and displacement in the metropolis is derived from the effective combination of different channels of communication and locomotion which are principally conceived of as circuits for directing flows." (definition in Gausa et al, 2003:454)

node
A point in a network or diagram at which lines or pathways intersect or branch. A point of intensity.

open
Open is non-closed, non-conclusive, non-confined.
Open is indeterminate - non-determinate and non-terminated.
Open is 'incomplete' (and unfinished).
Evolutionary. That is, animated. Unsettled. And liberated.
Open, then, means non-limited and non-limiting.
For uninhibited and unencumbered: unrestrained.
Open for exteriorised. Relational.
Relaxed and spontaneous (in attitudes and movements).

Frank and direct (in responses).
Joyful. And expansive.
Exultant (and exhibitive).
Explicit (clear) and expressive (eloquent).
Receptive (attentive) and vehicular (communicative).
Open also means dialogist. Meaning non-essential. Meaning non-univocal.
Meaning alterable. And influenciable. Disposed to interchange.
The more flexible the more undisciplined. The more dynamic - and uninhibited in their movements - the more informal the more definitively extrovert." (definition in Gausa et al, 2003:463)

organisms
"Whilst technology is taking us into the realms of virtual reality, architecture on the other hand, is becoming more corporeal. It is the merging of the body and architecture brought about by electronic media. A radical change in perspective is blurring the distinction between the organic and mechanic, and the artificial logic of the computer and the natural logic of man are fusing together." (definition in Gausa et al, 2003:466)

physical space
see : space (physical).

place
a distinctive identity of a space or collection of spaces.

product
"It's impossible to see what products are going to be. That is why a solid information architecture based on encouraging and managing diversity, as opposed to containing diversity, has become so important." (definition in Gausa et al, 2003:498)

public space
see : space (public) and space of the public.

public transportation

quality space
see : space (public)

skin
"Contemporary architecture replaces the idea of facade with that of skin: an exterior layer mediating between the building and its environment. Not a neutral elevation, but rather an active, informed membrane; communicative and in communication.

Rather than walls with holes, technical, interactive skins. Skins colonised by functional elements capable of housing installations and services; capable of receiving and transmitting energies; but also capable of supporting other incorporated layers: overlapping rather than adhesive. Manipulated and/or temporary patches, eruptions, graphics or engraving; but also projected images. Colourful reversible motifs and virtual - digital - fantasies aimed at transforming the building into an authentic interface between individual and environment; and the facade, into an (inter)active screen, the frictional boundary between the building and a context which changes over time." (definition in Gausa et al, 2003:555)

social inclusion
social inclusion is both an outcome and a process of improving the terms on which people take part in society, aiming to empower the poor and marginalised people to take advantage of burgeoning global opportunities; ensuring that people have a voice in decisions which affect their lives and that they enjoy equal access to markets, services and political, social and physical spaces (World Bank, 2016).

social space

see : space (social).

space (democratic)
Democratic space is an unwritten permission to think; a space of total social equality and social inclusivity.

space (physical)
neutral/objective space, or space as it exists naturally, in which traditionally architects and spatial planners think.

space of the public
If public space become an image of what it represents, then it should be substituted as a space of representation with a space of presentation. It becomes necessary to re-establish the relationship of body-to-body as a true construction of public space. A space that is not qualified by its forms but by its potential for benefiting a relation to its neighbour.

space (public)
"1. Space of public entitlement. 2. Space accessible to everyone, that can be appropriated but not owned; setting for countless heterogenous actions and actors that is not the result of a specific morphology, but of the articulation of sensible qualities produced by the practical operations and time-space schematisations procured, live, by its users." (definition in Gausa et al, 2003:563)

space (quality)
Space is not just a physical phenomenon, it is an atmosphere that includes non-judgmental attention, mutual respect, and appreciation.

space (social)
lived space, which is a reconstruction of the relationship between the physical and the
mental. It is informed by and informs this relationship.

spatial ability
the capacity of an individual to present knowledge about space and to then organise space, based on the individual's philosophy of space.

spatial apartheid
Spatial Apartheid refers to the spatial disjointedness and urban segregation of amenities to the people, though the apartheid regime. It entails urban inaccessibility and almost tangible boundaries to employment, land, housing and amenities and some basic human rights.

spatial oppression
The injustices created by the apartheid regime, spatial injustices and crimes that violate human rights to basic spatial amenities and needs. (see: spacial apartheid)

sustainability
In the pure sense of the world, it is the ability to maintain itself as an inter-cultural centre of interdisciplinary arts of excellence and innovation.

sustainability (ecological)
"The concept of sustainability is the result of seeing the world with limited resources and limited capacity to absorb waste, where every act involves future consequences. This leads us to conceive of the construction of a building as an act which does not start with the delivery of materials to the site and end when its inhabitants move in. Building is a closed circle, including every step from the manufacture of the materials to a re-use which brooks no concept of waste: maintenance and disassembly are also planned." (definition in Gausa et al, 2003:580)

symbiosis
"Symbiosis is the mechanism by which two [or more] organisms mutually come together to enrich their development or simply their permanence. There are harmonious (pure) ones and hybrid (impure) ones. ~~We are~~ [This dissertation is] is interested in the latter." (definition in Gausa et al, 2003:581) [Author's note]

system
"(the city as system)
The contemporary city cannot continue to be approached in terms of a single place or a single shape; nor in terms of a single evolutionary stage. On the contrary, today, the city manifests itself as a complex and interactive system engendered through the accumulation of manifold, simultaneous and, often, contradictory actions and experiences: states, stages and strata.

Social progress, technical development, the interchange of information and increased mobility have fostered, in effect, a growing freedom in the occupation of space. The contemporary city thus represents itself as an increasingly dynamic system - a process." (definition in Gausa et al, 2003:583)

viscous architecture
"Viscosity is a property of materials that makes them to flow and allows them to be deformed when we apply a load under certain conditions. Technically, it is requested that the time of application of the stress TC has to be bigger at its time of relaxation TR. Silicone, pitch and asphalt are viscous materials and their applied stress decreases when we keep the same deformation; when we keep the same stress, permanent deformation is produced.

All bio-materials possess elastic and viscous properties. An architecture built with viscous materials means the acceptance of more deformations and better integration with nature. The biggest deformations are reflected in the facade and in the structural elements. Viscous opens up to a road of economic and coherent research into elastic architecture. Elastic architecture is becoming extinct.

Viscosity is manifested equally in the distributions and the limits of the façades. The combination of holographic materials and the application of small generating energy machines together with structural deformation movements and the facade are reflected in the colour of the skin of the building. Either the wind or the deformations made by the use are very much appreciated in changes of colour. Viscosity is related with time." (definition in Gausa et al, 2003:653)

0.01 - Machinaria Graphic, Author

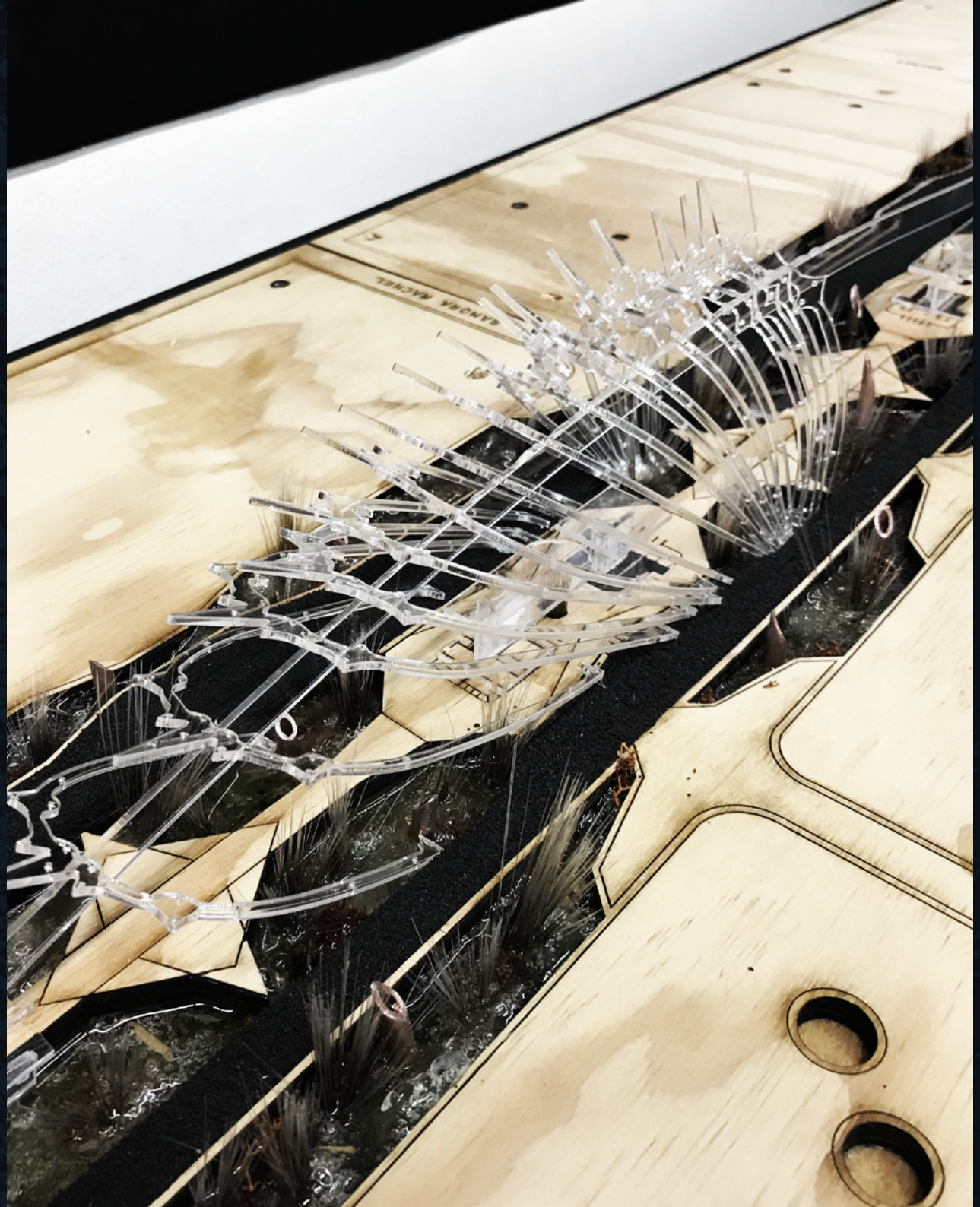
0.02 - Machinaria Graphic, Author

0.03 - Machinaria Urban three dimensional model, 2017

0.04 - Drakensberg Mountain range, Photo by Author, 2017

0.05 - Machinaria Urban Physical Model, 2017

0.06 - Machinaria Graphic - Title Image, Author, 2017



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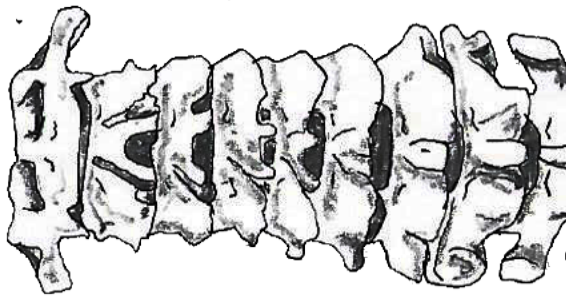

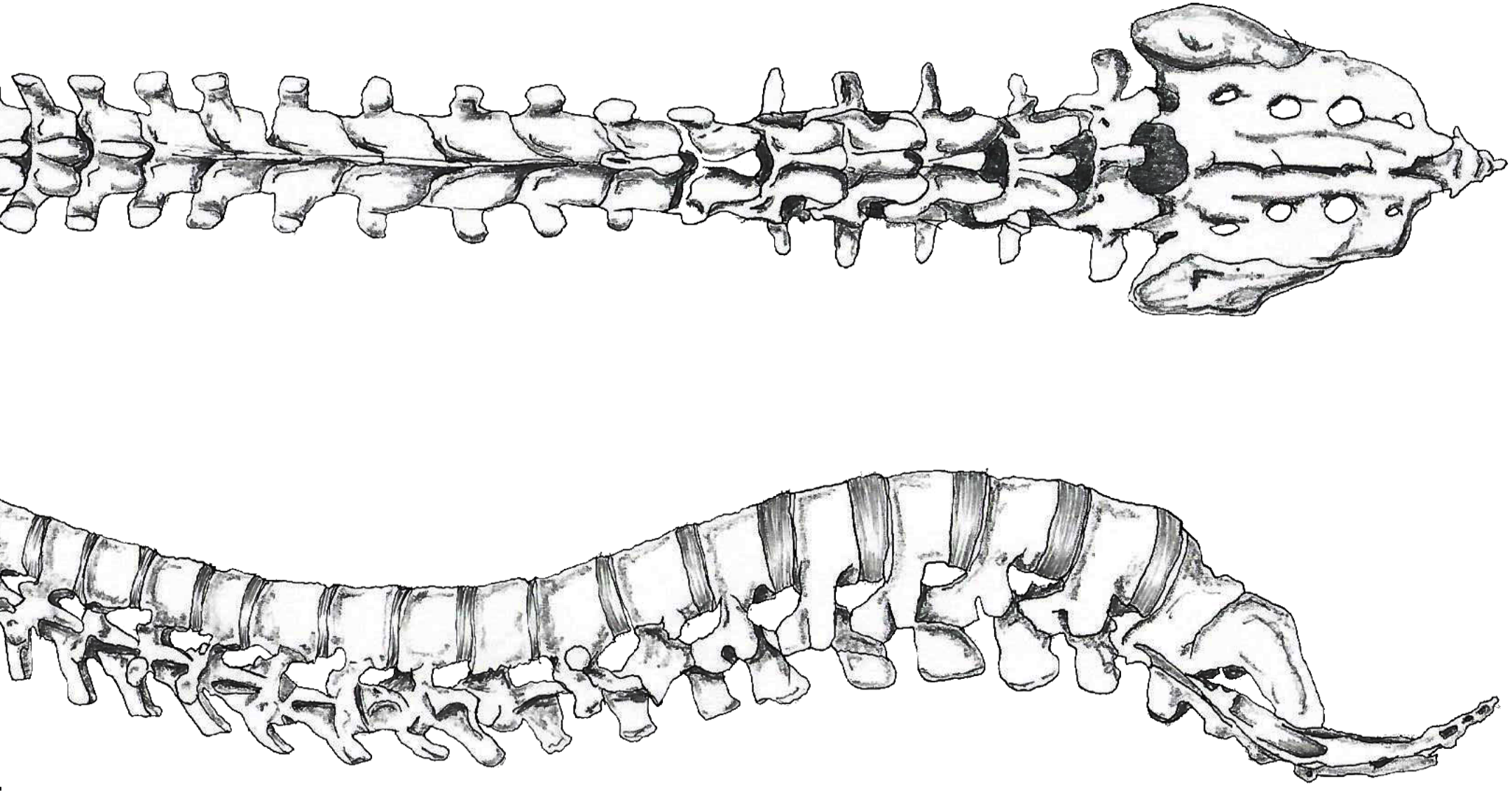

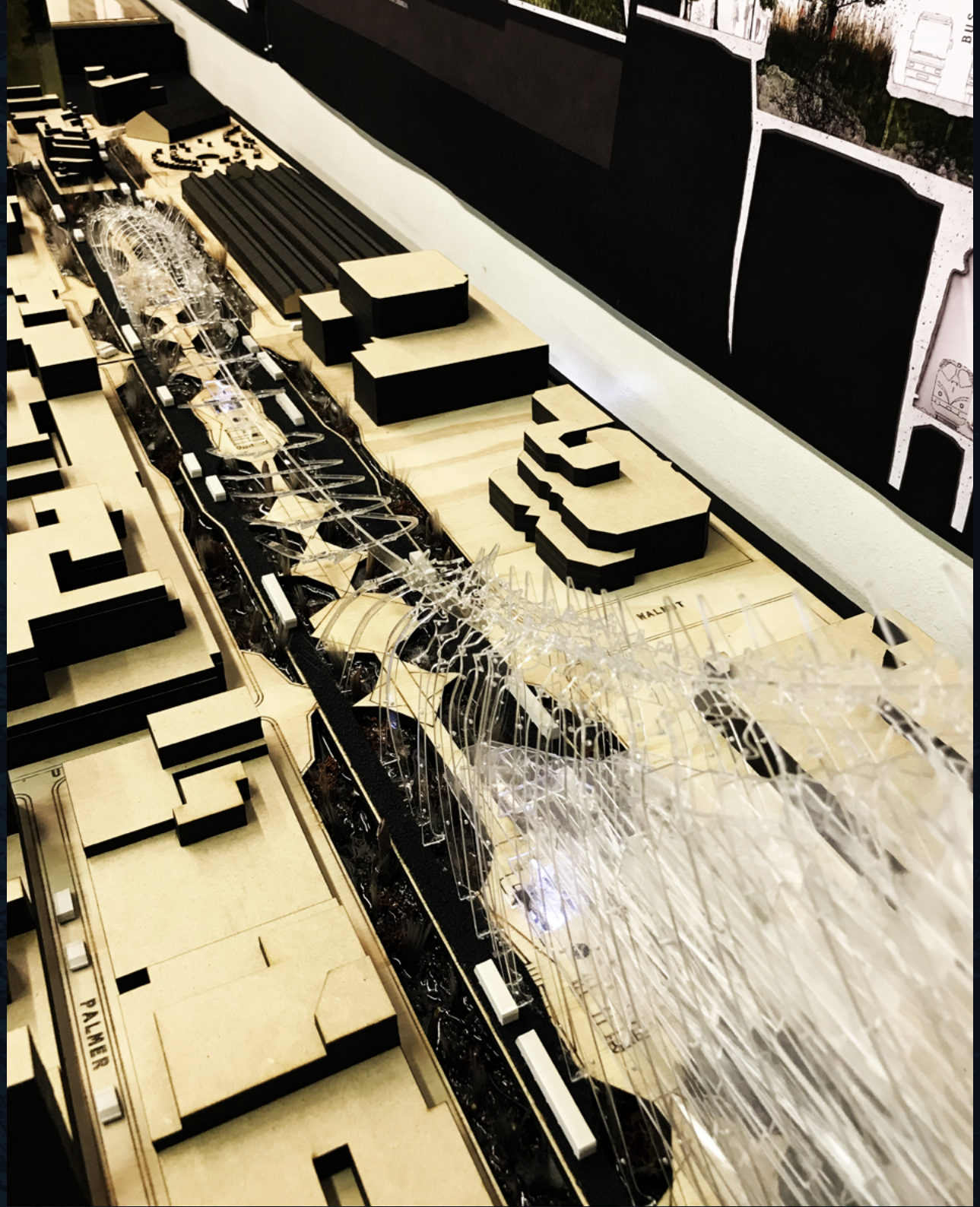
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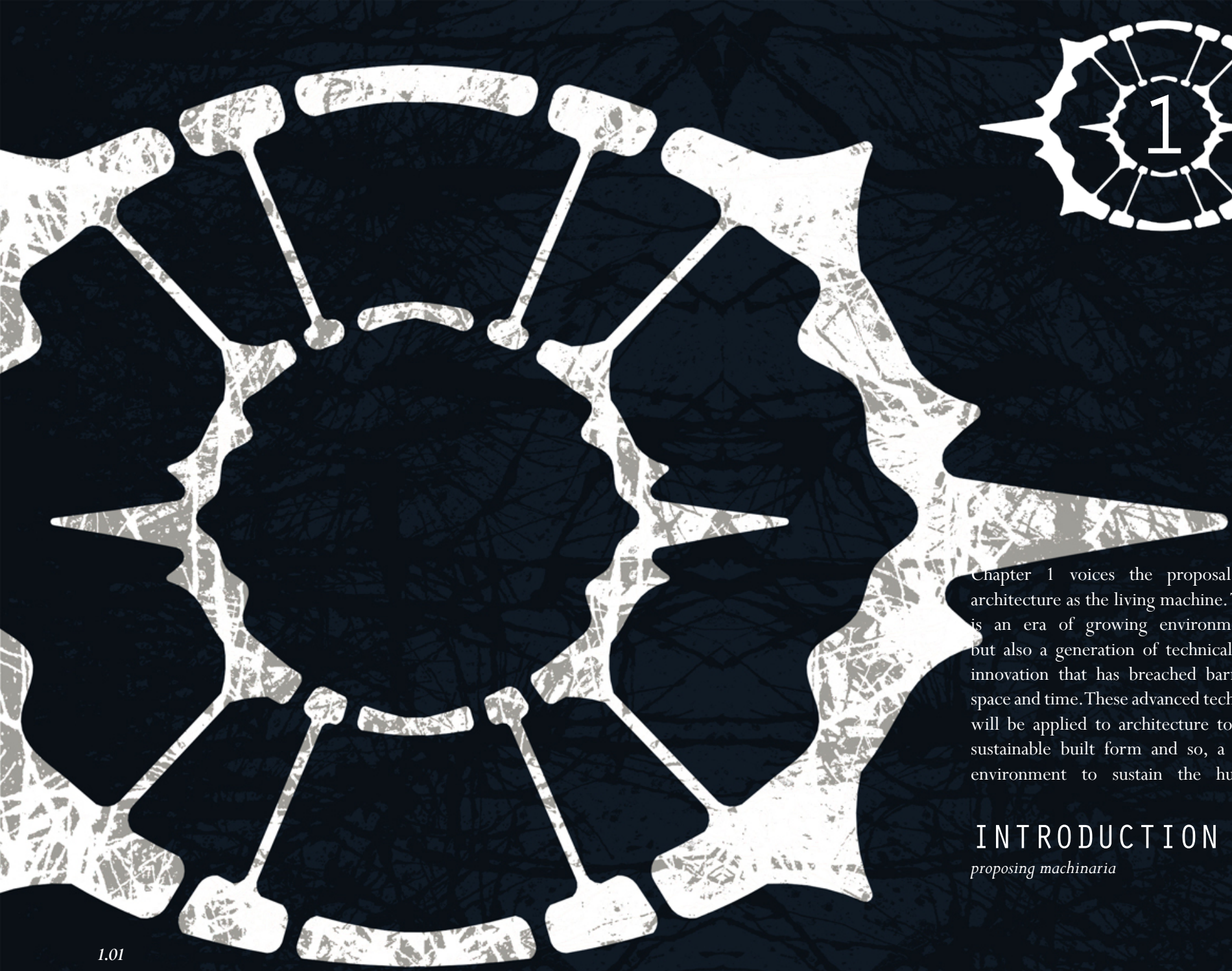


1.01

1

Chapter 1 voices the proposal of *Machinaria*, architecture as the living machine. The 21st century is an era of growing environmental cataclysms but also a generation of technical and mechanical innovation that has breached barriers far beyond space and time. These advanced technical innovations will be applied to architecture to achieve a more sustainable built form and so, a more ecological environment to sustain the human condition.

INTRODUCTION

proposing machinaria

1.1

MACHINARIA

the 21st Century African Living Machine

We abide in an era of predicted environmental cataclysms, as well as an age of bio-mechanical revolution (Kelly, 1994). The 21st century is the age of cumulative technological complexity - roughly automated machines of the Industrial Revolution have evolved to reach levels of complexities similar to those found in nature, securing the bond with human technology and nature.

Images of the machine as a living organism or the organism as a machine is as old as the beginning of its invention. This is becoming a reality. By extracting the logical principles and understanding of both mechanics and biology, complex systems are being engineered to solve issues found in our era (Kelly, 1994). Machines that print three-dimensional biological tissue, mechanisms and limbs that helps humanity overcome disabilities and technological advances that connect us physically and digitally are changing the way we view the world.

The future is now.

Machinaria encompasses the theoretical and conceptual gist of the dissertation - architecture as the living machine. It refers to merging mechanical technologies and biological material to form a *bio-mechanical* architecture that is responsive to climate change and the rise of a sustainably conscious architecture in the 21st century.

This is an architectural model for the future.

It also refers to the mechanical systems found in urbanity- how different systems work together to form a synthesized whole. This is also found in biological systems with nature working harmoniously to achieve symbiosis.

Machinaria is observed as a mechanical structure, housing different forms of mechanical units that are used to transport people. The concept of mechanics, married with that of ecology, enables us to venture into the future of architectural technology. A technology that works parallel to the cycle of nature rather than counter to it.

The future design of architecture represents a bio-mechanical expression as it is an extension of a larger systematic urban landscape. A single piece of architecture is not an isolated system but rather one which is part of an interrelated collective of systems that contributes to both society and the environment.

Vernacular African pattern-work, art and materials are inspired and sourced from nature. Colours, materials and patterns are related to and celebrates nature.
Through learning and adapting mechanisms of technological architectural advancements and merging these through the concepts of African Renaissance, we would be able to regenerate Durban's identity as an African City.

Therefore, the future of South African architecture abides in the design of living machines.

1.2

PROBLEM STATEMENT

the 21st century

21ST CENTURY EARTH:

Industrialisation of the 20th century has brought to us automated machinery that has evolved through to the 21st century, significantly granting it a complexity similar to that found in nature. This has increased the compatibility between human technology and natural systems (Frenay, 2006). Ironically, this means that the Industrial Revolution that has contributed to our technical advances, has germinated the disconnect between man and natural environments.

Moreover, it has lead to the growing depletion of these natural systems and as a result, a myriad of looming environmental crisis. Yet, this might be the cataclysmic mechanism which reconnects our severed ties to nature (Kelly, 1994).

We live in an age of exponentially booming population growth (in urban centres), waste, spatial and natural resource consumption and as a result, a festering anxiety over the consequence of global warming, rising petroleum prices and a combination of natural and political cataclysms.

There has been a growing need for urban regeneration and as a result, focus has been placed on public transportation, especially in cities (Edwards, 2011: 1). The solution is a switch between a private to public transport economy - a more socially and environmentally sustainable form of transportation. The design quality of transport facilities holds great importance in encouraging a shift in the acceptance of a new form of urban movement. Twenty-five percent of global carbon emissions are produced though transport (Edwards, 2011: 1).

In order to achieve sustainable development, energy efficient public transport rather than inefficient private means needs to be implemented.

21ST CENTURY DURBAN:

In an post-apartheid city such as Durban, the shift has more friction due to the spatial injustices placed within the city through the apartheid era. Urban inaccessibility is a concern and the perception of public transportation is associated to traits of poverty, violence and decay.

Machinaria will explore the link between human perception affiliated to spatial apartheid, the existential psychological implication of natural systems and a new, resilient form of bio-mechanical architecture.

1.02

"The more mechanical we make our fabricated environment, the more biological it will eventually have to be if it is to work at all. Our future is technological, but it will not be a world of grey steel. Rather our technological future is headed toward a neo-biological civilisation."

- *K.Kelly,* Out of Control *(1994)*

"…the 21st century is an extraordinary time - a century of extremes. We can create much grander civilisations or we could trigger a new dark age. There are numerous ways we could steer future events so as to avoid the catastrophes that lurk in our path and to create opportunities to create a better world. A revolutionary transition is ahead of us…this could be humanity's last century, or it could be the century in which civilisation sets sail towards a far more spectacular future."

James Martin, The meaning of the 21st century (2006)

1.3

THEORETICAL

approach

ECOLOGY

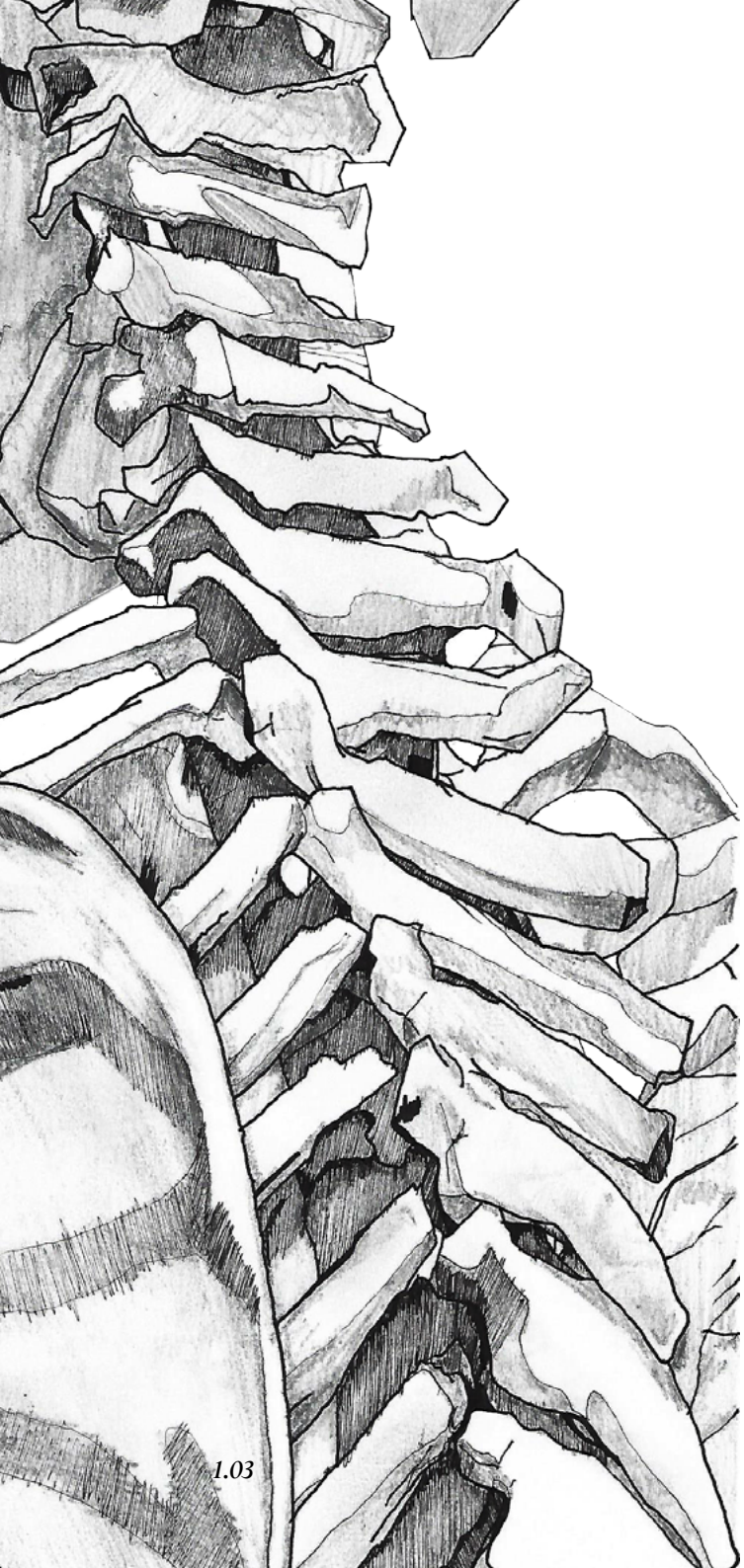
This dissertation harbours three interrelated ecological theories geared toward an understanding of symbiotic systems in nature and mechanics in order to achieve an architectural design solution that promotes urban regeneration in a post-apartheid, African city.

Ecology is used to study aspects of systematic logic in order to generate a hybrid productive architectural environment:

Urban Ecology, which refers not only the relationship between nature and the city but also the systems that work in symbiosis to make the city a mechanical entity. Cities are larger, living organisms rather than a collection of buildings (Schwartz, 2013).

Architectural Ecology, which speaks to the relationship between natural systems and architecture but also the production of a more resilient and ecologically based architecture that is able to respond to the constant change in climate, an architecture that contributes to the natural cycle rather than counter to it. This refers to a new paradigm for a sustainable architecture, a mechanical approach rather than a cosmetic one.

Human Ecology, is used to understand the interrelated relationship between the existential implication of natural systems, the human condition and the human experience within space.



1.03

1.4

PROGRAMME

Machinaria explores the nature of bio-mechanism in the age of the 21st century and how the new Industrial Revolution - the living machine - with the rise in endless technical possibilities. The goal is a productive urban environment that promotes porosity, which is both environmentally and socially beneficial: An African Transport Interchange as a Living Machine.

Programmatically, *Machinaria* will explore the nature of bio-mechanics and apply those principles found in nature as well as mechanics, to form a new architectural typology for the future of Durban – promoting Durban's once ecological topography as well as linking architecture back to the roots of African elements in design. A responsive architecture that is resilient to social as well as natural cataclysms that we face today and anticipate for the future.

The problems Durban faces on an urban scale are reciprocated globally. The rise in oil prices - yet the need for mobility, global warming and climate change – and the need for adaptation and comfort, depletion of natural systems - and the quality of life in and around cities. These issues affect us at a human scale and solutions or adaptations are made personally. There is a need for a collective solution, a macro solution to these issues. Transport infrastructure plays a vital role in the development of sustainable urban environments and it is a key component in creating successful, productive communities (Edwards, 2011).

Transport Architecture will be re-imagined as a 21st century African hybrid of both mechanical and natural systems: *Machinaria* – architecture as a living machine.

1.5

URBAN CONTEXT

site findings

SITE CHOICE AND LOCATION

Context and location plays a vital role in positioning the Bio-Mechanical African interchange of the 21st Century, it provides the resources necessary for the operation, sustainability and systematic typology of the building and must therefore be directly related to the architectural programme. For the purpose of the dissertation, a site had to be chosen which would provide the social, ecological and urban aspects necessary to establish an Interchange as a systematic hybrid environment.

A historic site that harbours qualities of economic and urban development as well as the first rail lines to be established - Durban Inner City, Centrum - was chosen not only to stress the validity and need for a Transport Interchange within the city but also an architecture that is central and focused to reclaiming Durban's identity.

THE 2040 VISION FOR THE INNER CITY OF DURBAN

Within this policy context for future development, the vision for the Inner City of eThekwini has been proposed as follows:

By 2040 the Inner City of Durban will be

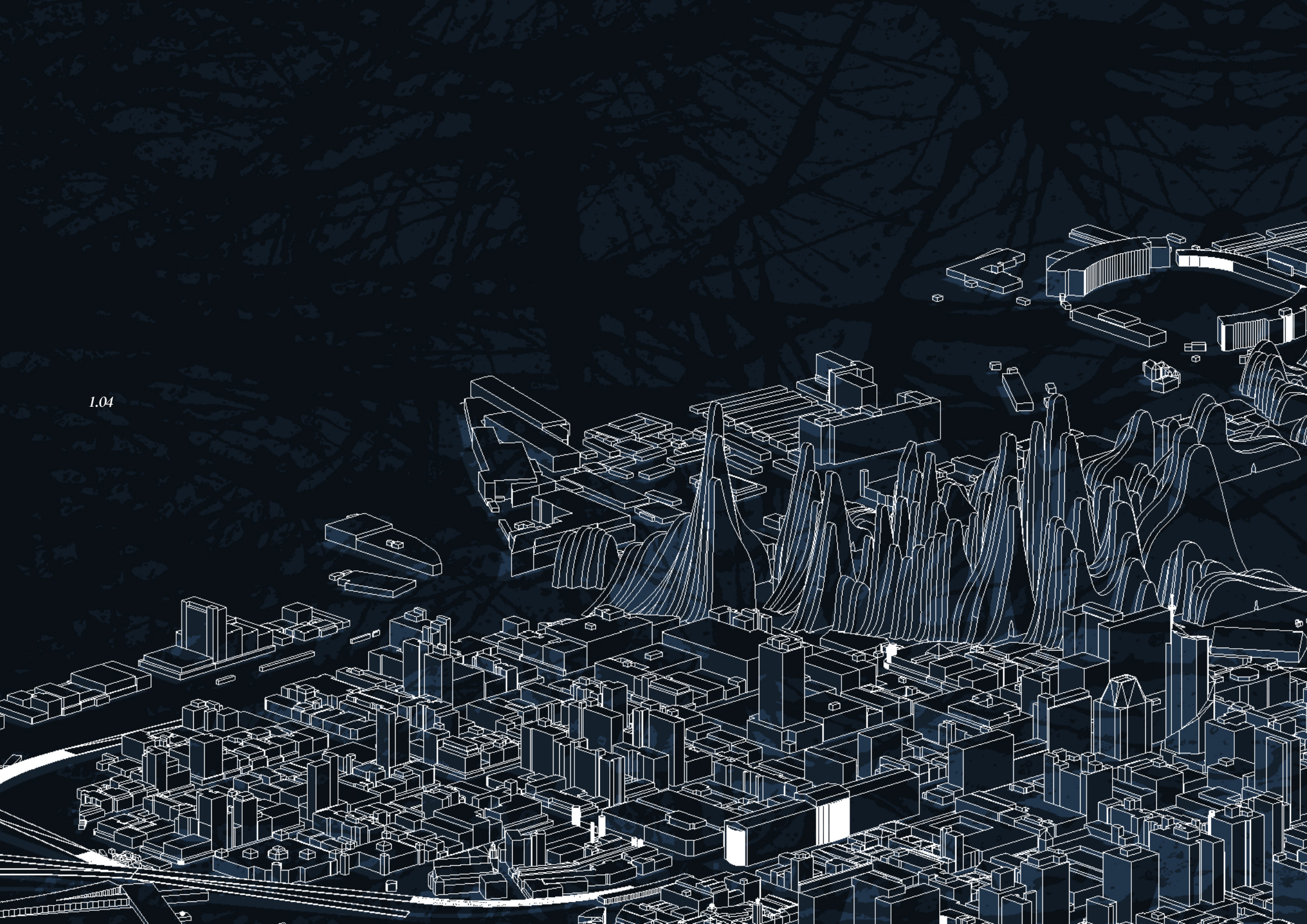
Africa's leading, most vibrant, liveable, walkable City Centre providing economic, residential, sporting and leisure opportunities for all

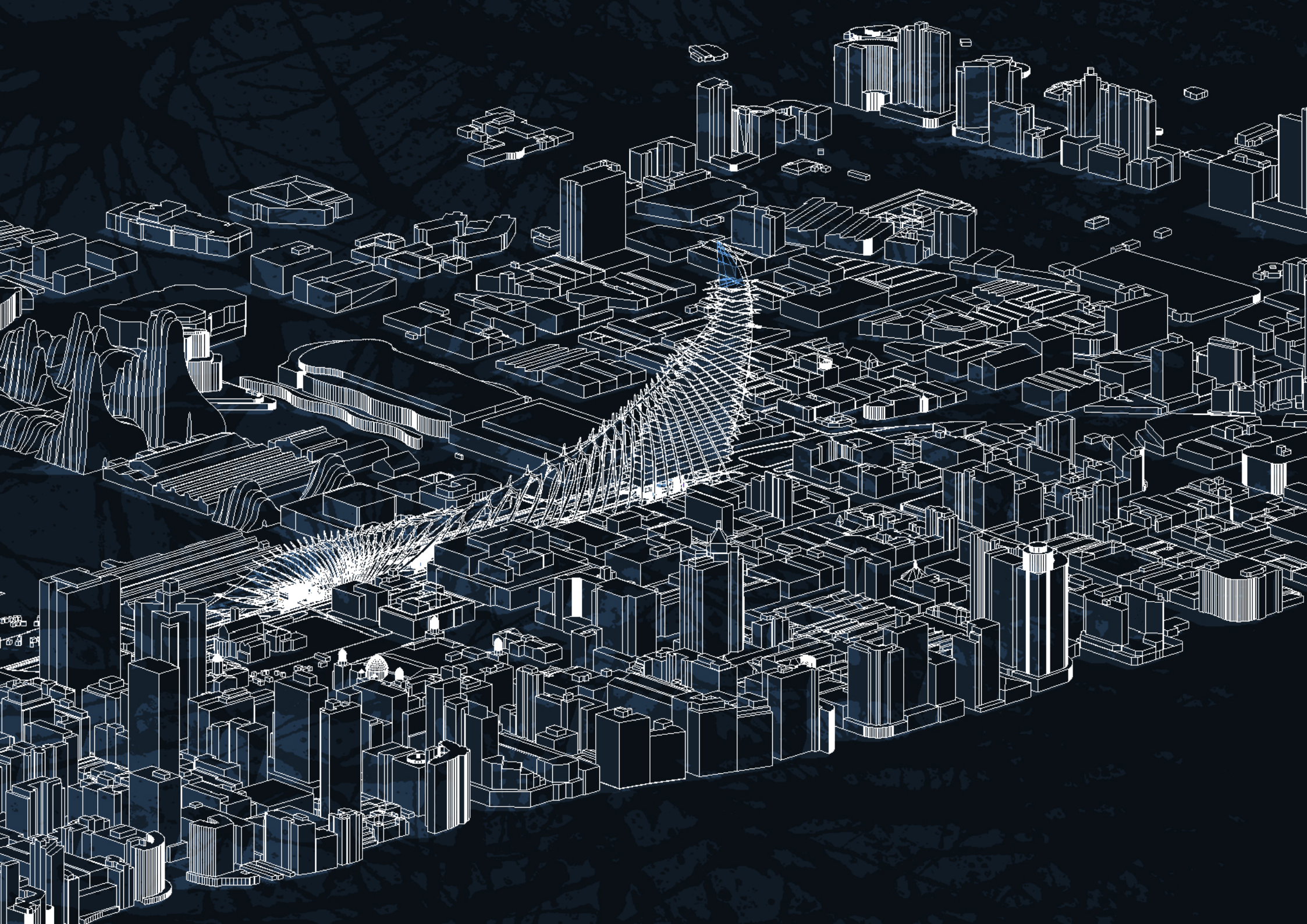
PROMOTING A CONNECTED CITY

All cities throughout the world have developed around a set of interconnected streets and the spaces they form. The greater the connectivity the higher the intensity of development. Similarly, the Inner City of Durban has developed around an interconnected grid of streets within the core CBD area.

The area to the north of the Inner City is, however, disconnected from the west by the railway line and Umgeni Road. This area remains underdeveloped but provides a massive opportunity for the growth of the Inner City area. The CBD core also suffers from congestion at certain times of the day and ongoing regeneration and densification requires a reconceptualization of the road network and public transport system as well as elevation of non-motorised transport in importance.

1.04





1.05

1.6

research

QUESTIONS

What is the appropriate architectural response for an inter-modal Public Transport Interchange in South Africa that can work toward a socially, economically and naturally ecological city, promote sustainable transportation and accessibility in and around a growing, developing African city?

Primary Question:

1. How could transport architecture align with the 21st century paradigm of the living machine in an African, post-apartheid context?

Secondary Questions:

2. How can the public transport interchange be reprogrammed as a sustainable urban entity despite 21st century transport mode vicissitudes?

3. How can different modes and forms of transportation programmes (Train, bus, taxi, bicycle and pedestrian) be programmed to form a symbiotic urban architectural relationship?

4. How can the transport network be re-imagined within the context of Durban in the 21st century?

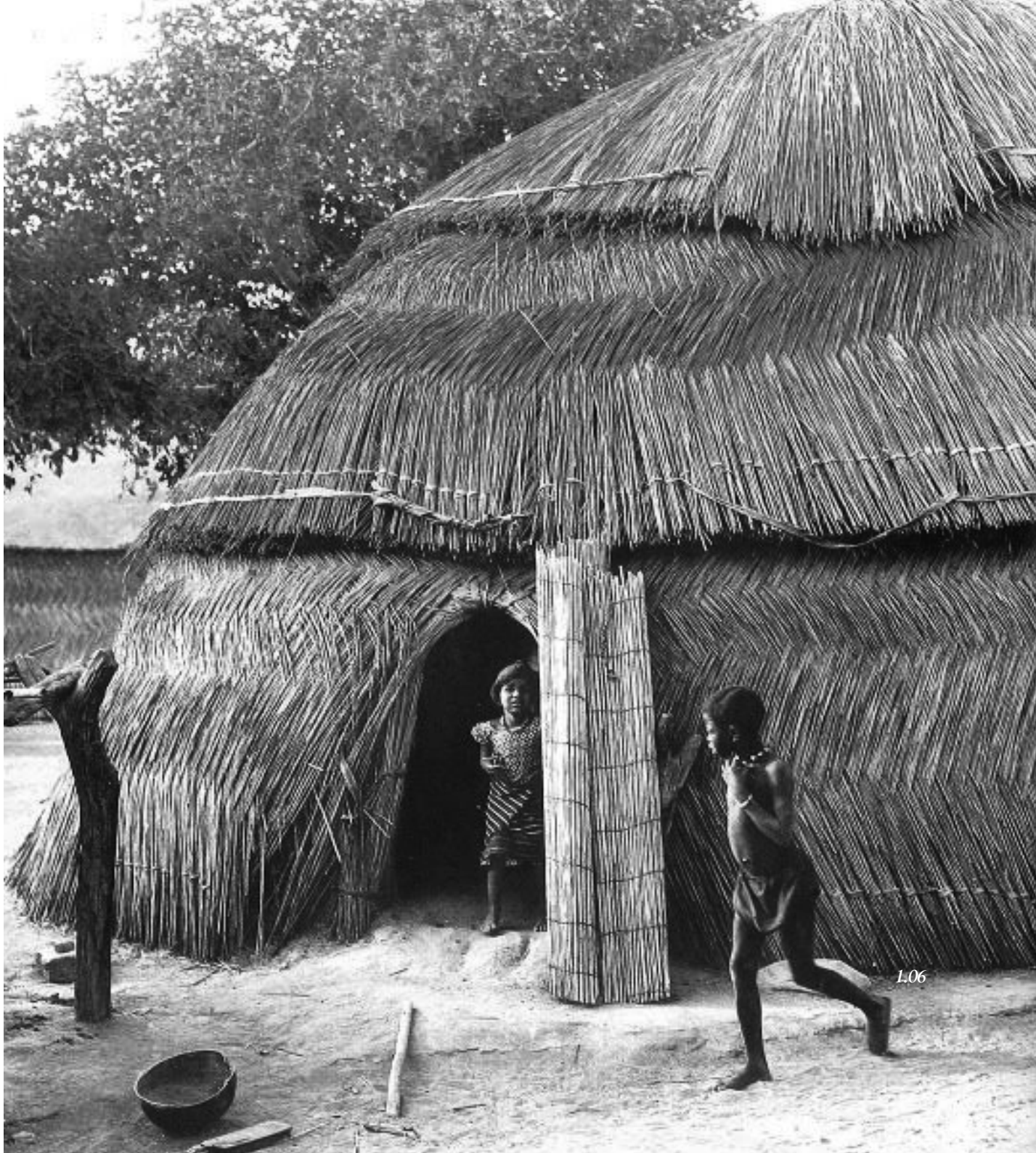
1.7

ARCHITECTURAL PROBLEM

The lack of cultural and social identity within the current state of South African architecture and design is the most dire issue with South African architecture. Even after democracy, it seems as though South African architecture has not yet achieved freedom in terms of an architectural model that is truly African.

African design harbours the unique ability to grasp images, patterns and natural beauty and replicate it through design pieces. Vernacular African architecture acknowledges natural systems and the overall ecology of biology and weaves it with either functional design or artwork. This is what grants African design its unique identity - its critical regionalism. The science and logic of vernacular African architecture is extracted from lessons learnt nature and natural systems - natural ecology

The link between architecture and a bio-mechanical living machine lies in the teachings of vernacular African architecture. The future of South African architecture exists in the marriage of African design and bio-mechanical technologies.



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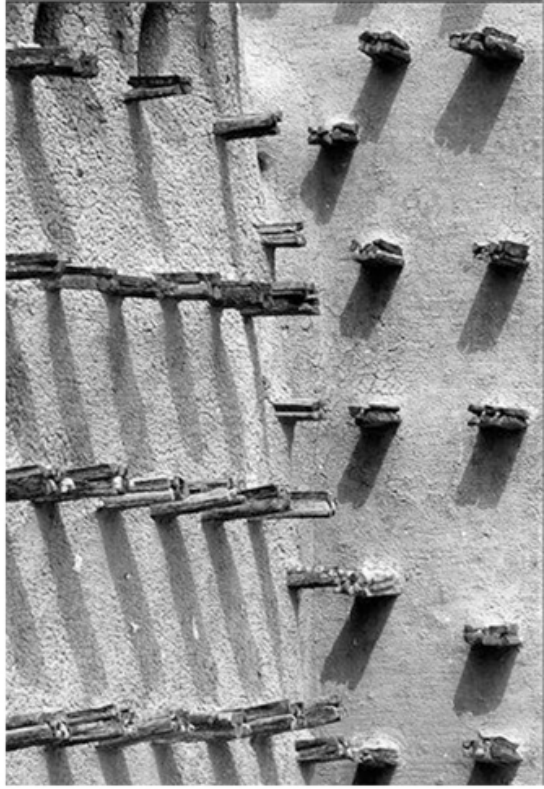
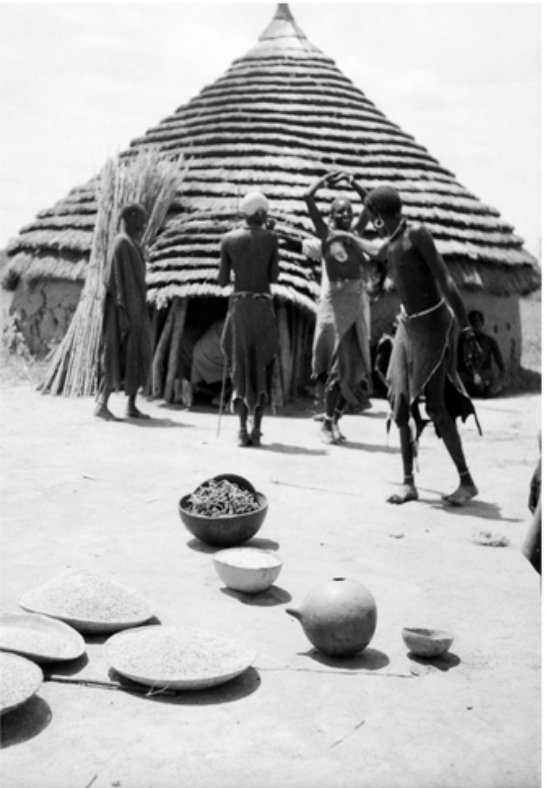




1.08

1.8

CONCEPT

theoretical concept and physical manifestation

The concept of 'Architecture as a Living Machine' is explored, both theoretically and architecturally.

This relates to both the hybrid approach of a bio-mechanical and architectural conversation and to the design of architecture as an extension of a larger systematic urban landscape. An architecture that integrates transport infrastructure, mechanical systems, architectural technology and African design strategies to produce social programmes and promote ecologies (social, economic and natural).

An African architectural revolution is overdue. There is a need to break the shackles on architecture in the African region and take back African identity, technologies and vernacular logics found in African architecture. The West has influenced and dictated the way Africans build, this is illogical as our climate, society and identities demand an African alternative.

A hybrid of African design and advances in technology is the architectural driver for *Machnaria*, the living machine.

1.9

design

INFORMANTS

1.9.1 *conceptual informants*

The concept of *Machinaria*, architecture as the living machine is applied throughout the dissertation as an all-purpose metaphor - the inherit hybridity in the statement indicated programmatic decisions , site choice, design decisions and resukting technology used in the design.

Machinaria is a term coined by the author as a theme for the design and dissertation of the Public Transport Interchange within the Durban Inner City. It engulfs the overall intention of the dissertation.

Architecture as the Living Machine: embracing the technological age to create a responsive architecture (climate, pollution, light and air) through bio-mechanical systems.

1.9.2 *systematic informants*

As a subset to the metaphor of the Living Machine, the interconnected ecologies of systematic environments guides the making of the architecturak spaces. Primary systematic informants are inclusive of site specific natural logic and extant environmental conditions, as well as the proposed integration of transportation and ecology with the architectural programme.

1.9.3 *urban vision*

The proposed urban vision and site exploration re-imagines the existing contextual landscape and therefore forms an integral part of the design of the interchange. This vision addresses fragmented elements within the larger context of the Durban Inner City, Centrum is redesign as part of a larger, systematically integrated environment to the interchange.
The envisioned social and urban energies resulting from the interchange proposal will therefore guide the programmatic and architectural design decision making.

The Urban Machine - an architecture that promotes urban systems. architecture as a public domain that connects, filters and responds to the urban condition.

1.9.4 *contextual informants*

In addition to the proposed vision for the interchange, the direct existing context is also a key architectural informant. This context guides programmatic decisions and the design of the proposed urban vision, and despite urban design additions, much of the existing urban landscape endures.

As the interchange is intended to act as an extension of the urban landscape - the heart of the inner city - context of existing and envisioned urban amenities are of dire importance. The existing landscape of the Durban Inner City is saturated with heritage and remnants of the colonial regime, which are integrated as contextual informants in the architectural design.

DURBAN'S NERVOUS SYSTEM

1.10

dissertation

INTENTION

1.10.1 *general intention and theoretical aims*

The intention is to re-examine an architectural understanding in relation to the 21st century paradigm: architecture is redefined as an integrated system of ecologies, not merely a built form.

An attempt to establish an architectural precedent for a bio-mechanical model in spatial terms - to reconnect human spaces to natural ecologies.

To challenge and redefine socio-cultural and spatial perceptions on public transport in South Africa, especially Durban.

1.10.2 *urban intention*

To catalyse the urban regeneration process of the Durban Inner City through the introduction of a new form of transport architecture - through the creation of an inter-modal public transport interchange which transcends accessibility and movement to be an urban node that encourages cultural expression, urban identity, social cohesion, economic growth, urban accessibility and ecological rejuvenation of the Durban Inner City context and beyond.

Reconnect the Durban Inner City to the greater context of Durban - suburbs, peri-urban areas and townships. This will generate the opportunity to repopulate the lost and once oppressed urban landscape and thus celebrating the fragmented remnants of the original urban fabric.

Redefine the perception of the Durban Inner City as a lifeless and disjointed urban wasteland and the cultural and ethical bias towards public transportation in general by encouraging cultural understanding of public transportation and creating an architecture of dignity as well as culturally uplifting to the inner city.

1.10.3 *architectural intention*

Challenge the conventional transport architecture programmatic and spatial arrangements through the design of a building as a living machine - programme transport infrastructure and architecture as a place for human interaction and ecological benefit and promotion.

Design a building as a systematic extension of the surrounding urban landscape and integrate transport architecture as a part the urban landscape.

An architecture that acts as an urban engine, working to ensure urban revitalisation and the freedom of urban accessibility in a once spatially segregated land.

Integrate Durban's industrial, developmental, harbour and ecological heritage and the historic, colonial presence on site as part of the new architectural intervention, so that the interchange may impose a new layer of spatial narrative on its contextual landscape.

1.11

dissertation

VISION

Instead of the current systems of transportation and transportation architecture which propagate increasing socio-ecological disconnect and carbon pollution, 21st century Transport Architecture has the potential to catalyse large scale urban regeneration.

The dissertation examines transport architecture and infrastructure in a 21st century context, where the hybridity between nature and technology is encouraged in spatial expression. Transport architecture is refocused towards inter-modal connections in terms of public transportation as well as social interaction - a programmatic demassification which reconnects human environments to nature and its processors. Architectural solutions are not focused on the design of an isolated building, but on the creation of living systems.

This approach encourages collaboration between different industrial processors and social programmes to resolve of pollution, climate change and social disjointness and redefines 21st century transport architecture as the ‘living machine’.

1.12

design

PREMISE

1.12.1 *urban re-vision*

The proposed urban vision for the Durban Inner City, Centrum site and the surrounding urban network is guided the Local Area Plan compiled by the eThekwini Municipality and used as a tool for the urban design for the Interchange, *Machnaria*. The phasing of the interchange is assumed to be on par with the contextual urban design and development that is proposed for the dissertation. The proposed rail line for the interchange will be the old rail line, reinstated. This was the first rail line established in Durban and the second rail network in the whole of Africa, coming after Egypt.

The proposed bus and rail systems are extracted from the LAP's plan - IRPTN (Integrated Rapid Public Transport Network) namely: Rail, Bus, Minibus taxi and Metered taxi and non-motorised transport. The IRPTN incorporates a Bus Rapid Transit (BRT) system, which is a high frequency road based bus system that consists of trunk, complimentary and feeder services to provide a modern, well-maintained, comfortable and efficient system. The BRT system, as a major feature of the IRPTN will integrate with existing transport modes to improve and simplify commuter's trips.

1.12.2 *delimitations and limitations*

For practical purposes, the architectural programme has been limited to the slender, linear shape of the site yet this is the ideal shape for a vertically integrated inter-modal interchange.

The location of the site, being the Durban, Inner City, Centrum site is ties in with the literature of the dissertation - the need for accessibility within the inner city as well as the historic and heritage rich context - market square, Durban City Hall, the harbour and the beach front. The exhibition (Durban Exhibition Centre) and conference (International Conference Centre) are neighbours to the interchange and adds to the relevance of site choice.

By focussing on a regenerative approach, the dissertation attempts to solve large scale issues both systematically and holistically. The architectural design therefore crosses disciplinary boundaries and incorporates transport, social, ecological and urban responses as part of an architectural solution. Where possible, external expertise in these fields will be sought and interviewed.

1.12.3 *assumptions*

This dissertation assumes that the current state of the Durban Inner City is currently highly fragmented under-utilised and undervalued. The current state of public transport in Durban is assumed to be inefficient and unsafe.

There is a negative perception surrounding public transport in South Africa, especially in Durban.

There is a growing need for public transport as fuel prices increase and environmental and climate problems become more detrimental.

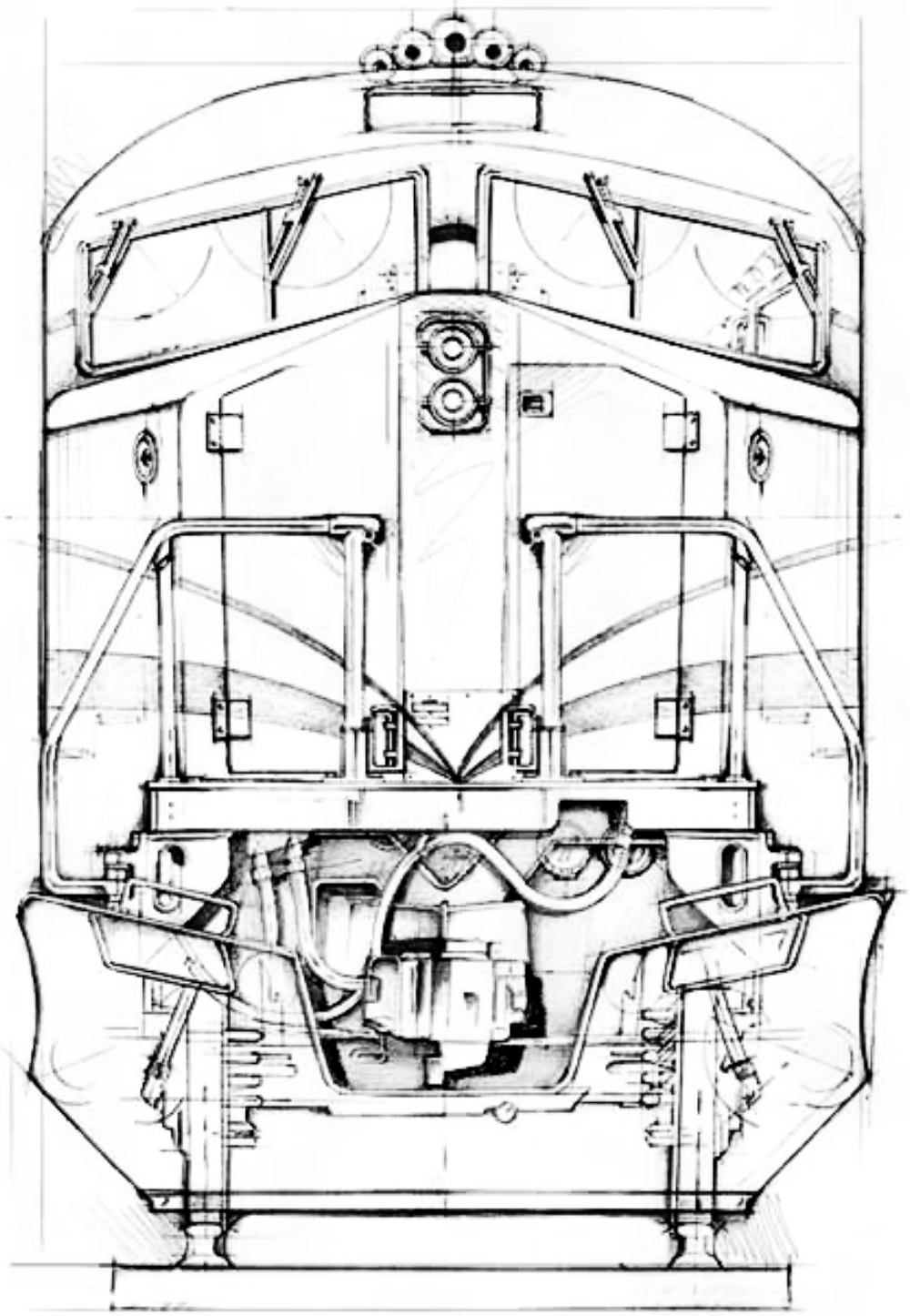
Architecture in isolation will not be able to regenerate the urban environment especially through transport architecture.

South African architecture lacks African culture and identity, there is a need for an African architectural model in Durban. The link between man-made engines and sustainable (responsive to climate, pollution etc.), ecological architecture lies in the logic of vernacular African architecture.

1.13

chapter

OUTLINE



2.01

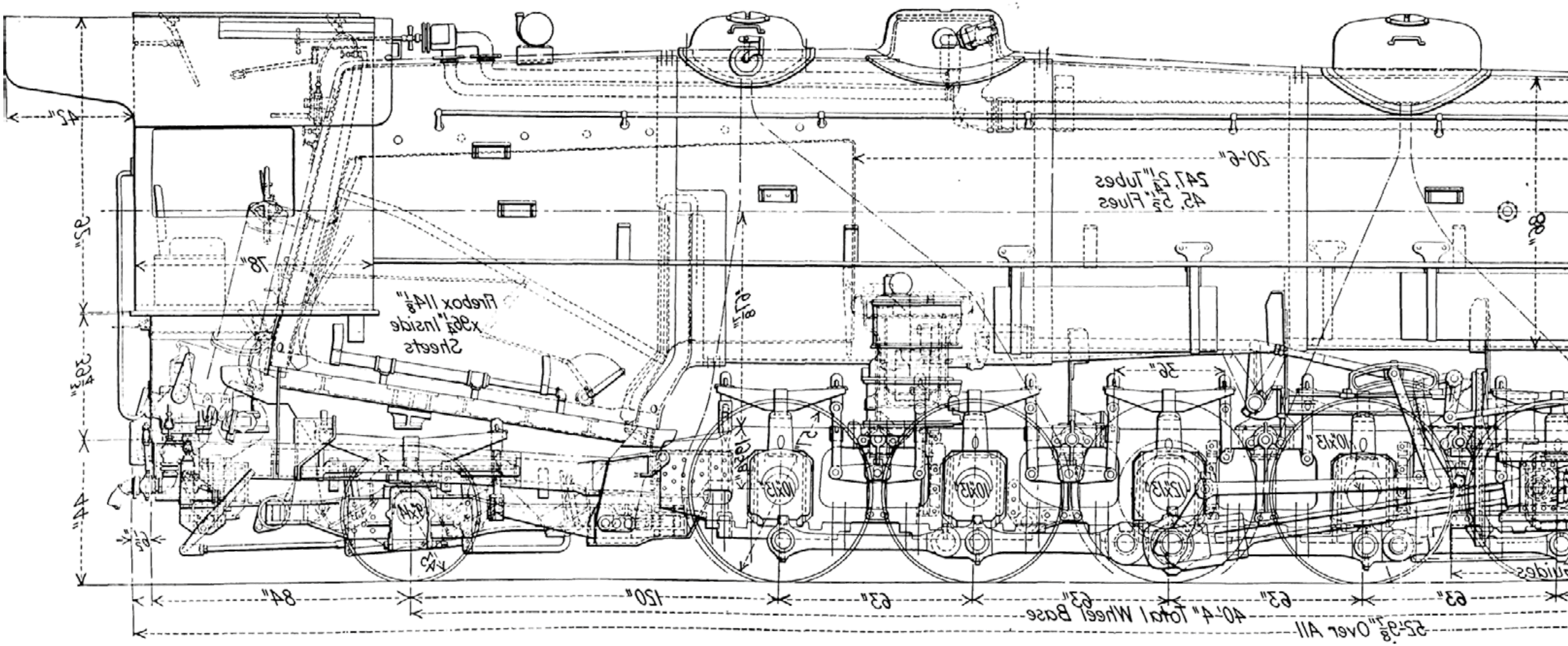
2

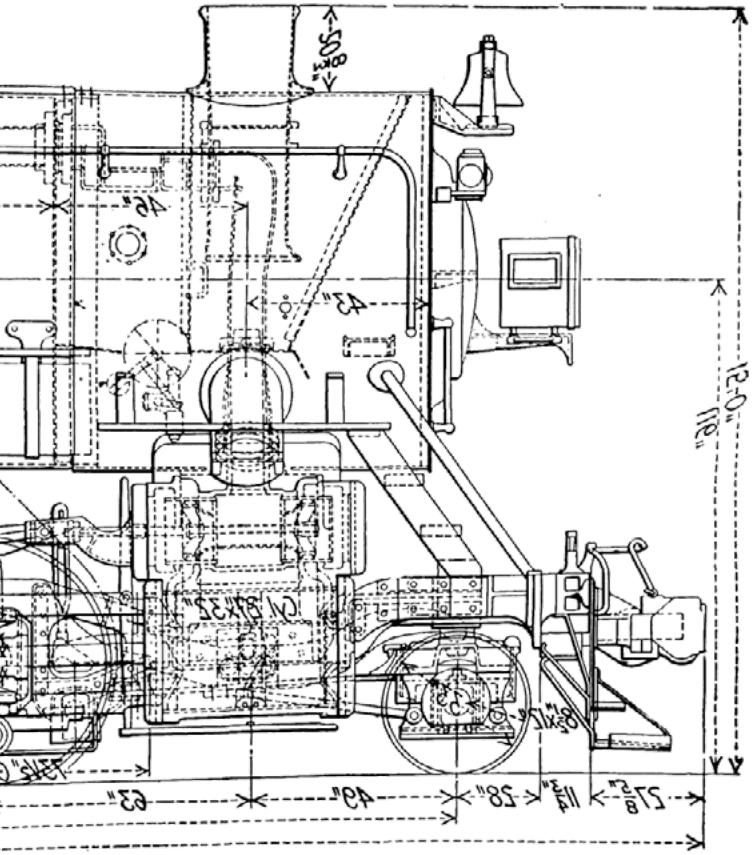
Chapter 2 voices the chosen programme for *Machinaria*, that of the Transportation Interchange. The programme for *Machinaria* is not only discussed in terms of its spatial requirements and processes, but also in terms of the social and ecological value and the impact it would potentially have on the urban fabric. One of the main objectives is to redefine Durban's identity as an African city. Here, approaches to the segregated state of Durban's urbanity are explored – socially and ecologically – into a regenerative urban environment.

The Local Area Plan (LAP) by the eThekwini Municipality and the Urban Hub Design Toolkit drafted by The National Treasury are studied and components and concepts that are in line with the Interchange (Machinaria), are extracted from the overall documents, as a future plan for the Inner City of Durban.

PROGRAMME

the 21st century african interchange


Firebox 114 1/8" x 96 1/4" Inside Sheets
247, 2 1/4" Tubes
45, 5 1/2" Flues
20'-6"
40'-4" Total Wheel Base
52'-9 7/8" Over All



re-defining

PROGRAMME

The 21st century is era of endless opportunity and possibilities. With advances in technology, scientific and medical research, almost nothing is impossible. It is also the era of exponential population growth and with that, the exponential consumption in resources and ensuing waste. In an attempt to alter these global climate and cultural depletions, the way in which we design buildings also needs to be re-scripted.

One of the most pressing concerns we face today, is how the industrial forces which made the 21st century possible – both in technological advancements as well as ecological crisis – will sit within the systemic, hybrid world, emerging before us (Frenay, 2006: 37). Nothing comes without a price and so, a system where waste and by-production is almost eliminated needs to be established. Another issue is the state of our Inner City, Durban. Undervalued and underutilised, after the apartheid era, the city has lost its identity and so, its heart. African vernacular architecture holds a close and sacred relationship with ecology. This is the missing link to creating an African architecture that reinstates the identity of Durban being and African city as well as the link between the built environment, nature, resilience, technology and sustainability – a bio-mechanical architecture.

Programmatically, *Machinaria* will explore the nature of bio-mechanics and apply those principles found in nature as well as mechanics, to form a new architectural typology for the future of Durban – promoting Durban's once ecological topography as well as linking architecture back to the roots of African elements in design. A responsive architecture that is resilient to social as well as natural cataclysms that we face today and anticipate for the future.

Transport Architecture will be re-imagined as a 21st century African hybrid of both mechanical and natural systems: *Machinaria* – architecture as a living machine.

2.03

ORIGINS

transport infrastructure

Transportation has, for centuries, been the backbone for development and progression of civilisations. It has shaped cities, influenced economies and granted thousands, if not millions of people, opportunities of social and economic growth. The state of public transportation within a city determines the state of that city, its services to citizens and the condition of the urban environment.

A solid, progressive transport infrastructure system has always been of utmost importance to the South African economy. With multi-billions of rands being pumped into infrastructure development, South Africa has some of the largest air and rail networks on the African continent and a comprehensive network of national, regional and suburban roads linking all of the major and 'off the beaten track' cities and towns. South Africa's ports are amongst some of the most famous in the world, with the Port of Durban, in KwaZulu-Natal, being the biggest and busiest shipping terminal in Africa and the fourth biggest in the Southern Hemisphere. Rail lines in Durban, linking to the Port, were the first in South Africa and the second rail system to be established in all of Africa, coming after Egypt.

South Africa's transport sector has been highlighted by the government as a crucial engine for economic growth and social development, and the government intends on spending millions more on developing our national transport infrastructure further. An integrated, efficient, public transport network needs to be established in order for the city of Durban to progress as an economically, ecologically and socially driven society and city.

spatial

CRISIS

Spatial apartheid was used as a tool to separate people of different demographics within spaces, placing emphasis on the superiority on Whites and disregarding the basic human rights of those with a darker colour skin. One of those rights being that of spatial occupancy, public and private.

The boundaries of spatial apartheid exceeded fixed space – from beaches and benches to homes and property ownership - and was implemented on different modes of transportation. Spatial apartheid within transport systems is one of the defining forces that have influenced how the city of Durban works today (as a legacy of apartheid) the perception of space (public) and public transportation.

The apartheid framework has left the city disjointed, has displaced its citizens and so, the heart of the city as well. There is a need for an urban environment that is accessible through public transportation - to revive the heart within the city that will pulsate life back into the urban fabric, to stitch close the wounds caused by lashes of the apartheid regime - to join communities, races and classes within an existing culturally diverse society.

2.04

2.05

TRANSPORT STRATEGIES

for durban 2040

A). CREATING A BALANCED TRANSPORT SYSTEM

The current transport modal split within eThekwini indicates that approximately two thirds of all trips are made by public transport and walking (cycle is currently negligible). Yet, the current transport system is focussed on the private car, with wide streets and/or parking dominating the public realm, making it difficult for other modes such as walking, cycling and public transport to operate in a safe and efficient manner. This trend of catering to the needs of the private car to the detriment of other modes is not sustainable, for a number of reasons, including inter alia:

The road network currently occupies approximately 11% of the total area of the Inner City and 32% of existing developed area/blocks. This is already considered to be a substantial proportion, and thus the provision of additional road infrastructure to meet private car demands is going to be at the expense of potentially developable area;

The car is the most inefficient form of transport for in particular inner city movements. The space required to transport the equivalent number of people by car versus bus is approximately 5 times greater;

Increased car usage has an adverse effect on the environment, in terms of noise, air pollution and on the general quality of life and amenity of an area.

Thus, Durban 2040's transport plan is focussed on creating a balanced transport network, which acknowledges that all modes have a part to play in moving the City, but that priority will be given to the higher capacity modes. In addition, the allocation of space for each mode will be provided on a more equitable basis, ensuring that the functionality and form of the transport network responds to both the users as well as the growth requirements for the Inner City. In line with the walkable city concept, walking will be the primary mode for internal city trips and the focus will be on creating and promoting a walk transport network across the city that is both functional and efficient, and that is supported by an attractive and safe public realm.

b). PROMOTING PUBLIC TRANSPORT

The full growth potential of the Inner City can only be realised if the efficiency of the transport system is maximised. Whilst the private car has been the focus of attention thus far, looking ahead, the focus will shift to higher capacity modes to cater for the increased population and development. An attractive, efficient and effective public transport system comprising train, LRT, BRT, bus and bike share is critical to achieving the developmental target. The following are the critical actions required to promote public transport:

Active priority of public transport over private transport from a funding and infrastructure perspective;

Investment in public transport infrastructure and fleet to provide a high quality system;

Provide a safe, efficient and integrated public transport service for all.

c). LAND-USE TRANSPORTATION INTEGRATION

Role of transportation is to connect people with the goods, services, activities and other people – which then forms the life blood of an economy. Thus the aim in developing a land-use and transport plan is not to reduce trips, but to reduce trip length, travel time and to encourage trips by walking, cycling and public transport.

To achieve a move towards sustainable transport it is essential that the development design encourages the most sustainable of all modes of travel for shorter journeys – walking and cycling and that public transport is the mode of choice for medium and long journeys.

Thus in the development of the Inner City, neighbourhoods have been centred around public transport, with a core of higher density commercial, residential and social facilities with active edges radiating out to a distance of about 400 meters which is a comfortable 5-minute walking distance. This facilitates access to key amenity by walk and cycle whilst public transport, for the longer journeys, is easily accessible by both these modes.

In addition, the mixed-use development form encourages a variety of activity 24 hours a day (as opposed to residential dormitories or office parks which are inactive for half the day), thus facilitating the implementation of a more cost effective public transport system and potentially reducing the need for high subsidies.

D). IMPROVE SERVICE LEVELS AND EFFICIENCIES

Critical to the success of the City is a high quality transport system that efficiently and effectively provides travel options to traverse to and within the City. Whilst the focus is on public transport, and ensuring that it is safe, reliable and provides a high level of service, attention needs to be given to all modes to ensure that the overall system operates as efficiently as possible.

(i) Travel Demand Management

The transport system takes maximum strain during the traditional peak hour, when most people want to travel for primarily work purposes. Promoting and incentivising travel outside of the peak hour, particularly private transport users, dramatically reduces this strain. Whilst this is dependent on a number of external issues, as part of the transport plan, engagement with employers and business as well as active campaigns to promote travel outside the peak is an essential component of the transport plan.

(ii) Integration of systems

Integration of all systems, from walk, cycle, public transport to private transport is critical to ensure an attractive transport system and to provide people with as many options to travel without undue impedance. Within the Inner City, walk and cycle are expected to be the dominant form of transport for short trips, and walk and cycle to public transport for longer trips. Thus, public transport terminals and stops need to integrate these modes into their design and operations. Likewise parking structures within the Inner City also need to be integrated with the public transport, walk and cycle network to provide coverage across the City. Apart from physical infrastructure, ticketing and payment systems for each of these modes needs to be integrated to ensure "seamless" travel across the City.

(iii) Policy and regulations

Parking and freight management schemes need to reflect the overall goal of promoting public transport and ensuring the transport network operates as efficiently as possible. The conversion of minimum parking standards to guideline or maximum standards would limit the overall level of parking in the Inner City, thus potentially reducing private car volumes and making public transport a more attractive choice. The creation of non- exclusive parking for applicable categories of development, to create parking pools, would result in this parking being available during off peak or event days, thus making parking utilisation for the entire Inner City more efficient.

THE TRANSPORT PLAN

for durban 2040

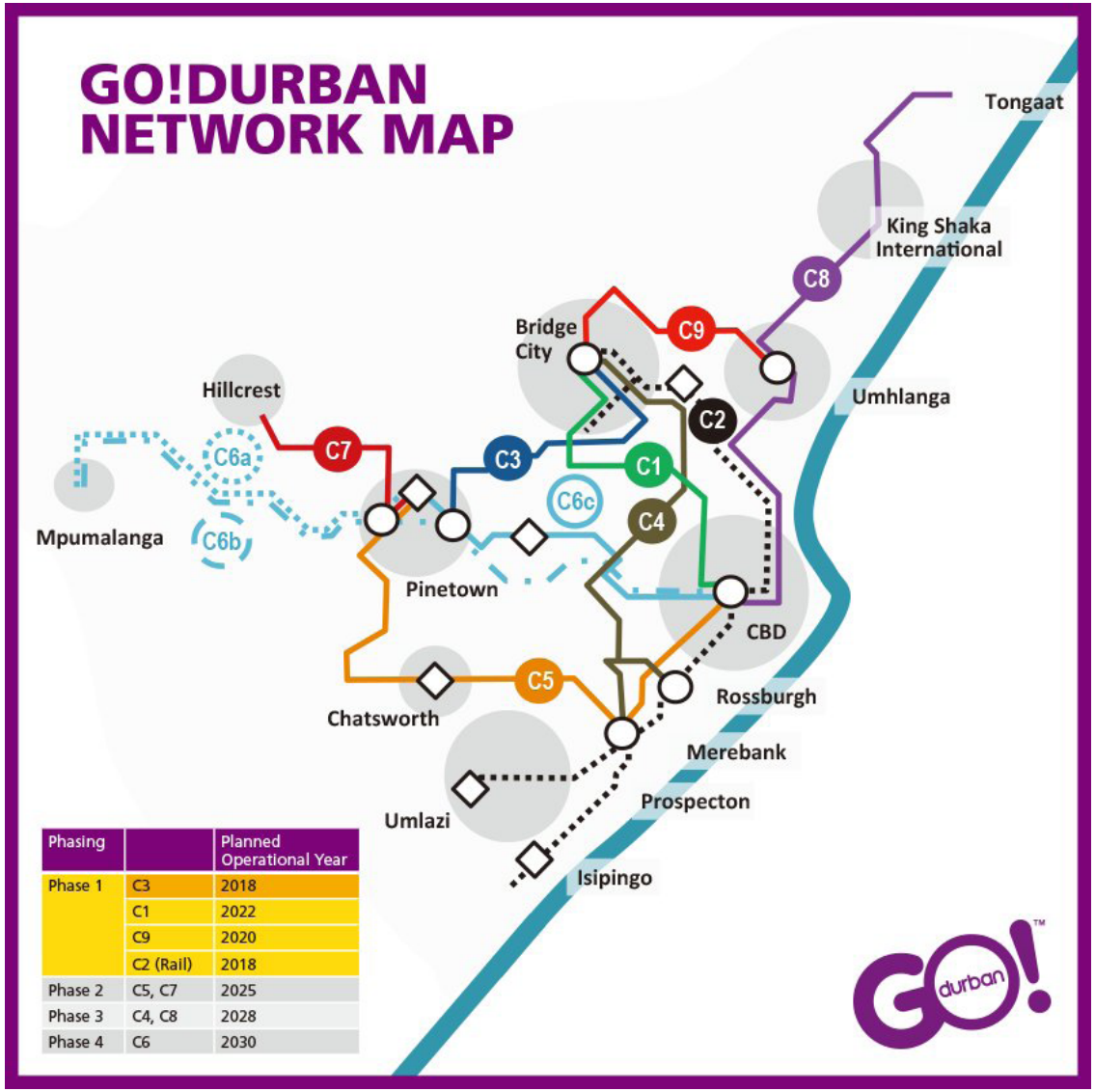
The Transport Plan for Durban 2040 is an expansion of the current GO!Durban initiatives, designed to create a world-class public transport system to connect and improve the lives of Durban's citizens. With a fully integrated public transport system, GO!Durban will provide easier access to work, social facilities such as education and hospitals as well as goods and services.

Overall the system will not only connect different parts of the city, but also connect the citizens of Durban to new opportunities and places that they otherwise would not have encountered. The system is an integrated public transport system, comprising walk, bicycle, bus and rail infrastructure and services.

Passengers will only wait between 5 and 10 minutes for a service during peak hours, and between 10 and 30 minutes during off-peak hours. Citizens will have access to public transport throughout the day as the system will run between 16 and 24 hours daily. Furthermore, all transportation will be equipped

with full universal access to cater for passengers with special needs or wheelchairs. A range of integrated feeder services will also be implemented as part of the GO!Durban project to facilitate accessibility.

GO!Durban believes in sustainable and long-term solutions for transport. The whole integrated rapid public transport system is centred on sustainability. The entire project will work towards reducing the overall impact of transport on the environment, through means such as reducing the need for cars by providing reliable bus services. The transport network will also rectify and enhance the spatial structure of the city through urban rejuvenation and by creating mixed-use developments. Overall, GO!Durban will have a positive effect on the economic structure of Durban as it will improve tourism, provide additional job opportunities and maintain sustainable development. The goal is to ultimately provide up to 85% of all residents in Durban access to safe, affordable and good quality, scheduled public transport, and ultimately promote the emergence of a world-class city.



2.06

2.07

THE CONNECTED CITY

a). CYCLING

The Promenade has highlighted the potential that cycling has within the Inner City, albeit primarily for recreational purposes. With the growth in the Inner City, particularly the student population, cycling is to be promoted as a safe, convenient and low cost alternative for Inner City transportation, encouraging daily commuter trips.

(i) The Priority Cycle Network (PCN)

The Priority Cycle Network (PCN) largely mirrors that of the Priority Pedestrian Network (PPN), connecting key origins and destinations throughout the Inner City, including public transport facilities. However, this network is segregated from both pedestrians and vehicles, allowing for safe and convenient cycling across the Inner City. Cycle phases will be introduced on all traffic signals along the PCN, further enhancing safe cycling in the Inner City.

(ii) Cycle Facilities

In order to promote and encourage cycling, ancillary facilities need to be provided across the Inner City, including:

Bike parking, both on-street and off-street, across the Inner City, particularly at public transport nodes and public spaces;

Lockers at public transport nodes to facilitate cycle to public transport.

(iii) Bike Share

A Bike Share scheme, as part of the integrated public transport solution, will allow residents and visitors to hire/rent bikes for short distances or durations, giving them the ability to pick up a bicycle at any self-service bike-station and return it to any other bike station located within the Inner City.

B). METROPOLITAN AND REGIONAL RAIL

The rail service provides the backbone to the Integrated Rapid Public Transport Network (IRPTN) for the eThekwini Municipality. These services provide a high capacity service from the north, west and south to and through the Inner City.

The system, together with stations along the routes, provide a fully accessible metropolitan wide transport network that is safe, reliable and convenient and has the potential to carry up to 30 000 persons per hour per line into the Inner City.

(i) Rail Corridors

The Inner City is serviced by 7 lines, viz:

Umlazi – KwaMashu Line

North Coast Line

Cato Ridge Line

Pinetown Line

South Coast Line

Crossmoor Line

Wests Line

(ii) Rail Stations

There are 5 stations in the Inner City, viz:

Umgeni Station

Moses Mabhida Station

Durban Station

Berea Station

Central Durban Station

(iii) Central Durban Station

The creation of a new Central Durban Station on the Centrum site will significantly improve the rail accessibility of the Inner City, thus reducing the demand for feeder/distribution services from the existing rail stations and promoting the growth and regeneration of the Inner City. *– This is the proposed typology and location for the dissertation design Interchange,* Machinaria.

(iv) Rail System Upgrades

The entire rail infrastructure and fleet is to be upgraded, providing enhanced line capacity, improved signalling systems, new and more comfortable carriages, station upgrades to make them fully accessible and an integrated ticketing system linked to other forms of public transport.

(v) Chatsworth LRT System

The Crossmoor, Pinetown and Wests Line is to be converted to high quality Light Rail corridor to improve the attractiveness of this corridor. This will transform the Inner City not only in terms of its connectivity to the south and west, but frequent services, convenience and on-street operations will transform and regenerate the Inner City. The on-street operation within the Inner City will also serve a distribution function for internal Inner City trips.

(vi) King Shaka Airport LRT System

In order to support the growth and regeneration of the Inner City as well as the promotion of Durban as a tourist, sporting and conferencing destination, a LRT line between the Inner City and King Shaka International Airport will be developed, linking the Point Cruise Terminal, Central Station and International Convention Centre, Sports Precinct to the Airport, via Umhlanga and Cornubia. Apart from catering for airport trips, this will also enhance commuter rail connectivity between the Inner City and the northern areas as well as serve a distribution function within the Inner City.

c). METROPOLITAN BUS

The BRT system provides the Inner City the connectivity to the broader Metropolitan area, complementing the rail corridors. Together with rail, complementary and feeder services (IRPTN), this system provides "wall-to-wall" public transport coverage across the entire metropolitan area, with connections at conveniently located interchange positions. The system will be a high frequency, safe and reliable public transport service that is capable of providing a capacity of 10 000 persons per hour per line into the Inner City. Thus the IRPTN provides the Inner City with a high level of service and accessibility to support and sustain its growth trajectory.

The system will be fully accessible and bus stops will be designed to be highly legible, with associated signage and passenger information to assist passengers in planning their journeys.

(i) BRT Corridors

The Inner City is serviced by 4 BRT corridors, viz :

C1 : Bridge City to the CBD

C5 : Chatsworth to the CBD via Warwick

C6 : Mpumalanga/Pinetown to the CBD via Warwick

C8 : Tongaat/KSIA/Umhlanga to the CBD

(ii) Outer Ring Distribution System (ORDS)

Acknowledging the close interaction between the Inner City and the surrounding areas within the 5km cordon, including inter alia the Berea, Cato Manor and the Bluff, an Outer Ring Distribution System (ORDS) will be provided to connect these areas with the Inner City and to other services (regional and national transport services) that operate from the Inner City. The ORDS comprises of the following services with links to the Inner City :

OU01 : Springfield

OU02 : Clare Hills

OU03 : Wiggins

OU07 : Sherwood

OU08 : Bellair

OU09 : Sea View

OU10 : Umbilo

OU11 : Varsity

OU13 : Botanic Gardens

OU14 : Florida

(iii) Centrum Transport Terminal

All BRT services to the Inner City terminate at the Centrum Transport Terminal, located in the middle of the CBD to ensure maximum accessibility and direct routing to the core CBD in so far as is possible. These services then integrated with rail and the Inner City Distribution System to ensure accessibility of the entire Inner City to these services. – *This is the proposed site for the dissertation design Interchange,* Machinaria.

D). INNER CITY DISTRIBUTION SYSTEM

The Inner City Distribution System (ICDS) provides public transport connectivity across the City, linking key origins and destinations, including public transport interchanges. The fundamental principles of the system are that transfers are minimised and direct routing is available on high demand corridors. The system will be a reliable, high frequency bus service in the peak periods with stops typically every 400m along the routes to maximise accessibility of the system. On high demand corridors, priority will be given to this service by means of dedicated lanes and bus priority signals in order to improve operational speeds and efficiencies.

The system will be fully accessible and bus stops will be designed to be highly legible, with associated signage and passenger information to assist passengers in planning their journeys.

Frequent services will run throughout the day to encourage off-peak travel for retail and leisure activities and a night service will also run to enable a 24 hour city.

(i) Routes

The Greater Point area and the Centrum Transport Terminal are the highest generators and attractors of trips in the Inner City (both internal and external trips) and thus the distribution system is focussed around these nodes.

The Point Services are:

P1 : Point to Moses Mabhida Station

P2 : Point to City

P3 : Point to Sports Precinct

P4 : Point to Greyville via Warwick

E). CONNECTING DURBAN TO THE WORLD

Durban 2040 is an attractive tourist, sporting and conferencing destination, both nationally and internationally. In order to support this initiative, fast and direct connections are needed between the Inner City and national and international destinations in order for Durban to be competitive and inviting.

(i) Cruise Terminal

A Cruise Terminal is to be developed at the Point, the southern tip of the Inner City. This facility will be a world class facility catering for both local and international cruises, and will stimulate the local economy and tourism industry.

(ii) King Shaka Airport LRT System

A LRT line between the Inner City and King Shaka International Airport will be developed, linking

2.09

the Point Cruise Terminal, Central Station and International Convention Centre, Sports Precinct to the Airport, via Umhlanga and Cornubia. Apart from catering for airport trips, this will also enhance commuter rail connectivity between the Inner City and the northern areas as well as serve a distribution function within the Inner City.

(iii) National Rail

Long distance rail services between Durban and other provinces will be enhanced, including:

High speed rail link between Durban and Johannesburg, linking the OR Tambo gateway to Durban via rail as an alternative to air and coach services;

Higher speed rail along the coastal belt, connecting Durban to Richards Bay in the north and the Eastern Cape, and ultimately Western Cape in the south.

These rail services will operate from the Inner City terminals of Berea Station and Central Station, integrating fully with other regional (BRT) and local (ICDS and KSA LRT) services.

(iv) Long Distance Coach Services

Long distance coach services will operate out of Durban Station and Central Station, with integrated connections to local services at these stations.

THE INTEGRATED CITY

A). NEW CONNECTIONS AND LINKAGES

A fine grained grid of streets with active edges is essential to promote the walkable city concept. Making new connections across large land parcels in the form of streets and paths allows developable land parcels to become a part of the expanded city grid. Smaller land parcels allow diversity, flexibility and fine grained development. A mobility concept with higher mobility edges and a grid of connected streets creates a hierarchical framework of connections within and between neighbourhoods.

The Berea is seen as an integral part of the Inner City, and creating additional connections that overcome existing barriers stimulate the development potential of both the Inner City and the Berea.

B). INTEGRATED PUBLIC TRANSPORT SERVICES AND TERMINALS

All public transport services, ie local, regional and national services, will be integrated to allow for easy and effortless transfer from one service to another. All termini will be safe and fully accessible, cater for all modes and provide passengers with the required facilities and services for greater convenience.

The 3 primary terminals in the Inner City, providing local, regional and national services are :

Central Transport Terminal

National Services – Dbn-Jhb rail, Coastal rail, KSIA rail, Cruise Terminal

Regional/Metro Services – Rail, LRT, BRT, LDC

Local Services – ICDS, cycle, walk

Warwick Transport Terminal

National Services – Dbn-Jhb rail, Coastal rail

Regional/Metro Services – Rail, LRT, BRT, LDC

Local Services – ICDS, cycle, walk

Point Transport Terminal

National Services – KSIA rail, Cruise Terminal

Local Services – ICDS, cycle, walk

C). INTEGRATED TICKETING SYSTEM

The MUVO Card will allow passengers access to public transport in the Inner City without the need for cash payments. This system is designed to improve safety, accessibility and capacity of public transport services by facilitating pre loading of credit and/or tickets (scholar, pensioner, travel passes) onto the card which is then available for all forms of transport in the metropolitan area, including bike share, road and rail public transport services.

D). TRANSPORT INFORMATION SYSTEMS

Up to date information on all transport services and offerings will be available to commuters, residents and tourists to enable them to plan and better manage their journeys. Real time information via variable message panels along transport corridors, stations and terminals, smartphones applications and the internet will provide passengers with up to date information on all services.

summary of key opportunities

OBJECTIVES

Spatial restructuring and reduced sprawl – i.e. prioritise urban over peripheral. Consideration of the whole is imperative. A sector based approach will not optimise the potential contribution of residential development to regeneration of the inner city. A dramatically increased resident population, living in mixed-use walkable neighbourhoods, with residential accommodation as the primary new and transformed built fabric, is envisioned, but the implementation of a residential strategy must be integrated with co-ordinated public realm improvement and infrastructure provision, economic opportunities, good affordable public transport, excellent urban management and good governance.

A liveable city for all. A residential strategy needs to respond to the whole socio-economic spectrum. One role of the Inner City is as a reception space for new urbanites. More choice would make the poor less vulnerable and provide a base from which to improve their lives. The employed poor - mostly domestic workers, security guards, gardeners, clerical staff and informal traders, generally have three options available to them: RDP housing units on the edge of the city, shacks in townships, and hijacked and/or dilapidated buildings in the inner city. 'Rough sleepers' in the Inner City need facilities and overnight shelter. Many homeless people/ street sleepers in the Inner City are not necessarily indigent. The 2010 Homeless survey indicates higher levels of skill and education than might be assumed and often short term circumstances as the reason for being temporarily without shelter. Psycho-social support is needed to support residential strategy for the indigent and homeless. The current CSIR Homeless survey will be completed in 2016.

An Inner City that comprises walkable neighbourhoods characterised by integrated mixed use development, which are safe, attractive and vibrant (economically and socially).

Regional, metropolitan and local social facilities and services that match user population needs and numbers.

Strategic, co-ordinated public realm investment that is aligned with overall inner city spatial principles and priorities, including residential densification.

More private investment

Aligned, and appropriate infrastructure and services investment, which must be sustainable in the long term, taking into account water and energy resource limits, climate change and its effects. New development must be planned for potential localised infrastructure systems such as electricity micro-grids and co-generation, organic waste to compost in large open spaces, etc.

Gentrification, although access to affordable residential opportunities must also be preserved in the long term.

2.3 CENTRUM

For the purposes of this LAP, what is commonly thought of as the Centrum precinct has been extended northwards beyond the municipal precinct, to the M17 (Argyle Road), to include the large parcels of state owned land and government functions. The precinct is bounded by the railway line to the west, Stalwart Simelene Road to the east, and Monty Naicker Road to the south.

2.3.1 ROLES

2.3.1.1 STRATEGIC

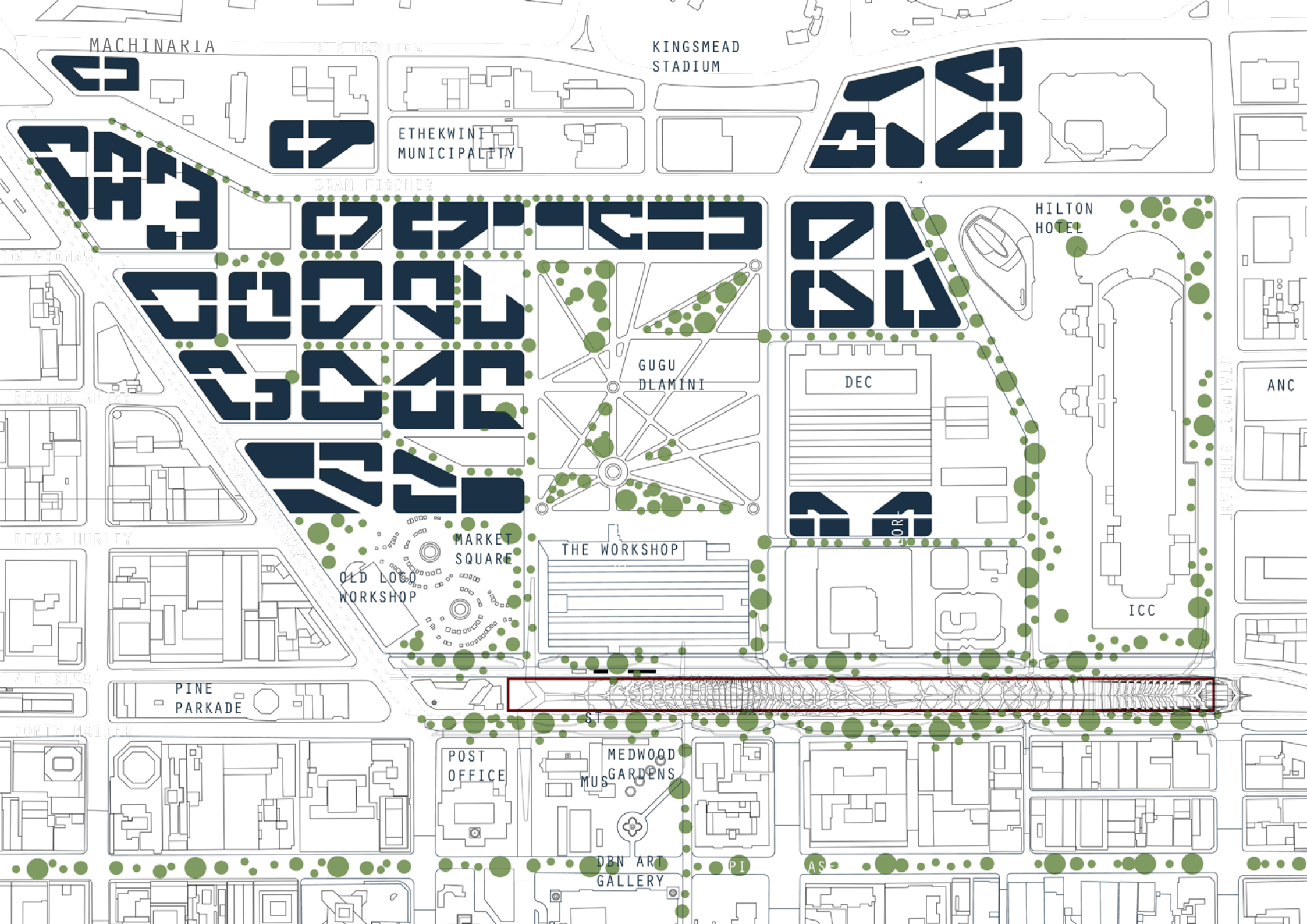
The precinct includes the ICC, the municipal precinct and various other public administration functions, which define its current key strategic roles. In a future expanded Inner City, the Centrum and Gugu Dlamini Square would be the civic and symbolic centre of the City. The Umgeni Station, and the proposed IRPTN terminus on the northern edge of the park suggest a strategic transport role that can be strengthened.

2.3.1.2 ECONOMIC

Currently the primary economic role of the precinct is as the local and international convention hub, and the range of commercial and retail is also significant. The civic and public administration strategic roles are also integral to the economic roles. In the future, the re-configured KE Masinga/Braam Fischer Boulevard will unlock economic potential, as will the implementation of the IRPTN, and the re-development of the centrum site around Gugu Dlamini square.

2.3.1.3 SOCIAL

The current recreation and sports roles of Gugu Dlamini Park, and the cricket stadium are important. Old Fort Park has potential but is underutilized. In the future expanded city, the role of the precinct, and Gugu Dlamini square in particular, surrounded by significant metropolitan scale social facilities such


MACHINARIA
KE MASINGA
KINGSMEAD
STADIUM
ETHEKWINI
MUNICIPALITY
BRAM FISCHER
DR GOODWIN
BERTHA MKHIZE
HILTON
HOTEL
GUGU
DLAMINI
DEC
ANC
DENIS HURLEY
MARKET
SQUARE
OLD LOCO
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THE WORKSHOP
ICC
A B XUMA
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MONTY MAKER
POST
OFFICE
MEDWOOD
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as the proposed library, is as the symbolic centre of the City.

2.3.1.4 ECOLOGICAL

The precinct does not play a major ecological role, although reducing the amount of hardened space and increased landscaping would enhance the ecological role through increased storm water attenuation, and biodiversity, as well as reduced heat island effects.

2.3.1.5 KEY IDEAS

Make a new pedestrianized north-south connection between the City Hall, through the centrum and the municipal precinct, to the Durban Station

Re-configure KE Masinga and Braam Fischer roads as the main central city boulevard

Re-configure the centrum site as the City's main public square surrounded by significant social and public facilities as per the Centrum urban design framework

New connections over the railway lines

Set up the reconfigured connection from the centrum all the way to Warwick along Bertha Mkhize Street

Major public realm upgrading including the introduction of indigenous vegetation and micro-green spaces into the public realm.

Implement the IRPTN proposals

Release land for fine-grained, perimeter block, mixed use green/brown field/infill/conversion development in support of creating high density, integrated walkable neighbourhoods.

2.10
Site plan for Machinaria (in red) within the Centrum precinct. (Authors graphic, 2017)

2.11

PHENOMENOLOGY

Space is the most fundamental architectural concept as successful architecture articulates space that is humanly meaningful and expressive. People's spatial behaviour is subliminally conditioned by the space ability to interact with man's five senses. Ergo, space becomes the medium for which mental and emotional communication is expressed. Meaningful architectural spaces distinguish between the space of the world and the human domain, the mental and the physical, the material and the spiritual (McCarter and Pallasmaa, 2012).

The needs of Man be can classified as biological, sensory or physiological or referred to as is body, senses, mind and soul (McCarter and Pallasmaa, 2012). Real lived spaces are experienced in a multi -sensory manner and not just visually. Spaces also have auditive, tactile and olfactory qualities and some architectural forms and materials can influence the sense of taste. This sensory experience may render the architectural form of space as monumental or intimate, harsh or soft, rejecting or inviting, to the occupant. This experience is linked to the perception of the human anatomy flowing through space.

ECOLOGY

Ecology is the relation to living organisms to one another and their physical relationship with their environs. In nature, this relationship is conducted in the form of a cycle – life, death and life again. There is a constant transference of energy from one organism to the next, perpetually to reach a level of balance. The city, with all its mechanisms for consumption – an insatiable hunger for energy and a production of constant waste, ever be viewed as ecological?

Ecological urbanism is geared to encourage people to live and thrive in cities through natural systems that improve the condition and quality of urban living. To achieve true balance, be it socially, economically and environmentally, is a major goal. Without a viable and positive human connection to a site or city, there will be no success in achieving a sustainable environment. The public domain is one of the most fragile components of our cities in terms of spatial design, yet it is the most critical for natural and social systems of the city to function (Scwartz, 2013).

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2.13

AFRICAN REVOLUTION

In the African city, 'informality' in planning shows the importance and the value of activist and participatory planning by citizens. This form of 'extraterritorial' urbanism, a bottom-up approach, developed outside of the regulatory framework, often produces ingenious solutions to the urban form. Culture and identity are concepts that grant the African city its unique character.

South Africa's society is comprised of a rich diversity of culture, race and creed. With eleven official languages, it is evident that such diversity can live together and form one united nation. These vibrant cultures come together to form a society that Durban is proud of, yet we still live amongst an architecture that dethatches and isolates us from our cultural roots - it harbours an almost alien identity that we conform to and abide within.

We have failed to realise the magnitude that architecture has on a society, on an African society. As Africans, we need to rejuvenate our identity and project that into our architecture, we need to stop conforming to Western ideologies of architecture but rather learn and adapt to these. We need to design for the specific regions we live in, according to our cultural diversities and weave our African identity

into our designs, instead of following the ways of the West and our former colonial government. An architecture that projects the cultures of its society is an architecture that is home with its environment and its society.

Through learning and adapting concepts of technological architectural advancements and driving through the concepts of African Renaissance, we will be able to reclaim Durban's identity as an African City.

The **African Renaissance** is the concept that African people and nations shall overcome the current challenges confronting the continent and achieve cultural, scientific, and economic renewal. The African Renaissance concept was first articulated by Cheikh Anta Diop in a series of essays beginning in 1946, which are collected in his book *Towards the African Renaissance: Essays in Culture and Development, 1946-1960*. This concept has been further popularized by former South African President Thabo Mbeki during his term of office, heralding the beginning of The African Renaissance, and it continues to be a key part of the post-apartheid intellectual agenda.

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2.16

THE LIVING MACHINE

integrating phenomenology, ecology and identity

By reprogramming the interchange as a living machine, Machinaria rewrites the typical public transport interchange for the twenty-first century.

A restructured and regenerative African interchange has the potential to alleviate environmental damage in its direct context and reduce the current global environmental impact of the transportation industry that currently contribute to twenty-five percent of the world's carbon emissions (Edwards, 2011,1).

By granting citizens the opportunities to access every part of the inner city through efficient and affordable public transportation, the programme for *Machinaria* has potential to a new cultural identity for Durban as well as generating new economic energy for the city.

By embedding ecological systems as part of the building's programme, social spaces and natural habitats are integrated with transport systems to fabricate a hybrid, living architectural environment.

By re-evaluating the identity of African architecture, combining common concepts found in the diversity of South African cultures and creating a new approach to African architecture, will result in an architecture that is more in tune with its surroundings as well as those that use it.

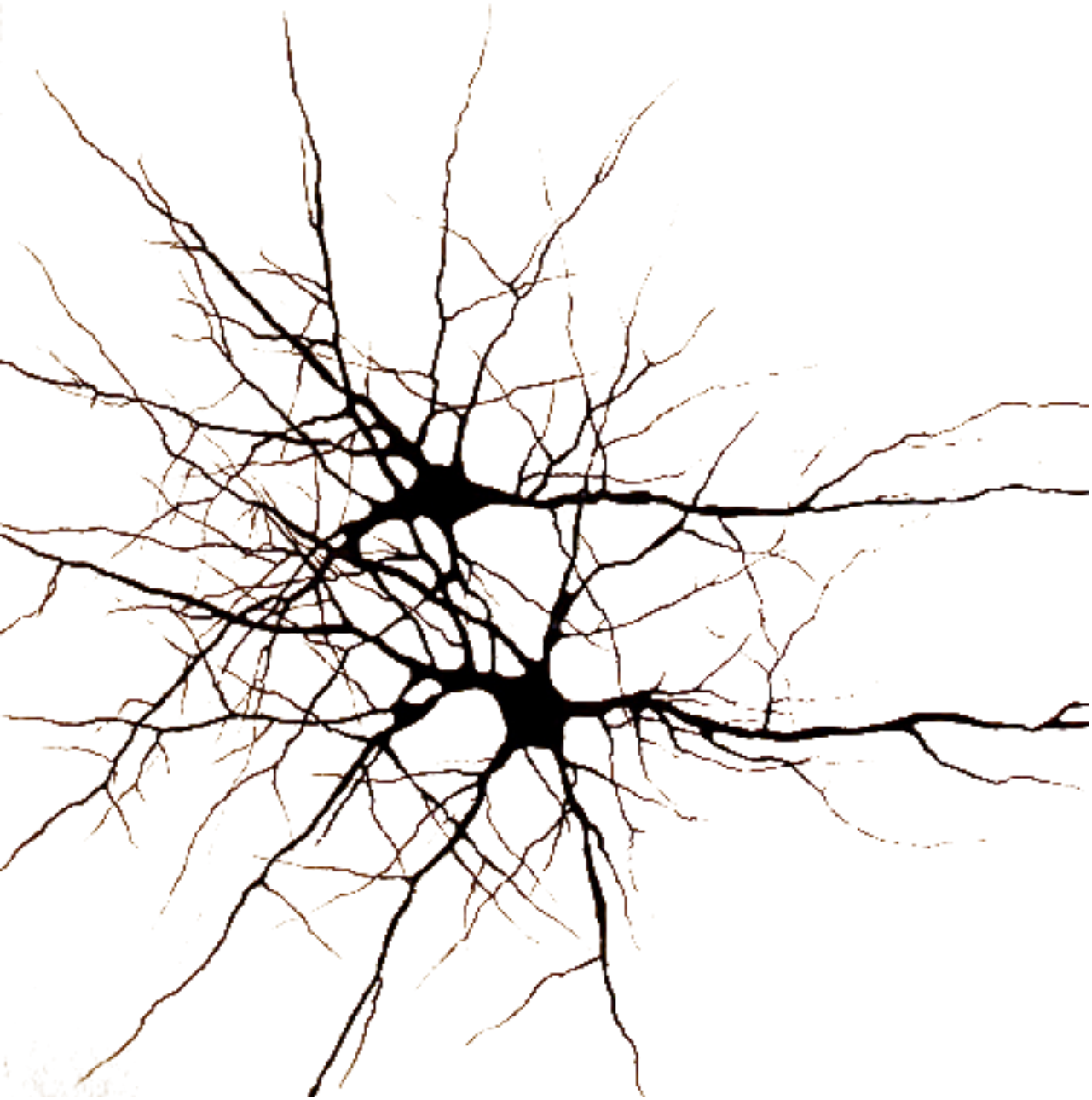
3

Chapter 3 explores the state of the 21st century and theories of Ecology through the lens of human perception - the symbiosis of systems in different elements of the city and architecture - ecology in urbanism, ecology in architecture and the link between spatial ecology and the human condition - phenomenological ecology in order to understand the role of *Machinaria*, the Interchange in the context Durban.

The future design of architecture represents a bio-mechanical expression as it is an extension of a larger systematic urban landscape. A single piece of architecture is not an isolated system but rather one which is part of an interrelated collective of systems that contribute to both society and the environmental ecologies.

the voices of

ECOLOGY



3.02

THE 21ST CENTURY

The 21st Century is an age of extremes, some of these extremes include wealth and poverty, technological advancements and scientific modifications, as well as the extreme forces of globalisation. With proposed global cataclysms such as food shortage, increase in waste and the constant shift in climate change, more global solutions are needed to challenge these issues. We abide in a time of revolutionary transition, a large part of that revolution lies in the architecture we design.

We are unlocking new capabilities (Martin, 2007) with the help of technological advancements and lessons learned from the Industrial Revolution that will lead to much more sustainable and resilient civilisations. Industrialisation of the 20th century has brought to us automated machinery that has evolved through to the 21st century. Our aim in this generation is to significantly granting it a complexity similar to that found in nature. This will increase the compatibility between human technology and natural systems (Frenay, 2006).

Paradoxically, this means that the Industrial Revolution that has contributed to our technical advances, has germinated the disconnect between man and natural environments. Moreover, it has lead to the growing depletion of these natural systems and as a result, a myriad of looming environmental crisis. Yet, this might be the cataclysmic mechanism which reconnects our severed ties to nature (Kelly, 1994).

We live in an age of exponentially booming population growth (in urban centres), waste, spatial and natural resource consumption and as a result, a festering anxiety over the consequence of global warming, rising petroleum prices and a combination of natural and political cataclysms. Our institutions do not harbour long term solutions for the future. Today's views of the future, still watered down, are mostly short term solutions (Martin, 2007). An extreme solution, evolving over time and adapting to the issues that surround it needs to be architecturally implicated if we are initiate a long term prototype for the future.

The Earth's resources are being depleted in an exponential rate, more carbon dioxide is being pumped into the air at a rate greater that than the Earths greenery can absorb (Martin, 2007). Water is vital for the survival of all animal and plant life. The production of food depends largely on the amount and quality of the water supplied. Today, man is using about 16 000 billion kilograms more water than the Earth can replenish though rain (Martin, 2007).

Natural climate control systems are largely out of balance. When the scale tips, when the population has grown and developed so much so that the Earth's resources are largely used up, the oceans have risen due to global warming and climate change has shifted so far that the Earth and nature starts fighting back through natural cataclysms such as hurricanes, floods, tsunamis, earthquakes etc - nature will win and great amounts of the human populace will diminish.

Therefore it is the responsibility of man to design solutions - in every discipline, especially architecture, in all scales –for the future. Sustainability in architecture has to reach a level of complexity that is chemical, mechanical instead of cosmetic. The built environment has a direct effect on our environments - as humans, it is our domain - it is therefore the responsibility of architecture and architects to initiate solutions that are responsive to the environmental issues we face today and the future.

The Earth's ecology, as a living organism, is comprised of many voices and layers - like gears and cogs in a machine, they construct the environment. Some of these ecologies build the human environment – urban ecology, architectural ecology and we dwell in the phenomenological ecology (relationship between human and spatial ecologies). These voices or ecologies help us understand the role of both architecture and man within the environment in order to design an architectural solution for the future.

URBAN ECOLOGY

3.03

ECOLOGICAL URBANISM

Preamble

The growing population of human life as a result of our advances in technology has caused a steady migration of the population from rural to urban centres. The increased number of people and cities has resulted in a significant increase in the exploitation of the earth's limited resources.

This is a growing challenge for the architect of today, yet those that are committed to sustainable and ecological architectural design have remained passive. Early examples of sustainable design were dependent on simple and inefficient technologies to recycle waste and produce energy (Mostafavi, 2013). Sustainable architecture was soon realised to be rudimentary and the renunciation of our lifestyle – stripped of pleasure. As the concept of sustainability becomes more prominent in the profession, the importance of this issue is changing. Yet, there still remains the conflict between the moral imperative of sustainable design and its tendency to supersede disciplinary contribution. Therefore, sustainable design is not viewed as design innovation and this situation will continue to create friction and scepticism with those who promote disciplinary building techniques and those who promote sustainability (Mostafavi, 2013).

Another issue is that of scale. Most of the sustainable work undertaken by architects has been limited in scope and thus lost or forgotten. There is a pressing need for us to search for alternative design approaches, on a large, urban scale – as our issues are at an urban scale. Urbanity, the site of complex relations between political, economic, social and culture, demands the equilibrium of responses and solution perspectives that may address both the current state and possibilities of the future.

A rise in multi-dimensionality and multidisciplinary thinking has shifted the paradigm for urban scale solutions. The role of architecture in the urban environment acts as a series of cogs and gears that help generate an almost mechanical system or series of systems that work together to make a successful urban form. Each piece of architecture has an elaborate and imperative role to play in order for the

3.04

It took the human species:
300 000 years to reach the first billion
130 years to add the second
30 years to add the third
15 years to add the fourth
12 years to add the fifth and sixth… billion

The global community is expectation reach 9 billion by 2050.
The driest and poorest regions in Africa are growing the fastest
(University if Berkeley
(See population growth map)

3.05 *World map with country sizes drawn proportionate to national CO2 emissions in 2004. (SASI Group, 2008)*

"The city is so vast and we have so much to say to each other."

-Francois Perier to Giulietta Masina in Federico Fellini's *Night of Cabiria (1957)*

system to work. This should be the understanding for our future urban systems.

Ecological Urbanism – an oxymoron, a hybrid of unrelated concepts that are placed next to each other and then merged to produce a new concept to challenge the way we perceive both Urbanism and Ecology.

Ecology, by definition is the relation to living organisms to one another and their physical relationship with their surroundings (Oxford, 2011). In nature, this relationship is conducted in the form of a cycle – life, death and life again. There is a constant transference of energy from one organism to the next, perpetually to reach a level of balance. The city, with all its mechanisms for consumption – an insatiable hunger for energy and a production of constant waste, ever be viewed as ecological?

The concept of urbanity works counter to that of ecology with emphasis on the interrelationship of organisms and the environment. The fragile state of the planet and its depleting resources should be viewed as an opportunity for speculative design (Mostafavi, 2013). The issues confronting our cities are opportunities to define a new approach 5to architectural and so, urban design.

In the African city, 'informality' in planning shows the importance and the value of activist and participatory planning by citizens. This form of 'extraterritorial' urbanism, a bottom-up approach, developed outside of the regulatory framework, often produces ingenious solutions to the urban form. Culture and identity are concepts that grant the African city its unique character. However, its informality raises many problems as well such as poor standards of hygiene and health (Mostafavi, 2013). We can learn from the negative forms found in the African city and adapt them, form solutions and apply it to urbanity whilst incorporating ecological systems for future urban plans. The role of Ecological Urbanism is to create and emancipatory infrastructure for a new urbanism.

What is found in African cities, although a norm may be uncommon elsewhere. Traditions, for example in the growth of Islamic cities did not form from an independent concept of urban development. It was rather dependant on local conditions such as materials and climate. This need for adaptability and differentiation calls for ecological urbanism to break away from fixed rules and norms but rather to promote flexibility and adaptability for particular urban forms or locations. Unfortunately in our current age, we face a multifariousness of differentiation yet an apparently sameness of conditions in urban development in various parts of the world.

The creation of ecologies and that of ecological urbanism is dependent on certain traditions of practice and the flexibility to interact with a series of physical and non-physical networked variables.

Mobility, infrastructure and society

Emerging building technologies that allow us to construct more environmental and climatic responsive buildings

3.06

3.07

"While it is clear that the pursuit of structural plans, development agendas, and rational decision making require economic supports and political will often lacking impoverished societies, the apparent provisionality of African urban life also masks the degree of which residents capitalise on some of the most elemental facets of "cityness" itself...Whereas planning discourses centre largely on defining, consolidating and articulating a given position in relation to others, the urban game for many Africans is to become nodes of gravity that draw attention not by standing still and defending niches but by an ability to 'show up', make oneself present, no matter the circumstances, in a kind of social promiscuity."

-AbdouMaliq Simone (2008)

that use less natural recourses and energy are on the rise. Enabling architecture in urban ecologies required measuring environmental impacts – carbon emissions, non-renewable resource usage and natural resources – in an ever expanding area of economic opportunity and social justice (Sommer, 2013). In most societies moving toward democracy, increased mobility – in both geographic and socioeconomic terms – has been envisioned as equality and civil liberty. Modern society has always needed to move, to feel progress – across the city, from one city to the next or from one continent to another.

The image of liberty or freedom is often portrayed at the pilgrim, moving forward and the mindset that progress is the physical possession of property. This is what drove the formation of societies such as The United States. This concept has been catapulted by mechanical forms such as telecommunication and locomotion.

It has come to the realisation of urban planners for the need of more compact urban strategies, efficient forms of public transportation is one of the best urban scale solutions for the increased depletion of our natural systems. Efficient public transport forms reduce negative environmental impacts and determine the potential for an increased human collaboration and sociability (Sommer, 2013).

Urban Mobility and the car

The automobile weighs roughly about twenty times as a human, a single seat measures to about three square meters yet a parked car uses about sixty square meters of precious urban real estate. The privately owned car is typically parked for about eighty percent of the day, consuming valuable space, materials, energy and money (Mitchell, 2013). Not to mention, it is powered by petroleum, a non-renewable resource that is rapidly diminishing, it has created and powered wars and emits greenhouse gases into the atmosphere that can contributed to global warming and a depletion in natural resources. With the rise in technical systems and the need for mobility, more and more people are reaching for the independence of the car despite the

3.08

3.09

3.10

"Landscape is not only the physical context, the constructed public realm, the national parks, coastline, squares, promenades and streets, places to walk or sit and watch the world go by. It also reflects our memories and values, the experience we have of a place – as citizens, employers, visitors, students or tourists. It is the material, cultural and social context of our lives."

Kathryn Moore – Ecological Urbanism

negative implications caused by this device. A more socially, economically and environmentally sustainable solution is needed – public transportation.

Nature Culture

This statement demands that we revert to nature and fight the dichotomy that has habitually severed it from culture. Nature in the city may range from small parks, trees, street cats and even rats - not all intrinsically good for the soul. Our fondness for nature is something we share culturally and universally, even if it is a visual connection, nature has a way to soothe the mind and absorb negativity (Moore, 2013). The issue we have in the city is that nature or natural landscape is an undeniable afterthought - most trees in Durban grow out of concrete or tar. Oblivious to the built environment, trees or greenery are only implemented long after the architect has left the site.

Urban natural landscapes have been reduced to neat, little square-meters of grass, trees and trenches. Nature is 'sandwiched' in after the seemingly important economic ventures have been implemented. It is fitted neatly between settlements and streets – it has been reduced to nothing more than living embroidery (Moore, 2013). Ironically, nature observed in this way is often assumed to be enough to address matters of quality and green spaces in the urban fabric. The presence of nature in urbanity enhances the cultural identity, the social and physical experience of the habitants who work and occupy the city.

Although spirituality and nature go hand in hand, we find it difficult not to associate it with technology. In order to breach barriers and make connections, we cannot view these concepts separately or in bite size pieces – scientific or artistic, biological or cultural (Moore, 2013). We must realise that nature is part of our culture, in all our actions (consciously or sub-consciously), we are expressing an attribute towards natural systems. The point of the matter is not whether we work with art or ecology, with culture or nature, but how creatively and responsibly we go about with our business as each of our actions has a reaction to the physical environment. Urban spatial design reflects the value and mindfulness we place on the quality of our physical environment.

A sustainable and lasting blueprint for the landscape of our environments is being established - a new and fresh approach, not a simple clip-on to reinforce existing practices. A connection between spatial strategies and real places must be created for developing design excellence, as the quality of our environment is directly proportional to the quality of human life.

Ecological Urbanism and the Landscape

The word 'landscape' is often mistakenly thought to be 'nature' and it is not typically thought to be something

3.11

"If we are to deliver a sustainable built environment, we must create places that people will value and to which they can connect emotionally."

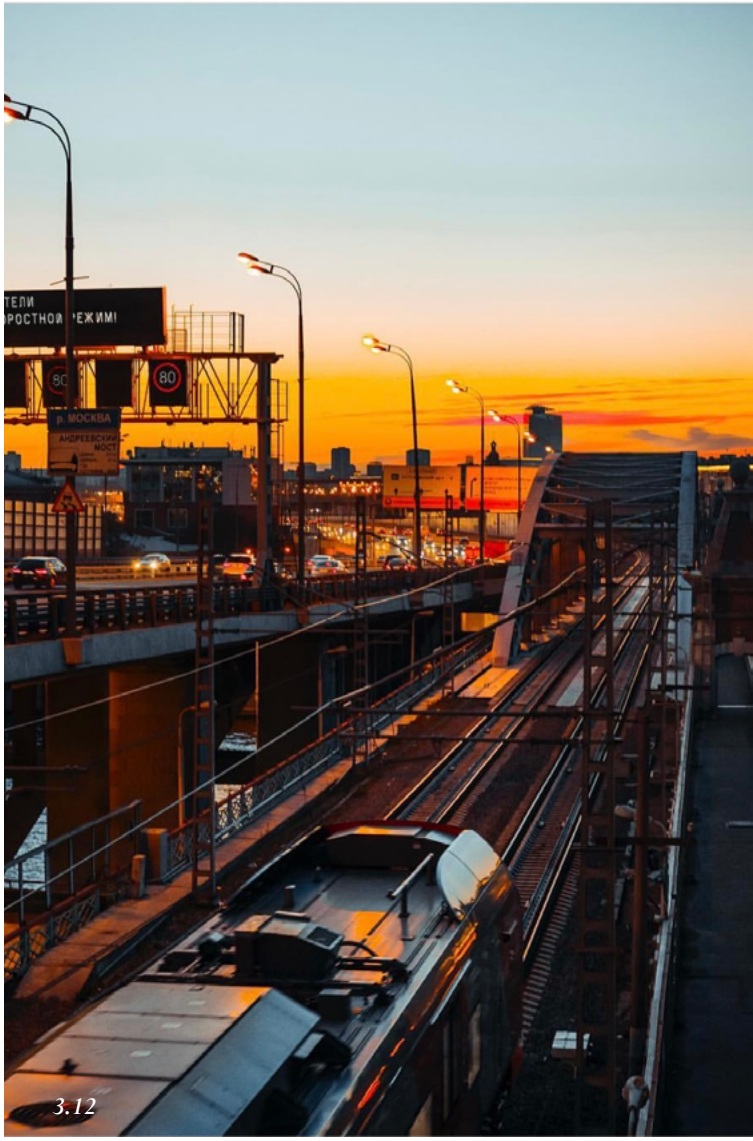
Martha Schwarts – Urban Ecology

found within the city. It is perceived to exist outside the built environment – similar to the juxtaposition of ecology and urbanism. When cities are thought of as living organisms rather than a collection of buildings within a space, the landscape becomes a major role player in terms of sustainability (Schwartz, 2013).

Ecological Urbanism then relates not only to the workings of the landscape - the geology, topography, soil structures, phenomenology, and the plant and animal ecologies but also to understand how the landscape plane operates within the city. The underpinning of specific urban landscapes speaks of the interrelated systems such as governance, economy and the social structure of the society (Schwartz, 2013). The design of optimal human cities will be impossible unless we study and embrace all of these systems – natural and human alike – as is the concept of ecology. Ecological urbanism shifts the focus to design for humans within the city as being part of ecology.

Ecological urbanism is geared to encourage people to live and thrive in cities through natural systems that improve the condition and quality of urban living. To achieve true balance, be it socially, economically and environmentally, is a major goal. Without a viable and positive human connection to a site or city, there will be no success in achieving a sustainable environment. The public domain is one of the most fragile components of our cities in terms of spatial design, yet it is the most critical for natural and social systems of the city to function (Scwartz, 2013).

The urban landscape that we share with ecological systems and plant and animal habitats influences our identity as individuals and so to become the image of the city. Through this, our impact on the environment can determine the health of and well-being of the earth itself, determine the liveability of a city, support the economy of a city and help create healthy and happy citizens.



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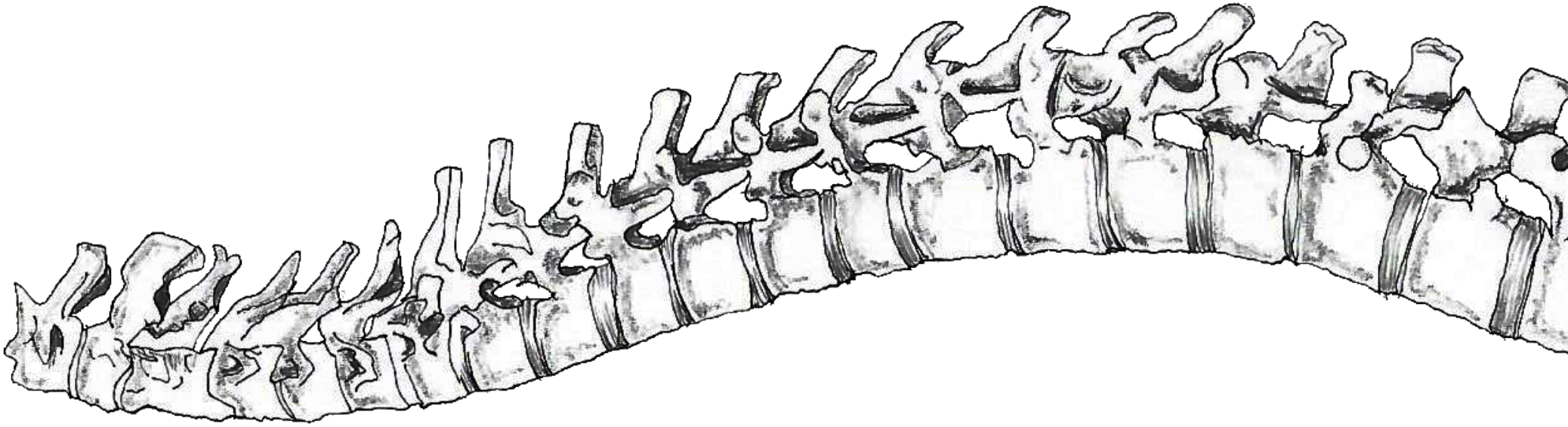
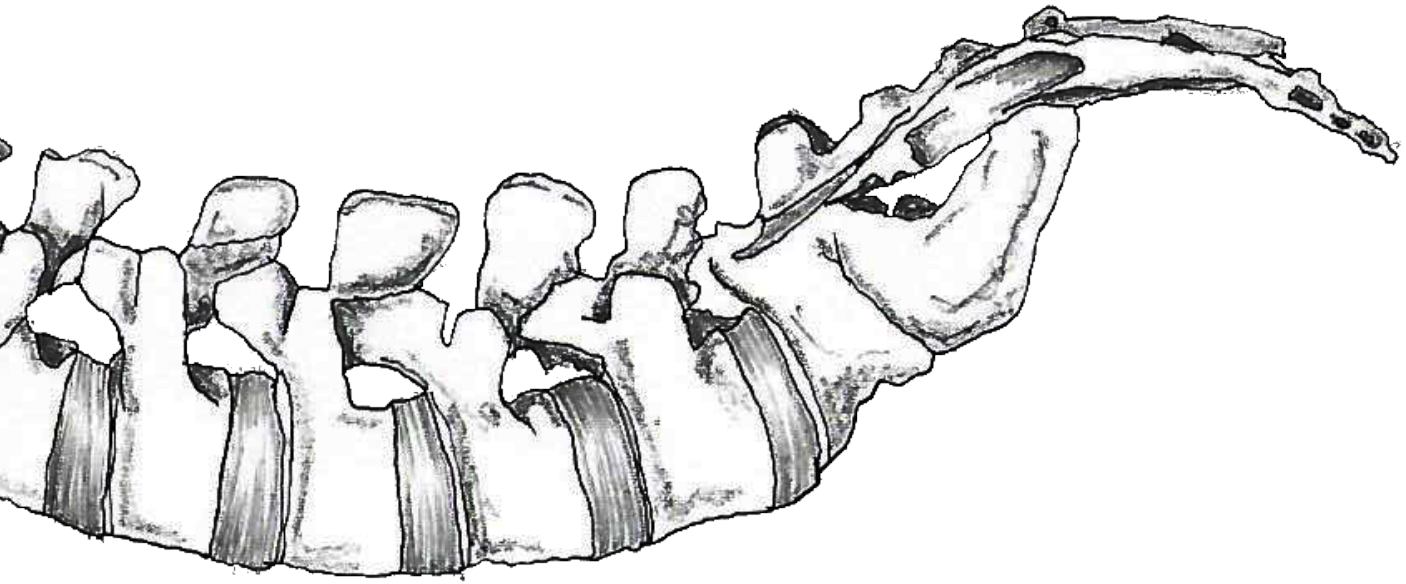


ARCHITECTURAL ECOLOGY



REVOLUTIONISING ARCHITECTURE

Declaration presented at the eleventh International Architecture Exhibition of the Venice Biennale, asserts that architecture should develop new forms of design and construction strategies that take account of the future energy crisis and global warming.

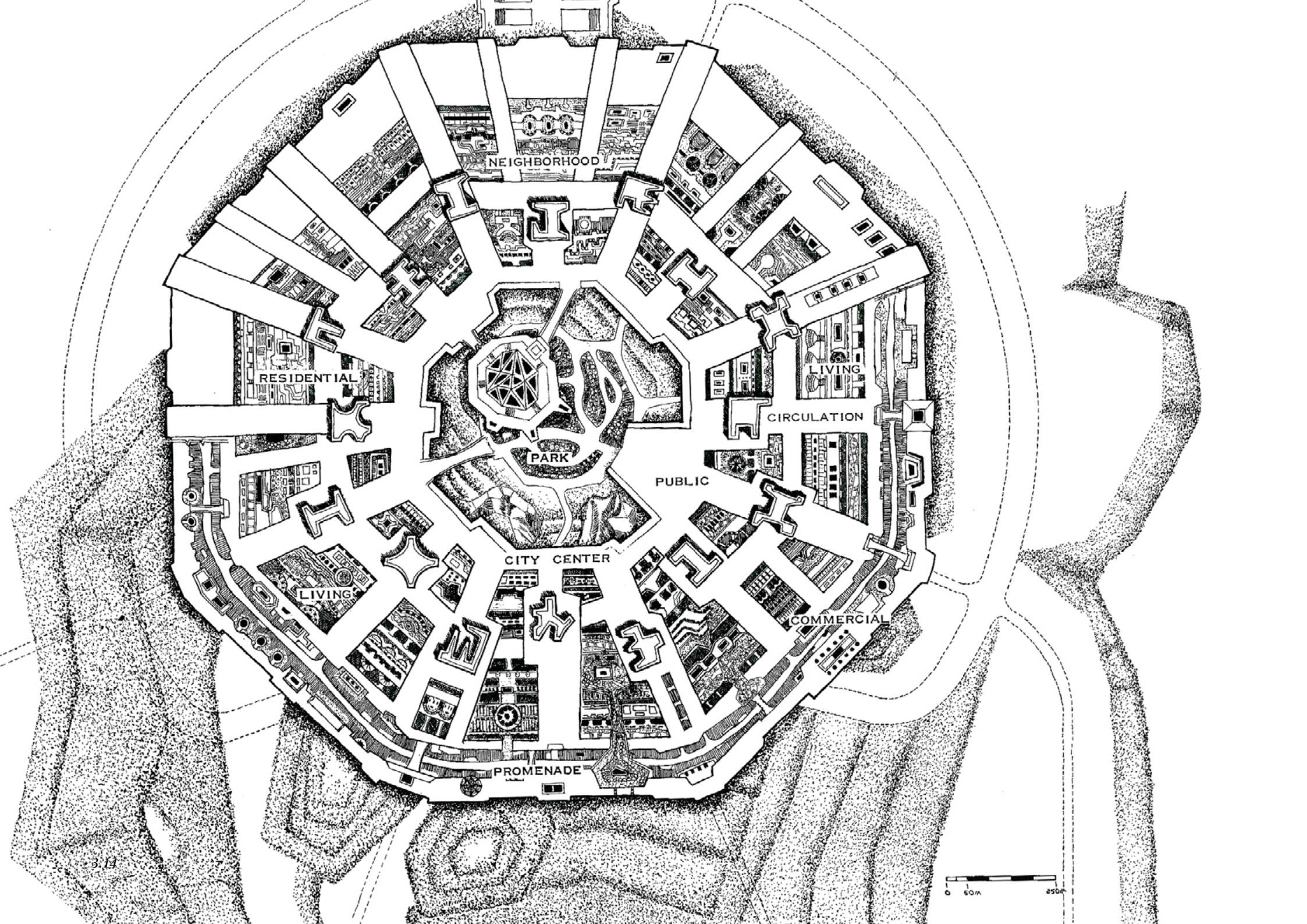
WE, the architects of the world, recognise the increase in energy costs is leading to a slowdown in the global economy, creating hardships for families everywhere.

WE further recognise that the dramatic rise in carbon dioxide emissions in the burning of fossil fuels is raising the earth's temperature, threatening an unprecedented change in the chemistry of the planet and the global climate, with ominous consequences for the future of human civilisation and the ecosystems of the earth.

WE further recognise that new technical breakthroughs make it possible, for the first time, to reconfigure existing buildings and design and construct new ones that create all of their own energy from locally available renewable energy sources, allowing us to reconceptualise buildings as 'power-plants'.

THEREFORE BE IT RESOLVED THAT we are committed to a revolutionary new concept of architecture in which home, offices, shopping malls, factories and industrial and technology parks will be renovated or constructed to serve as both power plants and habitats.

THEREFORE BE IT RESOLVED THAT this radical transformation of the role of architecture will be supported by confining urban growth entirely within the current boundaries within our cities, and undertaking the reforestation of extensive urban fringe areas that have not been built upon yet.

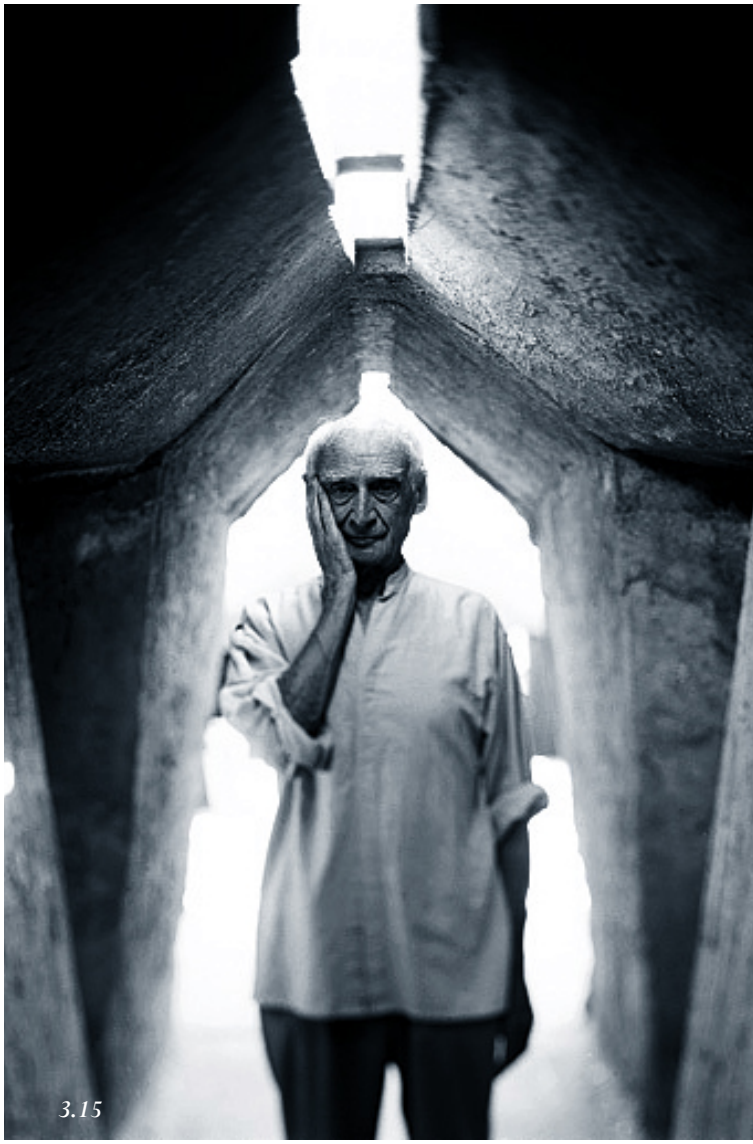

NEIGHBORHOOD
RESIDENTIAL
LIVING
CIRCULATION
PARK
PUBLIC
CITY CENTER
LIVING
COMMERCIAL
PROMENADE
0
50M
250M

POALO SOLERI

Poalo Soleri, an Italian born architect is one of the best known conceptual Utopian planners of the 21st century. Soleri relocated to the US where he apprenticed to Frank Lloyd Wright. He designed and conceptualized many self-sufficient cities and mega structures. He designed and built the Mesa City of Arcosanti - "the urban laboratory" in Arizona. Arcosanti was the prototype for Archology, a philosophy that was developed by Soleri in the 1960. Soleri died in the year 2013.-`

Arcosanti was a prototype "arcology," an idea developed by Paolo Soleri in the 1960s. Arcology, which conceptually addresses the interrelationship between architecture and ecology, was conceived by Paolo Soleri as a vital process as well as an end product. Arcologies ultimately provide alternatives to horizontal growth that characterizes most American cities and their resulting suburbs. By contrast, arcologies are self-contained, vertically layered megabuildings that combine living, working, and natural environments into condensed superorganisms. Although unconventional in form, the underlying assumptions are intensely urbanistic in that they support a complex philosophical position that relates megacities to the entire process of evolution.

Paolo Soleri makes a scientific analogy between the compactness in nature and the density, or critical mass, essential to urban societies. Because the degree of liveliness, energy, and efficiency is directly proportional to density, the city must be predicated on compactness: lack of density is synonymous with inefficiency.



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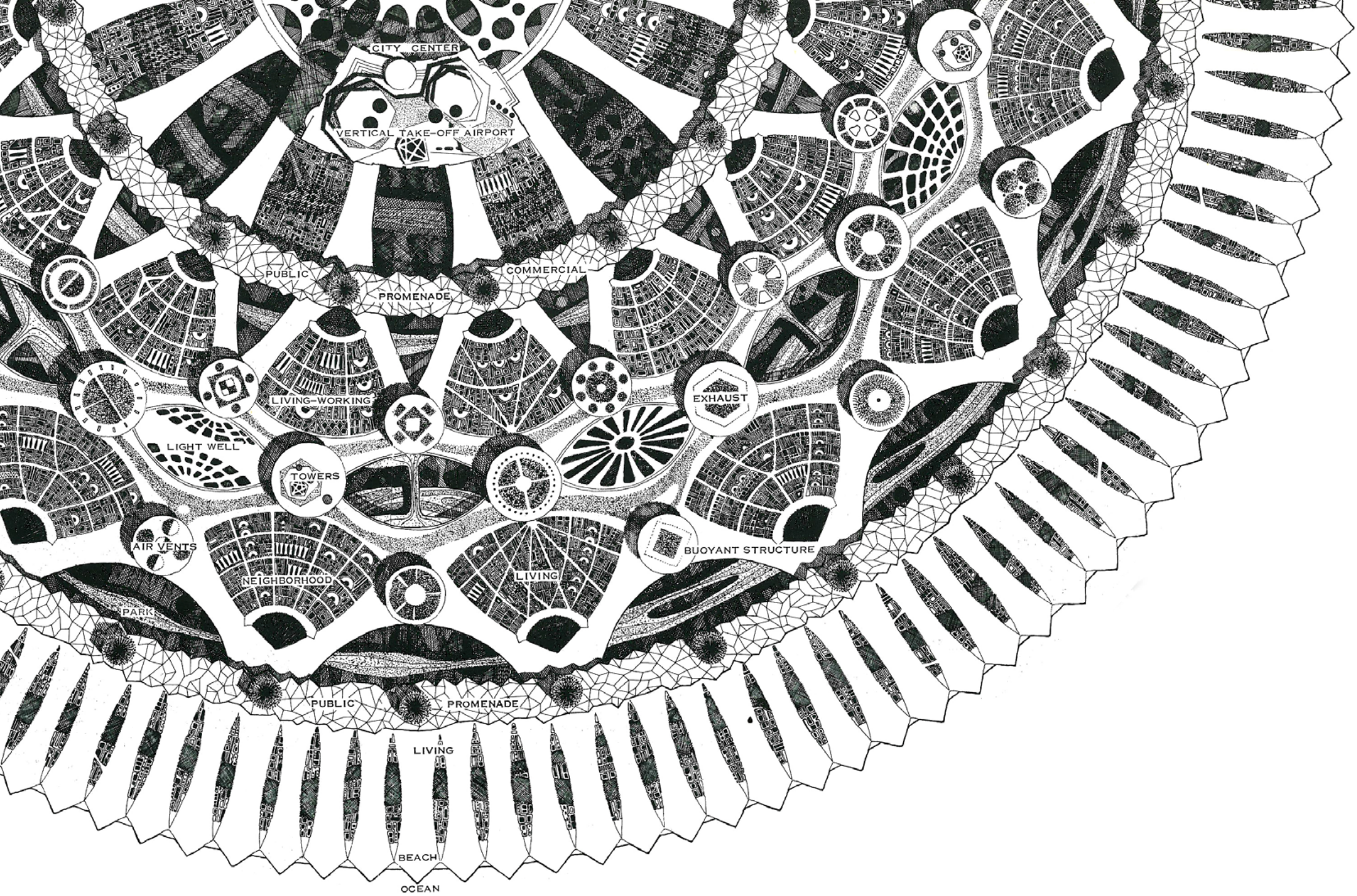

CITY CENTER
VERTICAL TAKE-OFF AIRPORT
PUBLIC
PROMENADE
COMMERCIAL
LIVING-WORKING
EXHAUST
LIGHT WELL
TOWERS
AIR VENTS
NEIGHBORHOOD
LIVING
BUOYANT STRUCTURE
PARK
PUBLIC
PROMENADE
LIVING
BEACH
OCEAN

3.16

ARCHOLOGY

- The City in the image of Man

The foundation on which the theory of Archology lies is:

Morphologically, the man-made machine which parallels and ecology of organisms, an ecology of scale, balance, dynamism and complexity;

Skeletally, an architecture in which there is an interplay of forces by which man and society grow;

Functionally, a dense and compact collection of forces in space, created and needed by man and society;

Humanly, space for the multiple expressions reflected of a single man and of a society;

Formally, the fusion of principles between the organisation found in natural organisms and architecture.

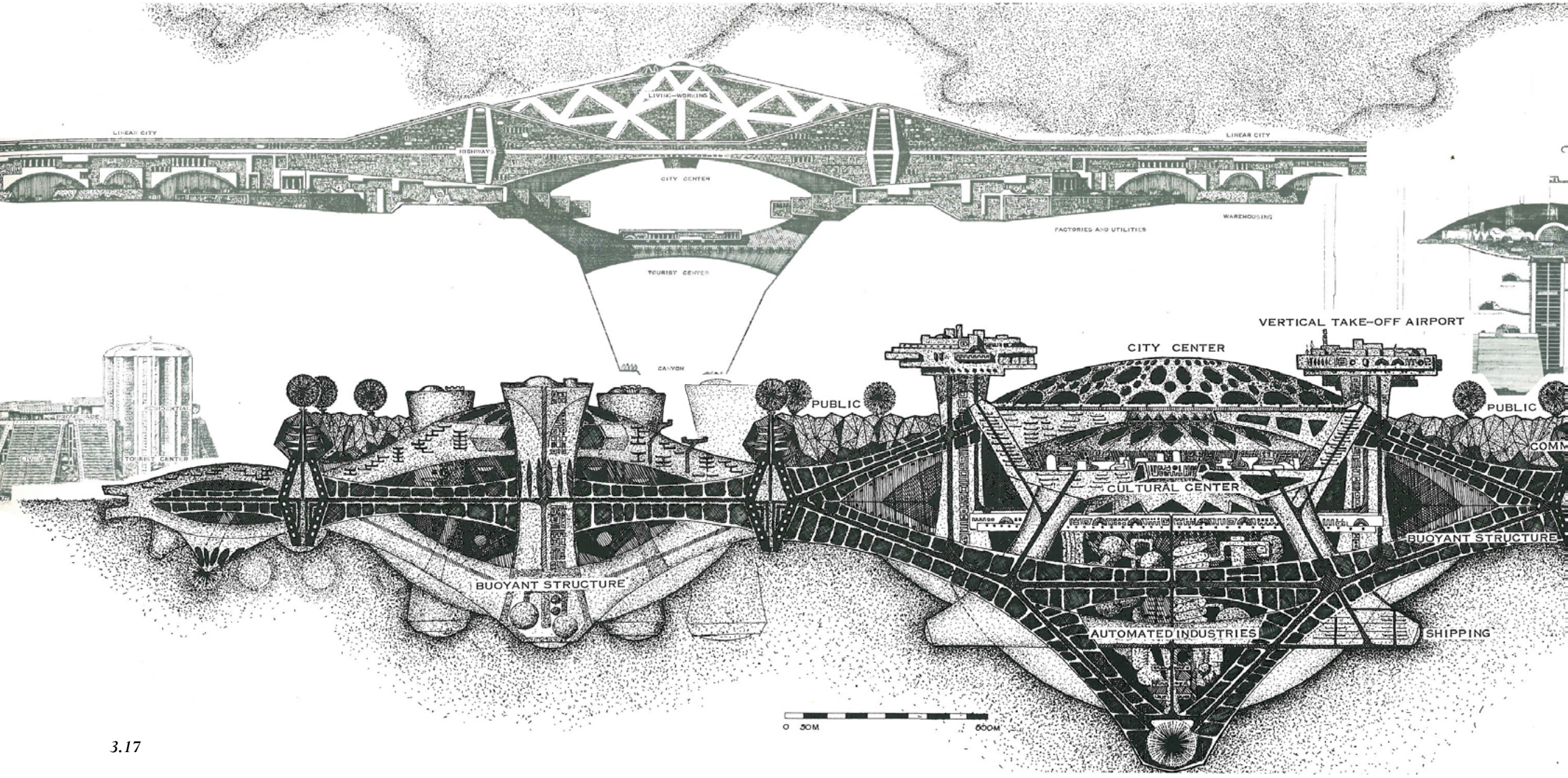
Soleri's theory of applying organisational principles found in nature to architecture may be on a larger, urban sized architectural scale but these principles can be applied to an existing city. His sociological philosophies are steered toward the creation of self-sufficient societies within a single structure that houses all amenities found in a successful city – his intention and goal is the creation of a compact, walkable city. Isolating cities into gigantic single structures are anticipated to have disastrous results - segregation, isolation as well as political and social issues are anticipated when reflecting on such a concept.

Achieving walkability within the urban structure is the future plan for the city of Durban. Extracting relevant elements of the theory of Archology and ignoring the negative concepts, it could be used as a tool for the success for the future plan of Durban.

An architecture redefined has the potential for new, exciting opportunities for city life. Architecture is the physical structure or framework for the life of man, apart from his own being and all biological

"There is an inherent logic in the structure and nature of organisms that have grown on this planet. Any architecture, any urban design, and any social order that violates that structure and nature, is destructive to itself and of us."

- Peter Blake (1969)



3.17

frameworks. Architecture is the tangible form of the ecology of the human, space allows man to radiate the best energetic and wilful influx (Soleri, 1969). Architecture is best experienced as a systematic entity within its peripheral, environmental determinant. The city is a human problem and the solution may only manifest through ecological awareness (Soleri, 1969: 7).

The condition of man is strictly related to the environment he is placed in, ultimately man is an environmental animal as he abides within space, his energies are reflected within space and he has the ability to existentially absorb space. Man is also a social animal and therefore one may observe that the predominant environment for man is the city. The city is the true concern for architecture (Soleri, 1969: 7).

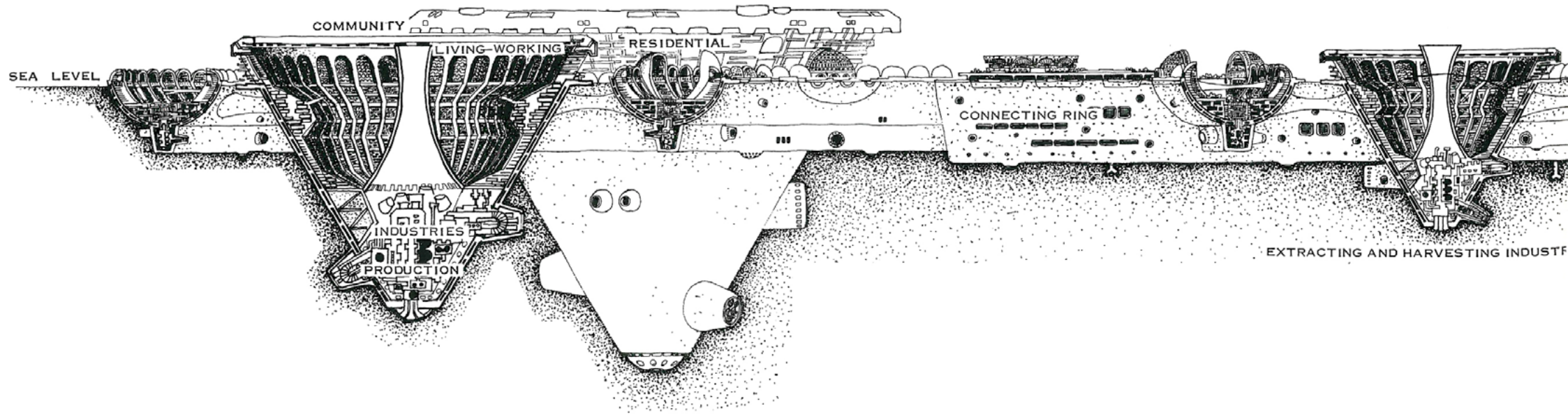
The idea of a one-structure system is not incidental to the overall organisation of the city but should be seen as central to it. The wholeness observed in a biological organism is sought in the making of a city, a symbiotic analogy between the functioning of an organism and that of a metropolitan structure (Soleri, 1969: 13). Flow is the element that is fundamental to the functionality of both systems. The flow of matter and energy is what makes life. Humans are in constant motion, from blood in the veins that are in perpetual flow (until death), to navigating cities and continents. With the intensity of flow in the city, interconnection is required, physical as well as cybernetic interactions eliminate time and space voids, maintaining a vital system. It is imperative that the interchange of the 21st century is one that is technologically advanced to overcome inefficiencies and is able to fill the void. These mechanical systems are fundamental for the functioning of a successful urban life (Soleri, 1969: 13). In physical terms, this means that the distance, time and all obstacles that separate man from his desired goal or destination needs to be scaled down to the amount of energy available to a person.

In a society where production determines success, the coordination of information, communication, transportation, distribution and transference are the mechanics by which a society operates. It is not a coincidence that all these aspects link to the phenomenon of life itself. Man, biology and mechanical systems cannot be viewed as separate entities, they are entangled and dependent on one another in the cycle of production and through the concept of movement.

Man's mechanical energies are absorbed by cement, tarmac, steel, pollution and all sorts of barriers that in the growing frame of space and time (Soleri, 1969: 14). His flow becomes sluggish and he becomes warn-out. Vital flow and therefore vital potential is made possible when there is minimal separation between man and his amenities. This can be said for the relationship with man and the city.

"The care of the citizen is the sap of the city. But one can care only for that which one loves. A lovable city is key to a living city. A lovely city is not an accident, as a lovely person is not an accident."

- *Paolo Soleri (1969)*



Wastes and Archology

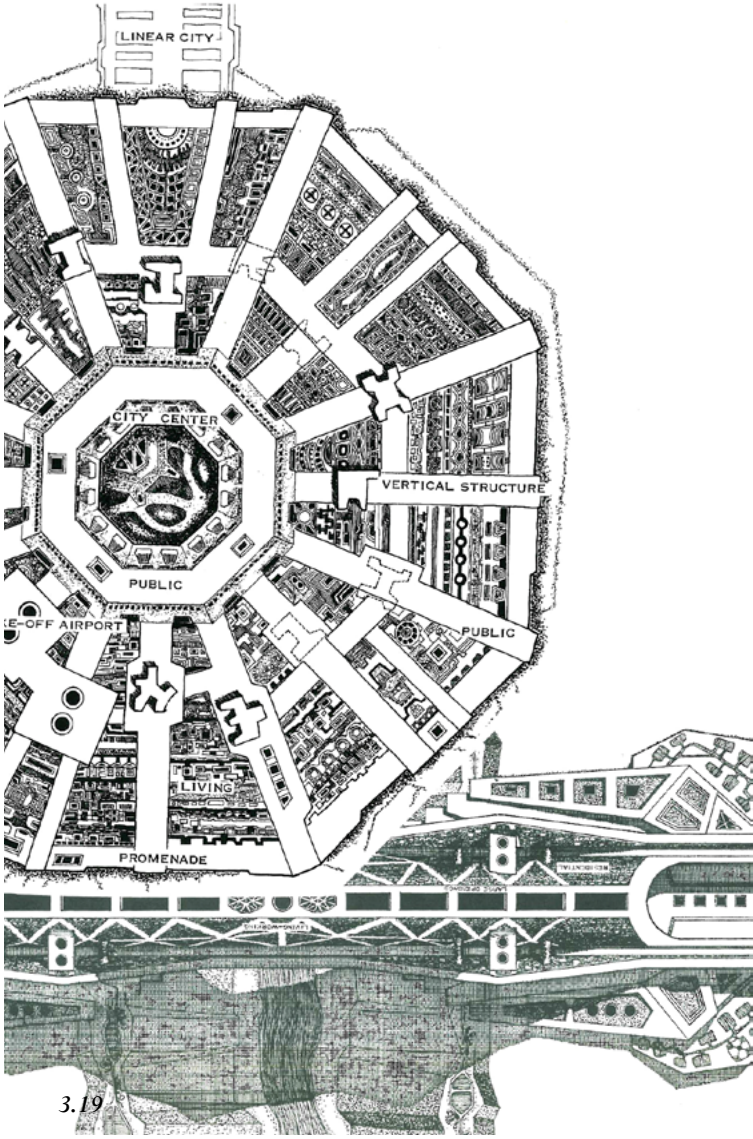
One of the most fundamental qualities of nature that has aided it in its resilience and in its sustainability thus far is its inability to produce waste. Nature works in a cycle, in perpetual production, even in death, nature is producing an element for another organism to benefit from. Man has not yet grasped this concept of evolution. Man works in a linear production line instead of circular. Man is in the constant state of consuming yet most of his production results in waste, a product that cannot be reused. This is an elemental factor to the on-going deterioration of the Earth.

Material waste refers to the destruction of natural materials, forests are transforms into cheap lumbar and then into even cheaper shelters – from wilderness to slums in the matter of a decade (Soleri, 1969: 16). Non-renewable natural resourced are continuously depleting by the hand of the consumerist ideology of man.

Biological waste or functional waste, a fractured landscape, poisoned or scorched vegetation, hot pavements, dust fumes, combustion of fuels, animal species displaced or destroyed, pollution of the land, seas and air—the disruption and destruction of ecologies.

Energetic waste refers to the displacement or sprawl of land and settlements – suburbia and its dependence of the automobile. A large fraction of the working population exists to keep cars on the roads, road building and maintenance (Soleri, 1969: 14), Despite the death, mental and physical wrecks caused by both the displacement and private car, we are fooled by its perception of wealth and freedom.

Mental waste is the perception of private car, man's ignorance of the state of natural resources he has destroyed over a matter of half a generation, man's ignorance to solutions of the issues caused by his actions and realisation of the implications of his actions and crimes against ecologies when it is too late and the destruction of the earth leads to his final demise.



3.19

3.20 Artist - Agnes Cecile

human - spatial

HUMAN ECOLOGY

JUHANI PALLASMAA

understanding architecture

The Finnish Architect, critic and educator is an international figure in the realm of contemporary architecture and art culture. Pallasmaa's thoughts for architecture promote basic yet evolutionary approaches to architecture and have revolutionised phenomenology in architecture through the 21st century.

Though Pallasmaa's architectural practice ranges from projects in urban design, building design, exhibition and graphic design, he is best known by students worldwide for his literature on phenomenology and existentialism: *The Embodied Image (2011), The Thinking Hand (2009), Encounters: Architectural Essays (2006), The Aalto House (2003), Juhani Pallasmaa: Sensuous Minimalism (2002), The Architecture of Image (2001), The Villa Mairea (1998), The Eyes of the Skin (1996), and The Melnikov House (1996)*. His works have become a standard text in studios and seminars around the world and has contributed to architects understanding the meaning of space, creating meaningful spaces and the connection between human and spatial ecology significantly.

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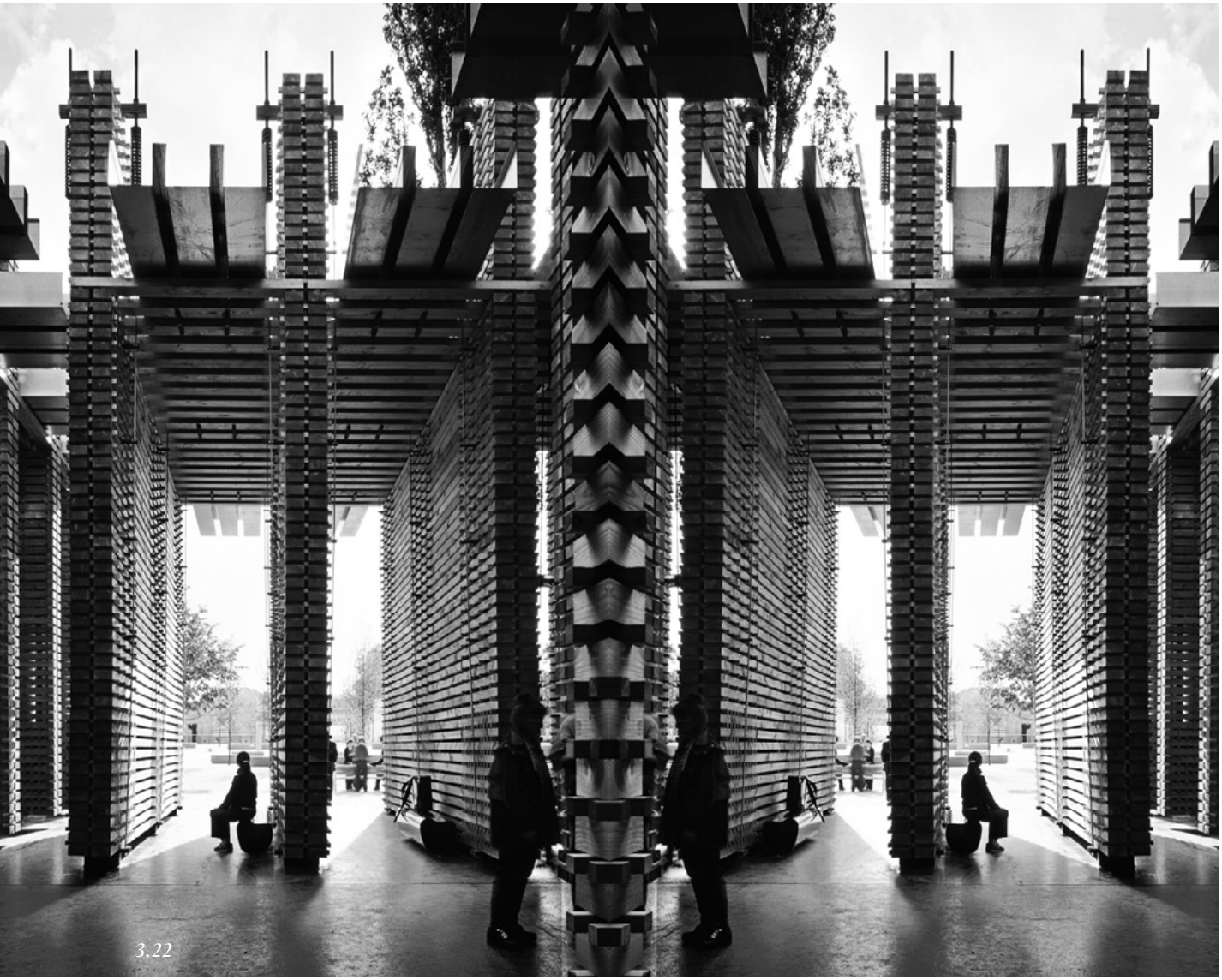

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Human and Spatial Ecology is derived from existentialism found in the meaning of the architectural realm. Human Ecology refers to the human perception, approach and attitude towards space and environment. Spatial Ecology deals with the spatial qualities that Architecture creates and the influence it has on the human perception – the connection with Human and Spatial Ecology is found in meaningful, humanly constructed spaces in architecture.

Creating a civic building that shifts the perception of society within the urban realm in a city such as Durban comes at a great realisation that the human, experiential entity within architecture has a significant and profound role in the process of creating a revolutionary building. Elements covered in this section of the dissertation relates to what the architecture of *Machinaria* can grant to the human ritualistic experience of travel in central Durban.

"We do not grasp space only by our senses… we live in it, we project our personalities into it, we are tied to it by emotional bonds; space is not just perceived… it is lived."
- Georges Matore - L'Espace Humain, 1962

EXISTENTIAL

and architectural human space

Man's experiences of the world are described as himself being the point of reference or the centre (McCarter and Pallasmaa, 2012). Therefore, space is the most fundamental architectural concept as successful architecture articulates space that is humanly meaningful and expressive. People's spatial behaviour is subliminally conditioned by the space ability to interact with man's five senses. Ergo, space becomes the medium for which mental and emotional communication is expressed. Meaningful architectural spaces distinguish between the space of the world and the human domain, the mental and the physical, the material and the spiritual (McCarter and Pallasmaa, 2012).

The needs of Man be can classified as biological, sensory or physiological or referred to as is body, senses, mind and soul (McCarter and Pallasmaa, 2012). Real lived spaces are experienced in a multi -sensory manner and not just visually. Spaces also have auditive, tactile and olfactory qualities and some architectural forms and materials can influence the sense of taste. This sensory experience may render the architectural form of space as monumental or intimate, harsh or soft, rejecting or inviting, to the occupant. This experience is linked to the perception of the human anatomy flowing through space.

Architecture plays an important existential and mental role on the human condition; limitless natural space is transformed to meaningful places for the human domain through architectural construct (McCarter and Pallasmaa, 2012).

The human condition strives to articulate and structure space through our measures and to give it mental and cultural meaning. This is created through the architectural manipulation of mass, geometry, structure, materiality, scale, rhythm and light. The outcome may be an architecture that is static or dynamic, geometric or sculpted, centripetal or centrifugal, closed or opened, uniform or complex (McCarter and Pallasmaa, 2012).

Lived space can be referred to as existential space because it is different from physical and geometric space. It is based on the essence of meaning and values of a group or an individual that may be reflected onto the space, it is interpreted through the inhabitors memory and intention. This then influences their behaviour in the space as well as their behaviour towards the space (McCarter and Pallasmaa, 2012). Architecture creates meaning and definition to the human experience.

An interacting system of relationships can be observed between the context and the object, the distant and what is near, the exterior and the interior, the material and the immaterial, may be experienced in a true piece of architecture (McCarter and Pallasmaa, 2012).

3.23

3.24

the space of

TIME

Time is known to be one of the most mysterious and uncontrollable entities of the human dimension – both physically and mentally. The scales of time, if categorised may be observed as: cosmic time, evolutionary time, cultural time and human experiential time (Pallasmaa et al, 2012: 45). Early twentieth century saw the rise of architects, poets, painters and sculptors abandon the narrow thinking of static external space and the enclosed path of linear time and turn to the dynamism of human perception that merges space and time, actuality and memory, reality and dream (Pallasmaa et al, 2012: 45).

The integration of space and time within architecture may be achieved through fragmentation and restructuring of elements and images in relation to the observer – a significant exchange is taking place between two dimensions: the spatialization of time and the temporalization of space. This statement is exemplified when one observes our method of measuring time today. We measure space through units of time to determine distances and spatial units to observe time, such as time zones.

Evolutionary architecture is one that grows and changes through time and age, it structures

and enriches itself in a cultural identity. This is experienced through the observer's movement of the building and its contextual history. Architecture itself has the profound ability to express and dramatise the passing of time through a seamless play of light and shadow (Pallasmaa et al, 2012: 47).

"Light serves to remind us of the way the language of space is also a language of time."

Karesten Harries, 'Thoughts on a non-arbitrary architecture', Dwelling, Seeing, and Designing: Towards a Phenomenological Ecology

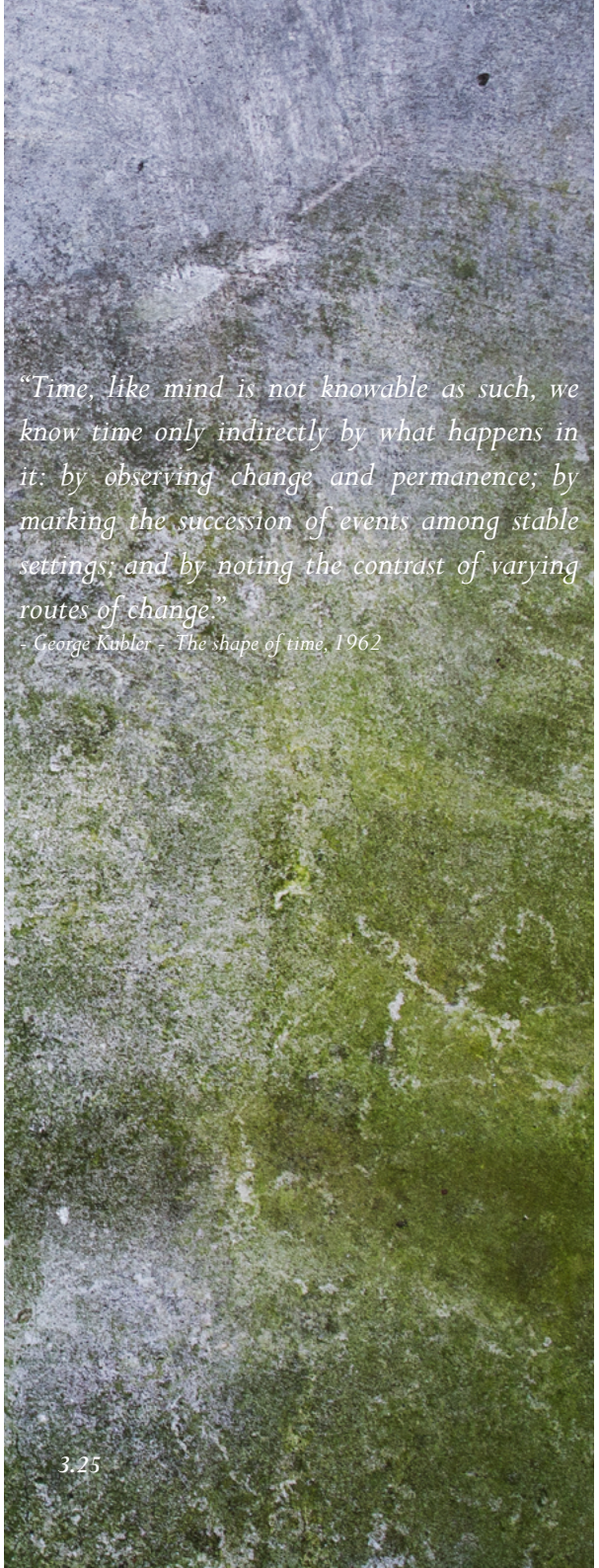
Architectural structures, explained by Pallasmaa, can be seen as external human mental structures and as an extension of consciousness and collective memories of an individual (Pallasmaa et al, 2012: 48). Architecture is an instrument for marking the passage of time though historic building techniques, building technology as well as understanding social and cultural realities of the eras.

Great buildings are museums of time, they not mere sculptures or metaphoric ruins of time. As an individual enters a historic building, its particular mode of time filters through his/her emotions and awareness (Pallasmaa et al, 2012: 48). Architectural construction is seen as a measure and expression of the evolution of history and culture.

Fundamentally, architecture may only be experienced through movement in space and therefore, architectural space is kinetic and embodied (Pallasmaa et al, 2012: 49). Architecture has the ability to create its own altered reality as buildings elude perceptions and understanding that alter the experience of space and time. Architectural elements can condition the way in which we read physical reality and time, architecture can slow down, speed up, halt or even reverse the experience of time.

> *"The melancholy of ruins arises from the realisation that we are not masters of our own destinies, and all achievements of civilisations will eventually be consumed by nature, decay and time."*
>
> - *Pallasmaa, Understanding architecture (2012: 49)*

Every era and every building has a distinct sense of velocity and time. Patient, calming and slow spaces as well as fast and hurried spaces exist according to the spatial design and functionality of the building. Today's culture aims to aspire to a form of agelessness and is afraid of signs of age, wear and decay. This is making it difficult for humans to identify and for buildings



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to communicate the traces of time. Buildings today often seem to exist in a timeless vacumn without any contact from the past or confidence for the future (Pallasmaa et al, 2012: 50).

Man is usually unaware of his evolutionary biological constitution yet we do not abide in a single moment, we are beings of history, memory and an intense depth of time live on in our biological constitution. In the twenty first century, a globalised world, we cannot view ourselves as just urbanised creatures that take advantage virtual realities – we are also condensations of evolutionary progress and processes (Pallasmaa et al, 2012: 51).

Our perception of fundamental architectural connections and understanding is not plainly aesthetic but rather embedded deep within our genetic make-up.

"You cannot make what you want to make, but what the material permits you to make.You cannot make out of marble what you would make out of wood, or out of wood what you would make out of stone."
- Constantin Brancusi - NewYork World, 1926

HAPTICITY

matter and time

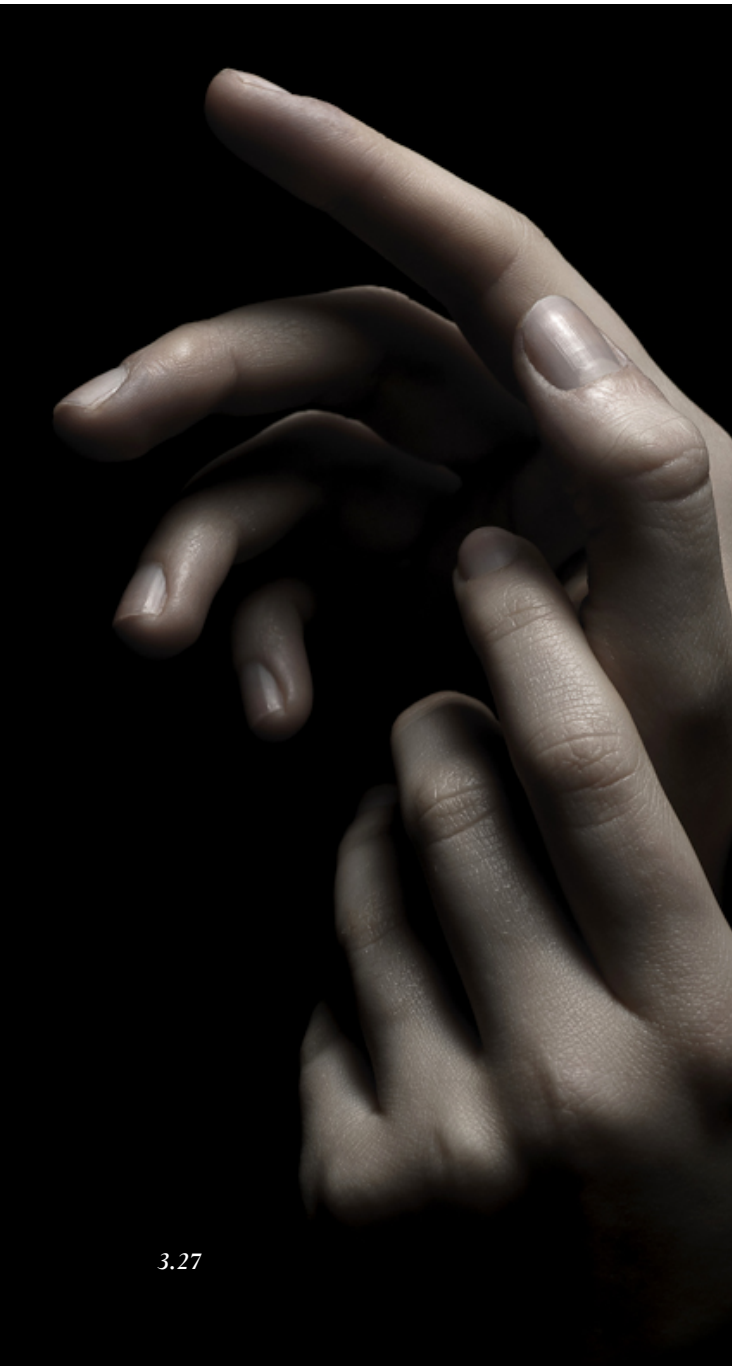
Basic materials since ancient architecture comprise of stone, brick, wood and metals. These materials are derivative of the earth and reunite the building back to the earth even after its processes are complete. There is a dialogue between these materials (matter) and time. Images indicating the presence of matter create a deeper and more profound experience for the observer than that of the overall form. There is a subliminal connection between human, matter and the earth. As creatures of nature, the connection with nature and the earth will always be sought and matter solidifies and strengthens the connection to the earth especially in man-made spaces that humans occupy.

Modernist architecture is treated as abstracted boundaries of volumes, they have a formal, conceptual and visual qualities rather than a tactile essence (Pallasmaa et al, 2012: 82). The plain surfaces of white plaster and paint remain mute, as the volume of the space is given hierarchy over tactility and the presence of matter is silent.

The lack of matter gives a space the feeling of distance, outsideness and isolation whereas the presence of materiality evokes haptic sensations and experience of intimacy and belonging (Pallasmaa et al, 2012: 82). Materials have a language and memory of their own – stone speaks of its geological origin, its permanence and durability, brick evokes the thought of the earth, fire and gravity, bronze refers to the extreme heats of its manufacture, labour and the aging process of patina, Wood speaks of its two existences – life, a growing tree and the second being that of an artefact carved by the hands of a carpenter (Pallasmaa et al, 2012: 82). These materials found in nature, speak of time, memory, duration, process and utilisation. These materials have the profound ability to relate to the human condition, induce emotions and sensations of calmness, warmth and belonging as well as evoke to memory and senses.

The technical environments man is exposed to today, often detach us from nature, memory and materials which make social cohesion difficult in these spaces as well. Man-made materials are devoid of traces of time and history, they evoke an air of alienation and demote rootedness (Pallasmaa et al, 2012: 82).

Architecture needs to be sensitive to the quality and dialogue of materials and the evolution of these materials over time – age and decay. The haptic qualities, apart from vision, are acknowledged as conduits for expression and experience. Recently, architects have moved away from cold, synthetic materials and have been attracted to the patina, opacity, depth, weight and aging of materials, yet again. The re-emergence of consciousness towards Mother Earth depicts that after



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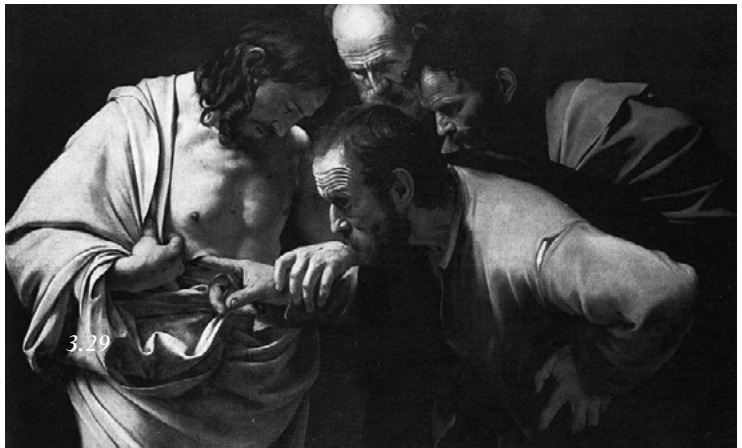

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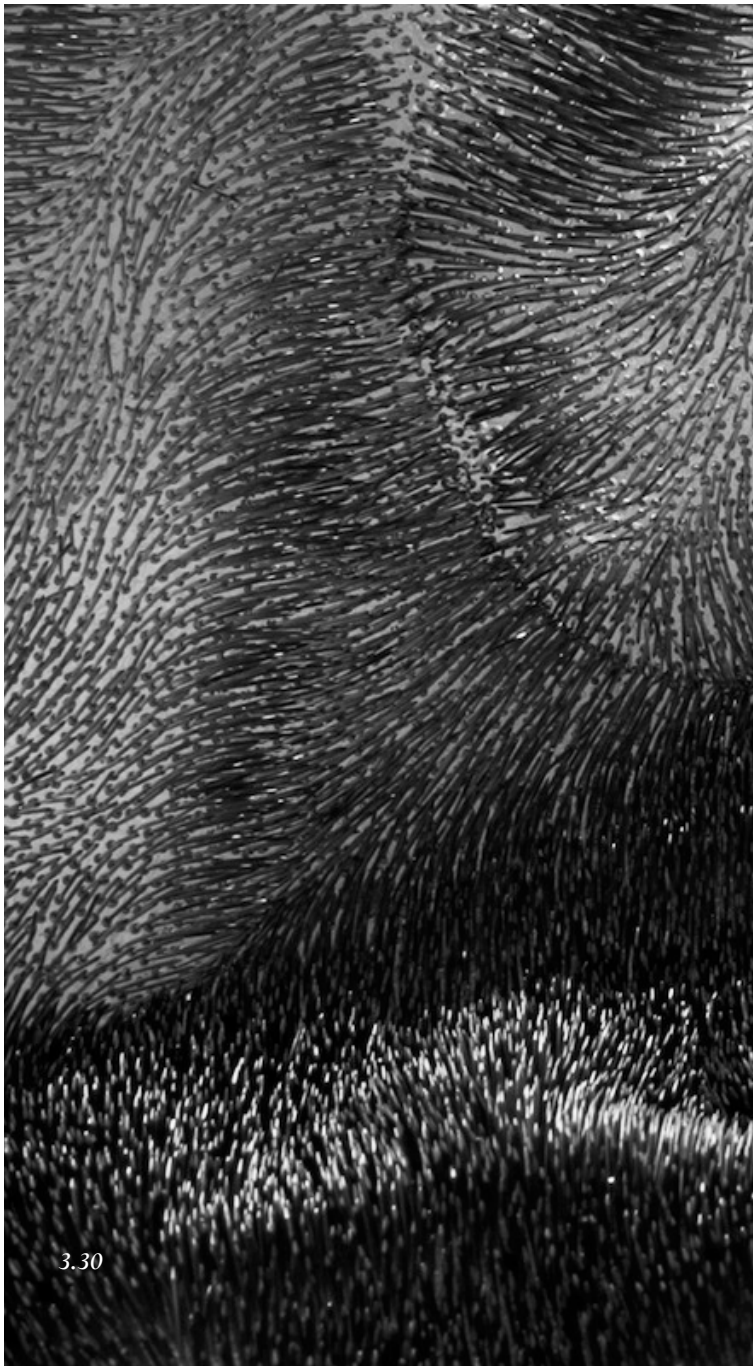

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our journey towards a utopian journey of autonomy and immateriality, architecture is detouring back towards materiality, primordial female symbols of interiority, belonging and intimacy (Pallasmaa et al, 2012: 83). This concretises a sense of safety, a sense of warmth and commitment to the architect and the observer – images of homecoming are becoming more prominent. This journey back to notions of earth and land is an indication of the human mental need for groundedness and basic existentialism.

The need for sustainability, evolution and a shift in technology has lead to innovations in architectural materials that are self-maintaining or adjust automatically to environmental conditions such as moisture, temperature, light, noise, air movement – what can be seen as a living skin (Pallasmaa et al, 2012: 84).

The montage is a technique used in art and architecture as a layering system made up of elements that form an overall image. This technique combines materiality and the layering of time, it enables the weaving of a dense and non linear narrative through the juxtaposition of fragmented images that are derived from unrelated origins (Pallasmaa et al, 2012: 84). The result is a complex form that grants the observer a time and story line through the experience of the spaces comprised in the built form.

Within this haptically sensuous architecture, materiality and a sense of culture and tradition evoke experiences of natural duration and mental alluring (Pallasmaa et al, 2012: 82). Man does not merely dwell in a space, he inhabits a continuum of culture and is bound by the memory of material.

Man envisions and dreams of an eternal, ageless life through symbols of perfection and beauty yet mentally, we have to experience the passing of time, traces of erosion and wear remind us of the ultimate destination of the biological world – death. This reminder will enable man to live a life of experiences that creates meaning rather than passing through time without the essence of life in his grasp.

3.31

3.32

"Lightness is born of heaviness and heaviness of lightness, instantaneously and reciprocally, returning creation for creation, gaining strength proportionally as they gain in life, and as much more in life as they gain in motion. They destroy one another also at the same time, fulfilling a mutual vendetta, proof that lightness is created only in conjunction with heaviness and heaviness only where lightness follows."

- Leonardo da Vinci - Les Carnets

3.33

FORCE

form and structure

Meaningful architecture arise from cultural, physical, material, functional and mental causalities and convert these elements into metaphoric architectural expressions (Pallasmaa et al, 2012: 117). All physical structures on earth are bound to the force of gravity. Structures are the physical forces that encompass a heightened sense of grounded reality. Specific functionalities are created according the spatial composition of a structure and the structure itself conveys an elegant expression if stability.

The tectonic expression of architecture speaks of the composition of the construction of the building, the process of joining different elements of construction of form a whole – an architectural montage. This tectonic language is in dialogue with the force of gravity and natural elements of the physical world. Tectonics in architecture can be seen as the as the mother tongue of architecture.

The resistance of the force of gravity and the mental state entails the human desire for liberation from the physical ties of matter – the desire for weightlessness and flight – freedom and power. The force of gravity is then fought with structural elements such as geometries and materials that transfer the forces of gravity through the structure, down into the earth. Man experiences the stability and force of the structure through an unconscious bodily reflection - of our skeletal and muscular system (Pallasmaa et al, 2012: 119).

We experience architectural structures, volumes and surfaces through virtual movement (Pallasmaa et al, 2012: 120). We have the subliminal ability to project a sense of touch towards the texture, weight and temperature of the structural materials (Pallasmaa et al, 2012: 120). This grants us the perception of safety and confidence within the structure. Even through the ages of advances technology and artificial realities, the need for grounded structural dialogues is still important for the connection and communication to our senses and existential experiences.

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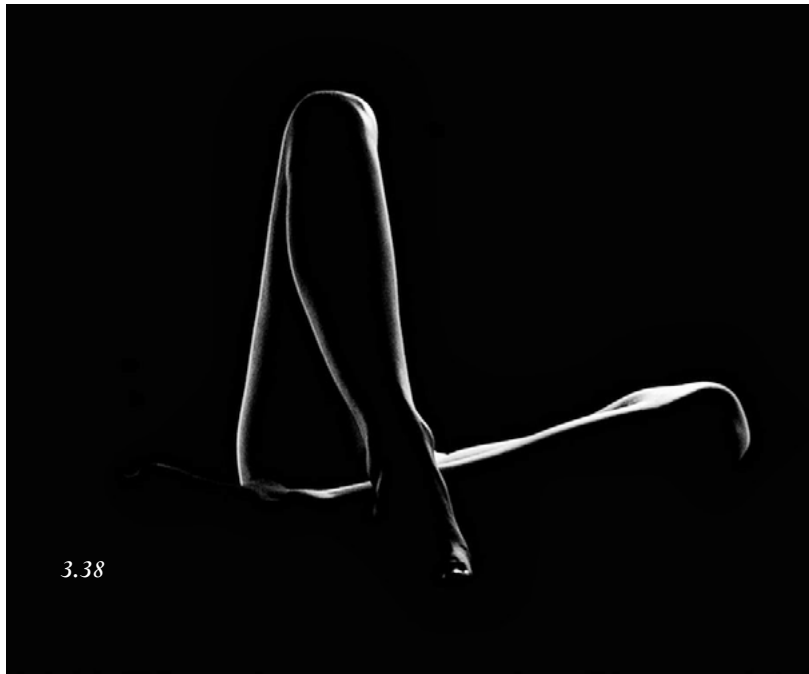

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"… we are born of light. The seasons are felt through light. We only know the world as it is evoked by light, and from this comes the thought that material is spent on light. To me natural light is the only light, because it has mood - it provides a ground for common agreement for man - it puts us in touch with the eternal. Natural light is the only light that makes architecture architecture."
- Louis Kahn, 1987

materiality and tactility of

LIGHT

The experience of architecture does not exist without light – space and light and inseparable (Pallasmaa et al, 2012: 151). The experience of a space grasped through complete darkness through hearing, touch or smell correlates to the understanding that space is formed through light and vision. Architectural experiences are multi-sensory yet the influence of light in a space directly conditions the mood.

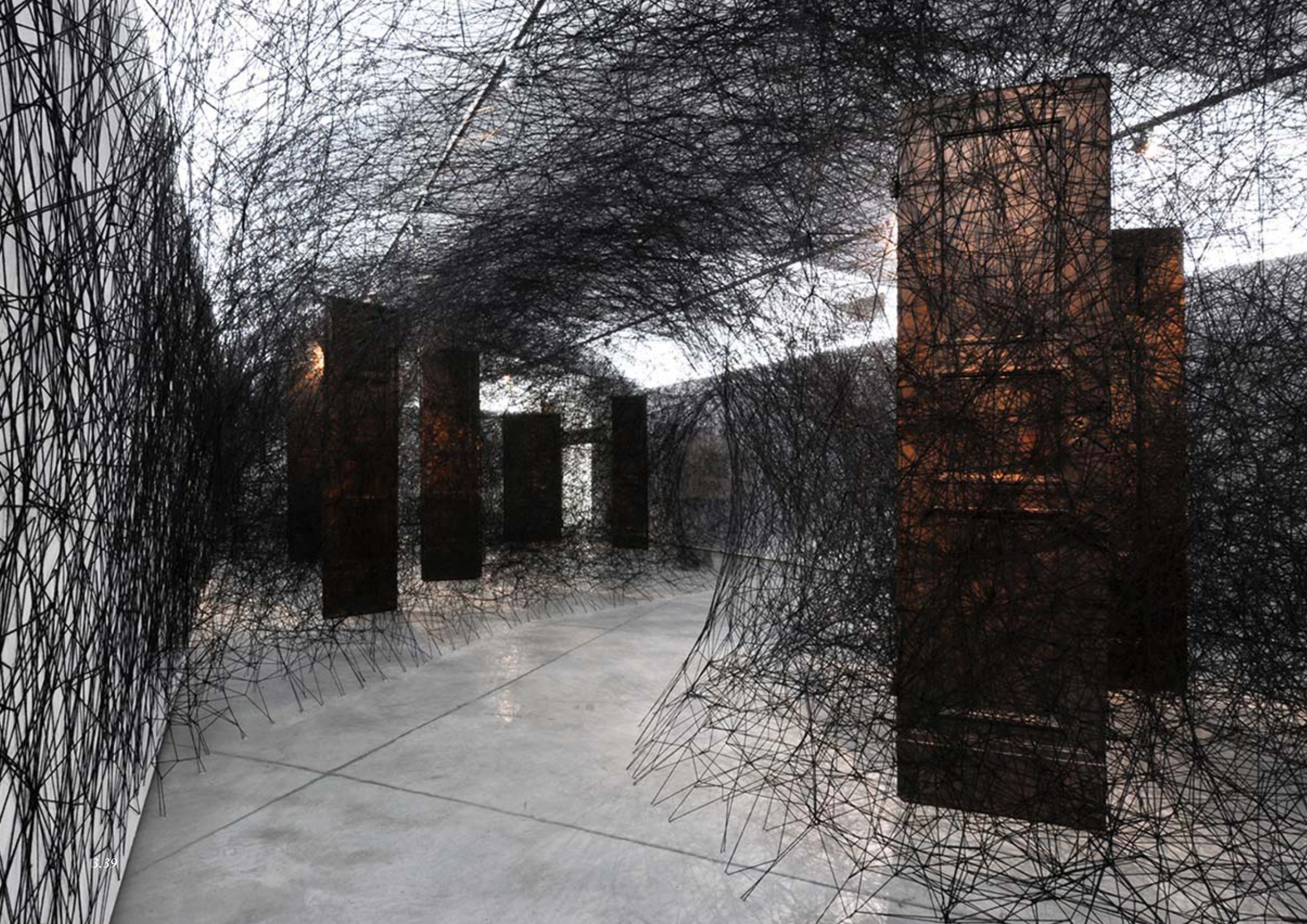
Light controls the processes of biological life and even has the ability to influence certain hormonal activities in humans, it affects the mood, activeness and energy levels as well (Pallasmaa et al, 2012: 151). Volumes, shapes of spaces, power, weight, moisture, texture, smoothness and temperature are all given characteristics through the quality of light and shadow in a space. Light connects architectural spaces with the physical and natural world as well as time, through luminous indications of the seasons and hours of the day.

"Natural light breathes life into architecture and connects the material world with the cosmic dimensions" (Pallasmaa et al, 2012: 151).

Light gives space its meaning by highlighting primary, sub spaces and places, it grants space a rhythmic trait and a sense of intimacy and scale. It creates points of foci and directs attention and movement. The influence of light on a space grants that space profound qualities, as Pallasmaa has stated, architecture is nothing without light (Pallasmaa et al, 2012: 151) yet on the other hand, light is just as dependant on space and composition to reach a level of meaning or articulation. We observe light unconsciously as light is tends to be emotionally absent unless it is contained within a space or enhanced by bouncing off a surface.

The absence of light or shadow grants light a deeper and more profound tactility, as moulded light seems to have the qualities of physical matter. The thin roof slits of Peter Zumthor force light into to narrow directional slivers that cut through darkness in space like immaterial veils or even as blades of illumination (Pallasmaa et al, 2012: 152). Luminance acquires a heightened sense of emotive supremacy in relation to darkness.

The sharpness of vision is dimmed by deep shadows creating spaces of ambiguous depth and distance, at the same time inviting subliminal visions of fantastical tactility. Evolution and memory has trained human skin to recognise and maintain the sensation to identify colour and light. Therefore, light is observed as not just an optical phenomenon but also connected to hapticity.



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"Architecture is the making of a room; an assembly of rooms. The light is the light of that room. Thoughts exchanged by one and another are not the same in one room as in another: a street is a room, a community room by agreement. Its character from intersection to intersection changes and may be regarded as a number of rooms."

- Louis Kahn - Architecture, Silence and light, 1991

ROOM

of memory

The room is the most intense and focused architectural, human experience. A room is defined as an enclosed space which harbours distinct characteristics. In certain architectural works, spaces in rooms may feel denser – as if gravity itself is strengthened. It has the ability to make us feel at the very centre of the world. A room may centre us but we can also experience it as an externalisation of our own bodies, as a second skin, and so a room has the power to connect us to a far larger space than we may realize (Pallasmaa et al, 2012: 255). *Machinaria* is designed as a space that connects people not only physically, but as a extension to hope, dreams and the future.

Meaningful architecture is able to paradoxically merge antonymic characteristics such as exterior and interior, public and private, landscape and room (Pallasmaa et al, 2012: 255), this deepens the experience of these juxtaposed characteristics and shifts the perception of these once ordinary entities.

Roomness may still be experienced in spaces that are not fully enclosed or sealed by walls. The essence of architecture lies in the defining and meaning of spatial creation – the shade of a tree, defined by the density in its branches has created a sense of roomness in the shelter it has provided.

The existential impact of a room on our memory may be forceful. Between the room and the occupant, an unconscious exchange takes place – the space defined by the room is internalised by the occupant and the bodily scheme is projected onto the spatial parameters of the room. A memorable room becomes part of us and we leave parts of ourselves in the room (Pallasmaa et al, 2012: 255).

While the human minds can break up and rebuild rooms into mesmerising forms, architects combine different functional rooms into a building for multi-use functionalities. These various layering of functions grants the building a profound complexity and vibrancy.

Rooms may be arranged in a variety of ways – centralised, netted patterns, linear, radial, clustered, configured horizontal or vertical (Pallasmaa et al, 2012: 259). These room assemblies develop into experiential realms – the house, the building, the village, the town, the city. Man relates each of these entities to him/her self, the various scales and functionalities of the rooms constitute a higher or lower order of roomness (Pallasmaa et al, 2012: 259).

"Tree is leaf and leaf is tree – the house is city and the city is house… a city is not a city unless it is also a huge house – a house is a house only if it is a tiny city."

- *Aldo van Eyck, 1982*

A single building works as a cog in the context of many cogs that contribute to the functionality of urbanity.

"It is as if I am being manipulated by some subliminal code, not to be translated into words, which acts directly on the nervous system and imagination, at the same time stirring intimations of meaning with vivid spatial experience as though they were one thing. It is my belief that the code acts so directly and vividly upon us because it is strangely familiar; it is in fact the first language we have ever learned, long before words, and which is now recalled to us through art which holds the key to revive it."

- Colin St John Wilson - Architecture - Public Good and Private Necessity, 1979

the form of

RITUAL

All meaningful architectural structures materialise ideas, beliefs and patterns of behaviour (Pallasmaa et al, 2012: 289). The repetition of activities in a building, mundane or religious, tends to grant that activity a ritualistic quality. By designing for and facilitating these tendencies, a building can turn into an instrument of ritual. The daily practice of commuting to and from work or home, business or pleasure, is a form of ritual. Therefore, the interchange, being part of the routine and daily life experience for commuters is a building of ritual that not only facilitates ritual but amplifies it. The repetition of rituals materialises and articulates time and periodicity, daily life turns into a reflection of the metaphysical world (Pallasmaa et al, 2012: 289).

Buildings that contribute to the memorable quality of human life draws its connective forces from the emotional associations in the architectural language, those that are most deeply rooted in the common sensory of the human experiences. This is derived from archaic remnants of the mind – through the repetition of ritual. These are the deep historic connections that operate between the intellect and the unconscious (Pallasmaa et al, 2012: 259).

The forms of buildings and the design and relationships between them are based on the connections of human thought and the larger world. Meaningful architecture is created through spatial geometry that follows anthropologically established patterns of human spatial perception and behaviour, this is derived from the ritualistic notion of the human condition (Pallasmaa et al, 2012: 293).


BUS LANES
BUS LANES
PARKING
PARKING
PLATFORM
CONCOURSE
PLATFORM
RAIL
RAIL

3.41

3.42

3.43

" I was a child of that house, filled with the memory of its smells, filled with the coolness of its halls, filled with the voices that had given it life. There was even the song of the frogs in the pools; they came to be with me here."

- Antoine de Saint-Exupery -Wind, Sand and Stars, 1991

MEMORY

and the lifeworld

As humans, with complexities that grant us our identities, we do not simply abide in a world of just spatial and material qualities, we inhibit cultural, mental and temporal realities as well (Pallasmaa et al, 2012: 329). We experience the world as a layered entity that acts as a pendulum that swings between the past, present and future. Apart from settling the human condition in space and granting us a sense of place, architecture articulates experiences of history and duration.

Buildings and landscapes make up man's most substantial externalisations of memory. Humans understand and remember we are through our settings, both material and mental – we also use this to judge and alienate ourselves from foreign or past cultures. Architectural structures were once used as mnemonic devices by orators of antiquity. Existing architecture and images of past buildings act as landmarks for memory and are still used today to: materialise and preserve the course of time and grant it visibility, materialise remembrance by containing and projecting memories, as well as to stimulate and inspire man to remise and imagine (Pallasmaa et al, 2012: 329).

Pallasmaa states that memory and fantasy are related, as are recollection and imagination and that memory is the foundation of self-identity (Pallasmaa et al, 2012: 329). It is our memories and our ability to condition and project those memories that build our characteristics as well as the way in which we view the world around us.

Buildings are able to absorb and maintain temporal perceptions and laminate layers of different cultural and human narratives in a space. When we inhibit a space, we project a bit of ourselves within that space, that space then projects a piece of our identity back to those that come after us. This is what builds the identify of a building.

We cannot perceive time as a physical dimension yet we can experience it through its remnants – its traces, places and events of temporal occurrences (Pallasmaa et al, 2012: 330). These traces speak to us of past durations – human fate, power and technology. It stimulates the human experiences and enables us to imagine a world of their cultures and of lives passed within that space or building. The constitutional court of South Africa, Johannesburg is great example of this theory – the prison cells, chipped away over the years - the auras of injustices, killings, floggings and people passing by, doing time is still surrounding the structure. Remembrance is one of the key elements when experiencing the painful and sombre, apartheid soaked walls of the prison.

3.44

We can then say that architecture can spark the imagination and then enables us to grant it space within our memory because of the experience it grants us. We often mistaken memory to merely having a cerebral capacity yet the act of memorisation requires the whole body. It is an act of bodily projection (Pallasmaa et al, 2012: 331). Memories are not subjected to the electrochemical conditions of the brain but also vibrate through our skeletons, muscles, senses and skin (Pallasmaa et al, 2012: 331). These are categorised through the bodily processes that relate to our situations and surroundings. The sense of smell has the profound ability to instantly take us on a journey to a past experience and evoke memories that affect our emotions either negatively or positively.

Landscapes and buildings are often amplifiers for emotions – they concretise sensations of invitation or rejection, of belonging or alienation, tranquillity or despair (Pallasmaa et al, 2012: 331). This can be done only through the memory of the occupant and his recollection of the experiences past in relation to his experiences at present and anticipates his time spent within that space in the future.

" Our human landscape is our autobiography, reflecting our tastes, our values, our aspirations, and even our fears, in tangible, visible form.We rarely think of landscape that way, and so the cultural record we have written in the landscape is liable to be more truthful than most autobiographies because we are less self conscious about how we describe ourselves."

- Peirce F. Lewis -Axioms for reading the landscape, 1979

the internalised

LANDSCAPE

Landscape is often regarded as empty or open platform for events, or is an object of man-made or natural beauty, aesthetic admiration and spiritual contemplation (Pallasmaa et al, 2012: 365).

Landscape is a key element for man's experience. Man understands landscape through cultural geography, metaphorical terms and thus we often feel a magnetic connection between our bodies and the landscape – landscape is body and body is landscape. Therefore, landscape is not merely the context of life (Pallasmaa et al, 2012: 365), it is then internalised to form a mental landscape and it moulds our experiences, emotions and thought processors.

Rhythmic, spatial, formal, material and colour are the elemental contexts provided by landscapes to buildings. Architecture is in constant dialogue with its landscape settings. Seen as a counterpoint to landscape, the relationship architecture has with its natural landscape can be very dynamic. Buildings may be woven into their landscape, through architectural elements that echo the traits of the site it dwells upon.

A profound piece of architecture always enhances the landscape and grants it a deeper meaning that just open or empty space. The relationship between architecture and landscape needs to be intertwined for a significant experience. Landscape frames the architecture and the architecture underlines the landscape (Pallasmaa et al, 2012: 366).

Buildings relate to larger natural landscapes by incorporating gardens and courtyards into its layout design, this expands the architectural realm and mediates between nature and built form. Landscape design is an extension of the architectural realm as it requires specific thought processers because of its engagement with elements that relate to architecture such as living, material, time and growth (Pallasmaa et al, 2012: 367). With the shift for more sustainably conscious architectural technologies, landscape architecture is increasing as a model for a new age of sustainable and ecological architecture.

Natural landscapes often have their characteristics ranging from sublime and majestic, terrifying to romantic, melancholic and lyrical – our perception and our sensitivity towards landscapes to their features are culturally formed (Pallasmaa et al, 2012: 368). This is dependent on the relationship we have to our environments, or perception is moulded by memory and experiences in nature and the characteristics we associate with our environments.

Climate, landscape and the changing seasons also have the ability to mould the human perception, behaviour and character.The human senses are tuned to specific nuances of the surroundings by particular traits experienced in ones childhood environment. The open or closedness of views, for example, conditions ways of visual perception – we are able to view the world through the landscape of our domicile (Pallasmaa et al, 2012: 369).

"Whatever is true for space and time, this much is true for place: we are immersed in it and could not do without it. To be at all - to exist in any way - is to be somewhere, and to be somewhere is to be in some kind of place. Place is as requisite as the air we breathe, the ground on which we stand, the bodies we have. We are surrounded by places. We walk over and through them. We live in places, relate to other in them, die in them. Nothing we do, is unplaced."

- Edwards S. Casey - The fate of place, 1989

the power of

PLACE

Our innate structuring of the world is dependent on our experience of place, this also influences our mental and environmental perception of the world (Pallasmaa et al, 2012: 403). Our experiential perception is a layering or mosaic of places, it is not merely a single space that has little or no meaning. Physical space is transformed into lived spaces when we project particular meaning onto these spaces, natural spaces that are defined into experiential places (Pallasmaa et al, 2012: 403).

Kevin Lynch speaks of the notion of 'imageability' regarding shapes, arrangements and colours that aid in the mental configuration or perception of the environment. The Roman concept of genius loci observed the sense of placeness and speaks of the spirit of a place. A landscape is also experienced as a collection of places by defining and relating the human perception to different elements in the landscape.

Man has the ability to structure his/her spatial world into places, experiential coherence and personal meaning (Pallasmaa et al, 2012: 403). The most fundamental task of architecture is to create a sense of place. A meaningful piece of architecture should have its unique ability to exude its own sense of placeness and presence. The architectural concept of placeness arises from identifiable and memorable traits such as signification, scale and ambience (Pallasmaa et al, 2012: 404).

'The word "place" is best applied to those fragments of human environments where meaning, activities and specific landscape are all implicated and enfolded by each other.' – Edward Relph 1993

The feeling of placeness can come from a sensation of clarity, repetition, ritual, mystery, restraint or spontaneity. A place is bound by size and scale yet it can be an immense space such as a continent or country, a city or an urban square, or as small as a home or room, or as intimate as ones special seat at a favourite cafe (Pallasmaa et al, 2012: 404). Overall, we experience place as an entity and we project our lifeworld as a lamination of multiple experiences as a configuration of many places.

Man's senses and temporal function has a special capacity to grasp the feeling, ambient or atmosphere of a place, landscape or city, in an instant, and form a memorable projection of that space (Pallasmaa et al, 2012: 404).

The primary task of architecture is to grant meaning to a space, to convert physical space into human, experiential places that are useful and functional, mentally and practically. Space becomes functional and mentally uplifting through its familiarity and identity. The experience of place implies on the mental and physical fusion of space.

"Today, as lifestyles and values are becoming increasingly universal, as generic methods of production are ever more common, and both people and goods are increasingly mobile, the unique character of regions, cities and buildings keep declining and the sense of place continues to weaken."

- *Juhani Pallasmaa, 2012*

The lack of sensuality and meaning in spaces eliminate the sense of place and determine cold and unwelcoming surroundings. Some of the most technically advances civic buildings of today such as airports and hospitals are more commonly becoming non places, with little or no sense of identity or permanence. This is one of the defining challenges of the Interchange - creating a sense of placeness in such a building that harbours the flow of many people, has an innate effect on their senses and emotions and could either influence a large some of people positively or negatively.

4

Chapter 5 explores the history of spatial apartheid in the city of Durban – the social, economic and geographical voices that influenced the city through the apartheid era and how those voices has affected the socio-spatial quality, perception and value of the city of today.

Leonard Rosenberg states in his book, *The making of Place*:

"The spatial and characteristic of the city of Durban from the 1870s to the 1890s, is a story about a bay, a dry patch of land between two vleis, the systems of Indian indentured labour and white racism. The new urban phenomenon that the embryonic town experienced in the late nineteenth century, described as 'east meeting west in Africa', unfolded and took physical expression of the landscape."

D'URBAN

historical overview of the apartheid city

4.01

4.02

THE DURBAN SYSTEM

a land divided

The principles discussed are intended to suggest the contours of change, to highlight forces that shaped the city, looking at the context of its urbanity – Industrial city, Port city, Third World city, a racially divided city – and the forces that are in motion that influence Durban's society.

Responsibility is placed on urban entities for the economic development, economic change and the economic crises of a region (Freund et al Padayachee, 2002: 2). Focus is placed on the emergence of trends and habits due to a colonial past, that go about unnoticed and uncontrolled by the state and the forces that allow various categories of poor people to occupy the city and make it work for them today. Cities are vortices - they contain deeper currents - social and cultural trends that shape the economy and political trajectories (Freund et al Padayachee, 2002: 2).

The colony of Natal developed to form the city of Durban, a South African province after 1910. Natives were scattered and displaced, confined to numerous reserves or locations. Durban's development is based on economic factors, the second largest industrial city, and harbours the most valuable port recognised through history and the second most important population centre in SA (Freund et al Padayachee, 2002: 3). The city houses a substantial proportion of all South African racial groups recognised under the apartheid era. Apart from urban Gauteng, Kwa-Zulu Natal has the thickest population density in South Africa, between fifty to sixty percent of the population are African, two-thirds of the population are of Indian origin (Freund et al Padayachee, 2002: 3).

Durban was once a place where the market brought together, in the classic colonial form, a fertile mix of people who created a dynamic urban structure (Freund, 2002). It was also the land within which white, colonial power structured a system of racial division and dominance, establishing 'communities' through racial and ethical terms. Racial segregation was of great importance in terms of establishing apartheid urban systems, created as a response to challenges faced through a society where the dominant discourse and was of divide and European cultural hegemony.

The concept behind the 'Durban System' was not only race and separation but also about economics and how to shape it through colonial control. The racial aspect was a part of the system in place to train the growth of the city through these dominant forces (Freund et al Padayachee, 2002: 4). The democratic urban regime now has the responsibility to restructure urban growth and development without further displacing economic revenue within the city. Social and cultural life is also factors that are connected to a political economy of an ever changing Durban.


CITY OF DURBAN
UNDER SECTION 37 OF THE DURBAN BEACH BY-LAWS, THIS BATHING AREA IS RESERVED FOR THE SOLE USE OF MEMBERS OF THE WHITE RACE GROUP.
STAD DURBAN
HIERDIE BAAIGEBIED IS, INGEVOLGE ARTIKEL 37 VAN DIE DURBANSE STRANDVERORDENINGE, UITGEHOU VIR DIE UITSLUITLIKE GEBRUIK VAN LEDE VAN DIE BLANKE RASSEGROEP.
IDOLOBHA LASETHEKWINI
NGAPHANSI KWESIGABA 37 SOMTHETHO WAMABHISHI ASETHEKWENI, LENDAWO IGCINELWE UKUSETSHENZISWA NGAMALUNGU OHLANGA OLUMHLOPHE KUPHELA.
4.03


CAUTION
BEWARE OF
NATIVES
4.04


4.05

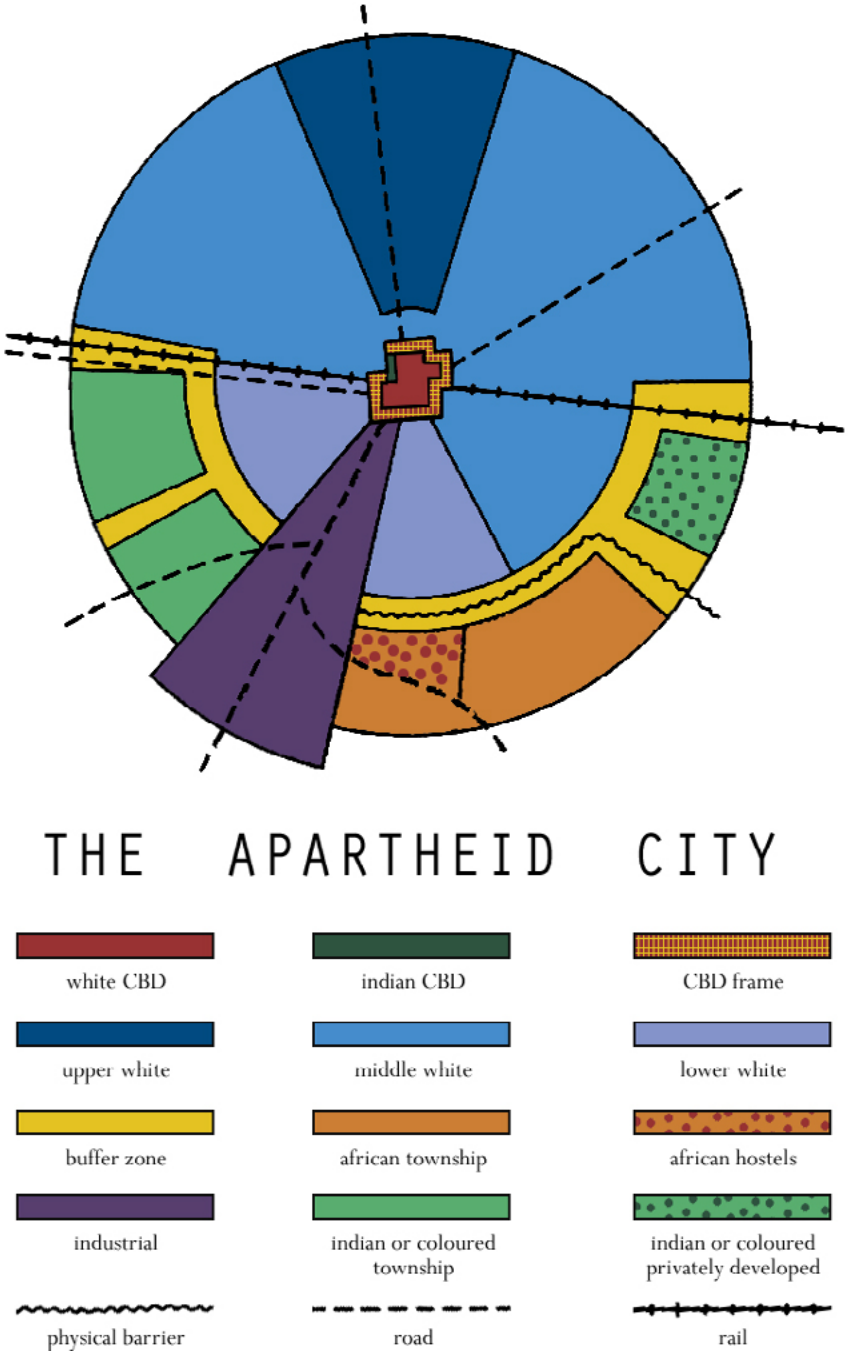
SPATIAL EVOLUTION

Racial politics and the city of Durban

Similar to many South African cities, Durban does not function efficiently and this is largely due to the apartheid regime (Maharaj, 2002: 171). The analysis of any urban form is an embodiment of the political, economic and cultural structure of its society.

The culmination of the Group Areas Act (1950) in Durban is based on the perceived economic threat from Indians which resulted in a historical alliance between the white working class and the local state (Maharaj, 2002:172).By the year 1970, the socio-spatial structure of Durban, as an apartheid city was complete. However, social movements demanded transformation from the apartheid local state and the state was also forced to face issues of land invasions and informal settlements. Political rivalry between the African National Congress (ANC) and the Inkatha Freedom Party (IFP) caused endemic violence in Durban, 1980s (Morris and Hindson, 1992).

High levels of crime and violence had a major impact on the development and growth of the city.The city's development crisis was observed through the rapid population growth, the slow economic growth rate, increase in informal settlements, lack of housing infrastructure, a rise in poverty, high unemployment rates and a lack of basic services to the majority of the population (Pillay, 1996).


THE APARTHEID CITY
white CBD
indian CBD
CBD frame
upper white
middle white
lower white
buffer zone
african township
african hostels
industrial
indian or coloured township
indian or coloured privately developed
physical barrier
road
rail

4.06

4.057

SPATIAL APARTHEID

urban racial segregation

Historically, the local state in Durban has played a critical role in the functionality and development of commerce and industry in the city. The city was marketed as a 'premier borough' referring to the opportunity and promise for further development to attract capital to Durban. The local state, Railway administration and the local capital attempted to advertise the city as an industrial and tourist centre (Mharaj, 1996b). The harbour was a key role player in alluring industries to the city of Durban.

The presence of Africans and Indians in the city forced municipal officers to struggle with issues of crime, sanitation and disease (Swanson, 1983). Apart from maintaining roads and controlling trade passes within the city, the municipal laws identified such activities as a responsibility of the local government. Panic grew regarding the amount of *Togt* (casual) workers within the city who demanded high wage and refused to live in municipal barracks. Pressure was applied to the local state to appease the white working class without compromising the supply of cheap labour in the city and the local state was not willing to use state money to finance African housing (Maharaj, 2002).

The twentieth century sought the demand for more industrial land and so the concern to increase control over the bulk of the labour force which was displaced in informal settlements, in peri-urban areas. The need to plan for industrial expansion and racial residential segregation was strongly pushed by the City Evaluator who motivated the concept by stating that it would in the interest of all race groups to be housed separately (Maharaj, 2002). This issue of displacement of the labour force is still present today due to the implications of racial residential segregation.

The Indian 'penetration' commission was recognised in 1941 when the white civic organisations and the Durban Chamber of Commerce (DCC) raised concerns of the growing Indian encroachment into white areas. With pressure from white residences, the DCC played a momentous role in the initiation, development and promulgation of segregation laws such as The Pegging Act (1946), The Indian Land Tenure and Representation Act (1946) and The Group Areas Act (1950) (Maharaj, 2002). The Group Areas Act was regarded by the local state as a preservative for Durban as a 'European' city.

It was not long after the passing of laws when a Technical Sub-Committee, established by the local government, drew up detailed racial zoning plans for the city of Durban. The TSC's vision for the Group Areas Act had far reaching implementations for the rest of the country. They believed that each racial group area have effective boundaries and each race group access to its place of employment without traversing the area of another group (Maharaj, 2002). The TSC utilised existing natural topographical boundaries as well as the typological development qualities of the area and the needs of each group such as transportation, employment etc. These planning strategies lead to racially segregated residential 'radii' which seemed to extend from a spinal employment area (Maharaj, 2002). By displacing settled Indian communities, the Council drew various race zoning plans and ensured that amenities to the white communities were entrenched.

Durban was zoned as a 'White City' after the Group Area proclamation on June 6, 1958. This resulted in eighty-one thousand Africans and seventy-five thousand Indians being uprooted from their settled communities and displaced from the city. Segregation represented a double edge sword for the underclass – many became homeless as a result of slum clearance and explicit rental costs while others were positioned in municipal housing schemes (Freund, 1995).


WILL BE FREE
RESISTANCE LIVES ON!
HOSPITAL WORKERS UNION
LOCAL 250

URBAN LEGACY

a race is just a game

The delay on the local government elections in Durban resulted in city being one of the first to implement anti-racial policies yet one of the last cities to embrace the new, democratic order (Maharaj, 2002: 189). Although emphasis is placed on the reconstruction and development of the segregated city, linkage policies to benefit the disadvantaged need to be implemented in the city. Elements of desegregation, in Durban, occurred predominantly on the fringes of the city, within the affluent suburbs. The post-apartheid city has seen a rise in vacant land being occupied in the core of the city. The need for employment and seeking a better life has become the main goal of most of the populace and so accessibility within the city is a growing need.

The apartheid city may be eradicated through the opportunities sought in the land restitution process, providing non-racial housing, rise in job opportunities and granting citizens the prospect to contribute to the development and growth of the post-apartheid city.

The oppression of segregation has been entrenched within the social fabric and is reinforced by the socio-economic differences between blacks and whites (Maharaj, 2002: 189). Spatial apartheid has been one of the most memorable and consequential crimes against the people of South Africa, it is the responsibility of the democratic government, planners, developers and architects to rehabilitate the injustices faced by city. Decades of institutionalised segregation will not be alleviated overnight (Maharaj, 2002: 189). Almost twenty odd years into democracy, people of the city still feel the social consequences of spatial apartheid, perception of the city in terms of crime, violence and the racial implications associated with social consequences – the legacy of apartheid will live on in the city but as a society, our perception can be moulded, shifted to witness a more democratic Durban city.

4.09

TRANSPORT APARTHEID

the apartheid plan

Since the 1950s, all planning was geared toward the racial separation of people in the city. When the city planned for future expansion of the Central Business District in Durban, in the 1960s, plans for public transportation reinforced this separation (Rosenberg, 2013: 42).

Spatial apartheid was used as a tool to separate people of different demographics within spaces, placing emphasis on the superiority on Whites and disregarding the basic human rights of those with a darker colour skin. One of those rights being that of spatial occupancy, public and private. The boundaries of spatial apartheid exceeded fixed space – from beaches and benches to homes and property ownership - and was implemented on different modes of transportation. Spatial apartheid within transport systems is one of the defining forces that have influenced how the city of Durban works today (as a legacy of apartheid) the perception of space and public transportation.

Trams

The first operating tram in Durban dates back to 1881 and the first municipal tramline was laid down on Florida Road in 1885. Initially, horses provided the mobile energy, it was only a few years after when electric powered tram lines were installed in 1902 (Rosenberg, 2013: 37). In 1910 the city of Durban began manufacturing its own trams instead of importing them and these trams were known to be the largest in the world at the time.

When trams were first introduced, there was a very small Indian population and racial segregation had not been brought upon the city at the time. However, when the Indian and White population were roughly equal in 1891, the Tramline Laws were passed. This called for blacks to stand at the rear end of privately owned trams. It was recorded the Mohandas K. Gandhi challenged this ruling in court but lost on account of the judge stating that all blacks should be banned from trams. The Durban Corporation established new laws in 1905 stating that only whites could travel on the downstairs carriage and blacks would only be allowed on the tram if their dress and behaviour was 'to the white man standard' (Rosenberg, 2013: 38). Complaints from white commuters about travelling with the 'oil-smeared umfaan and the mephitic coolie' increased as the tram service extended its coverage to accommodate more passengers.

Due to pressure from the public, from 1914, ticket office queues were segregated and trams for blacks only were run but proved to be financially unsustainable (Rosenberg, 2013: 38). The white community petitioned, with six thousand signatures, to the Council for a segregated tram system and in 1920 new by-laws were drawn up which allowed the Council to segregate trams and tram shelters for exclusive use for whites and blacks. The number of black commuters in the city at the time was around twelve thousand daily. Due to cost inefficiencies and the ratio of black commuters to that of whites, the council was unable to segregate the facilities.


EUROPEANS

4.10


NET NIEBLANKES.
NON-EUROPEANS ONLY.
NETBLANKES.
EUROPEANS ONLY.

4.11


HIPPOMERE
ND 15381
LAKEVIEW PASSENGER SERVICE
ND 15381

4.12

From 1921, three rows of seats were reserved for black passengers at the rear of the tram and red discs were placed on certain trams to indicate that they were for black commuters – the Council was forced to take this initiative because black commuters made the trams economically viable. Apartheid remained a feature of the tram with preference to whites at all times (Rosenberg, 2013: 39). On the lower deck, white commuters had comfortable padded seats while on the top, black commuters had wooden seats and were not protected from the elements due to canvas blinds as the overhead shelter (Rosenberg, 2013: 39).

The Motor Carrier Transportation Act of 1930 increased segregation between races within the transport systems. In the 1930s, the boundaries of Durban were extended due to the growing black population and exerted new pressure on the transport system. In 1939 racially segregated seats at termini were introduced. On average, red disc buses ranged from six hundred on weekdays and over eight hundred on weekends during 1946 (Rosenberg, 2013: 39). Trams eventually failed to meet the needs of citizens and were phased out, the last tram to run was in Durban, 1949.

The report of the 1946 Commission to inquire into The Durban Passenger Transport Undertaking stated that the city had "failed lamentably throughout its entire transport history to serve the citizens of Durban as comprehensively, efficiently and adequately." (Rosenberg, 2013: 39).

Buses and Trains

During the 1920s, buses became a feature to the city of Durban when Indians pioneered motorised public transport that took the form of open back trucks to carry passengers (Rosenberg, 2013: 41). The initial established truck-bus routes were between Riverside and Clairwood to the inner city. This mode of transport served the non-European population of Durban and became a major feature for the city.

The Green Line or 'Green Mambas' were formalised as racially based public bus services by the Durban Transport in 1955, for non-European residential communities and the Blue Line serviced European areas. In 1968, Durban transport enforced total racial segregation on its buses (Rosenberg, 2013: 41). Soon after, in 1987, apartheid on bus systems was abolished and both bus services were consolidated into the Aqualine service in 1994.

In 1987 the use of minibus taxis in the city was established as a major public form of transportation and by 1999 there were approximately eight thousand minibus taxis in Durban.

To deal with the growing population in Durban, the introduced transport proposals that started in 1957 and embraced the whole of Durban metropolitan area which included both private and public modes of transport as well as railway and roadway transportation (Rosenberg, 2013: 42). Plans for diverting vehicular congestion out of the CBD to non-white inter-transport terminals on the periphery of the white CBD:

4.13

"The expected locational pattern of residential and industrial areas together with future road and rail links between them could well reduce the need for many non-Whites to enter or transverse the central area. At present, practically all major road, rail and bus lines between the northern, southern and western areas pass through, or near, the central area). Large scale development of shopping and other central area facilities in non-white townships, together with any official policies which would make it more difficult for non-whites to visit the City centre and its facilities would still further reduce the need." – Holdfords report (Rosenberg, 2013: 43).

The Council saw future plans for Durban being a city for whites, non-whites entering the city would have to do so through the periphery of a White CBD. In 1968 futuristic spatial planning frameworks for transport routes and nodes through rail and bus stations reinforced and further entrenched the city into the segregation of Durban's public transport system and so, the apartheid regime (Rosenberg, 2013: 43). These transportation plans sought for the main mode of non-white transport be that of rail as many townships and industrial areas were planned along rail corridors, making them favourable for a successful rail transit network.

Non-white bus ranks and train stations were proposed for the periphery of the white CBD and were seen as a main conduit to divert traffic congestion away from the centre of the CBD. Non-white train stations were proposed for Berea Station, Leopold Station and Durban Station and additional stations were proposed along the Esplanade and the Point (Rosenberg, 2013: 43). A central terminal along truck-bus routes for non-whites was proposed as well. This proposal served as an inter-modal transfer interchange between bus and rail services, located above the Leopold Street Railway Station. All transfers were envisioned to take place on this site as to minimise the amount blacks and Indians within the inner city. Parallel to these plans, whites only elaborate structures were proposed for the inner city. The interchange at the Leopold station did not get built but the Berea and Durban Stations were built as envisioned by the apartheid planners.

Reminisces of the apartheid spatial planning can be experienced today. From the physical location of the stations to the perception of poverty and crime that eludes from public transport currently, spatial apartheid had moulded the functionality of the 21st century 'democratic' city of Durban. The inner city is still seen today as an exclusive city in terms of class and race - and although our laws and constitution thrive for freedom in every facet of life - the perception of people on the city is still that of segregation. Value is an important voice that has been forgotten in terms of the perception of the inner city of Durban. A rich history lies in the inner city, the struggles of a people once united in the face of injustice, has faded by a veil of ignorance.

4.01 — Spatial segregation, segregated amenities for blacks and whites during the apartheid regime in South Africa

4.02 — An Indian community occupying a non-white area - showing the gravity of spatial oppression

4.03 — Even beaches were segregated for Whites and Non-Whites during the apartheid era in Durban, South Africa

4.04 —"Caution, Beware of natives" signs in South Africa were common

4.05 — Segregated Amenities for Whites and Non-Whites

4.06 - The Apartheid city sketch by Author, 2017

4.07 - The Apartheid city sketch by Author, 2017

4.08 —Protesters ranged from around the world, to fight against apartheid in South Africa

4.09 — The last tram in South Africa, Old Faithful

4.10 —Segregated amenities for Whites and Non-Whites during the Apartheid regime in South Africa

4.11 — Segregated amenities for Whites and Non-Whites during the Apartheid regime in South Africa

4.12 — Truck Buses were one of Durban's first modes of public transport

4.13 —Young Black man sits in a whites Only area on a bus to protest the segregation of transport in South Africa, Durban.

5

Chapter 4 highlights the importance of sustainable public transport architecture and infrastructure, especially in the twenty-first century with a growing population thus, increasing resource demands. There is a need for connections in urban and surrounding areas - displaced communities, sprawl and the Durban inner city left largely inaccessible as a result of spacial apartheid that once dictated the spacial planning of the city.

Today, transport architecture is explored and implemented as a catalytic conduit for a changing society, a democratic Durban inner city.

TRANSPORT

architecture

4.01

4.02

TRANSPORT ARCHITECTURE

an introduction

The problems Durban faces at an urban scale are reciprocated globally. The rise in oil prices - yet the need for mobility, global warming and climate change – and the need for adaptation and comfort, depletion of natural systems - and the quality of life in and around cities. These issues affect us at a human scale and solutions or adaptations are made personally. There is a need for a collective solution, a macro solution to these issues. Transport infrastructure plays a vital role in the development of sustainable urban environments and it is a key component in creating successful, productive communities (Edwards, 2011). Through meaningful architectural design and by stitching together flows of transport infrastructure and people in a coherent and sustainable way – the transport interchange – this may be achieved. Urgency for sustainable and ecological urban design in cities falls largely on the shoulders of public transport infrastructure.

The quality of architectural transport design harbours great importance in an urban community when encouraging the switch from private to public transport economy and new forms of urban navigation. Therefore experiences in spaces created in the interchange need to connect to the occupants on an existential level, this can be achieved through the theory of place making. In the case of a post-apartheid city, much more design effort is required in the process of reinstating the urban fabric. Culture, heritage and tradition are important factors when designing an interchange for the future of a post-apartheid, African city. Through creating meaningful, human spaces, the architecture of the interchange plays on the memory of the occupant and he or she is able to carry a piece of that experience away with them. A lack of cultural authenticity in public architecture is a major issue the city faces as well, ownership and identity is almost devoid in public spaces because of this problem. This is one of the major issues the city faces today.

There is a growing need for sustainable forms of transportation infrastructure – for both vehicles

4.03

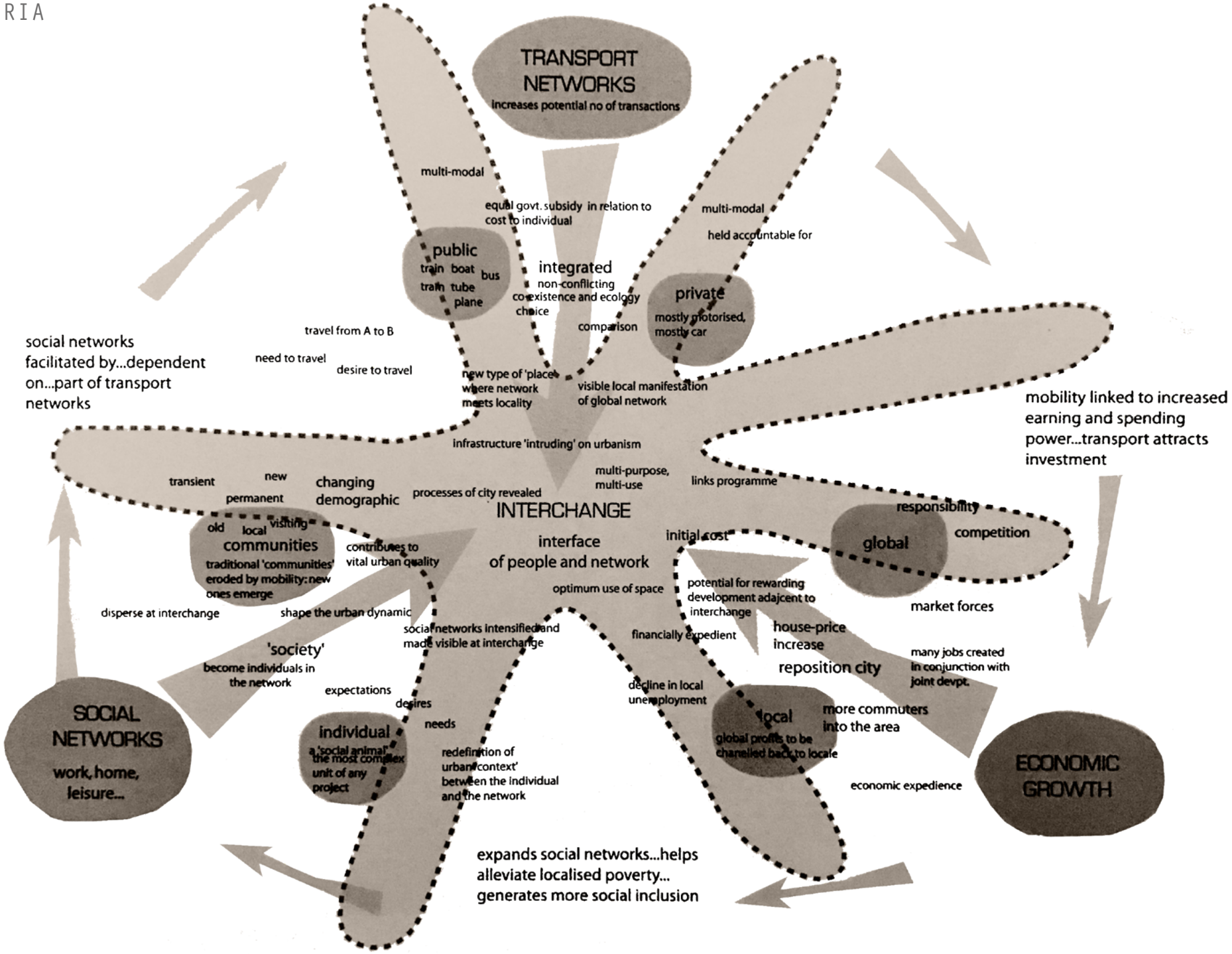
and for the wider systems that support transport infrastructure. The green market economy of the future relies on achieving more sustainable forms of urban movement and transport architecture encourages this form of sustainable development (Edwards, 2011). Mobility in and around cities is crucial to the quality of life of its occupants. However, transportation is responsible for about twenty five per cent of global carbon emissions, sustainable growth requires urban navigation through public transport systems rather than inefficient private means. This age will see a rise in investment not on roads, but public transport infrastructure and that of car constraints (Edwards, 2011). Durban, a growing urban environment, is currently observing issues of congestion and pollution in the central city and a shifting paradigm for public transport infrastructure is a growing demand. Through apartheid planning, the city and all its resources is difficult to reach or inaccessible for some people abiding in suburbia. The socio-economic implication of apartheid planning makes public transportation into the city almost compulsory for most South Africans. The scarcity of socially sustainable transport architecture in the urban environment has made it difficult for its occupants to navigate the city and will not improve the quality of life for these occupants (Edwards, 2011). An integration of transport systems rather than individual modes of urban navigation will prove more sustainable to city life and will grant the people of the city access to the richness and opportunity the city brings.

4.04

BRIAN EDWARDS

Edwards is an Emeritus Professor of Architecture from ECA, Edinburgh, he is a corresponding member of RIBA's Sustainable Futures Group and currently teaches and researches at the Royal Danish Academy of Fine Arts, School of Architecture, in Copenhagen. An architect by training, he received his PhD from Glasgow University and has focused on the field of sustainable design as both, academic and practitioner (ECA, 2012). He is the author and co-author of over twenty books geared towards sustainable design including that of sustainable transport architecture. His works, '*Sustainability and the Design of Transport Interchanges*', is researched for an understanding on the relevance in transport architecture and sustainability in urbanity.

4.05


TRANSPORT NETWORKS
increases potential no of transactions
multi-modal
equal govt. subsidy in relation to cost to individual
public
train boat bus
train tube
plane
integrated
non-conflicting co-existence and ecology
choice
comparison
multi-modal
held accountable for
private
mostly motorised, mostly car
social networks facilitated by...dependent on...part of transport networks
travel from A to B
need to travel
desire to travel
new type of 'place' where network meets locality
visible local manifestation of global network
mobility linked to increased earning and spending power...transport attracts investment
infrastructure 'intruding' on urbanism
multi-purpose, multi-use
links programme
transient
new
permanent
changing demographic
processes of city revealed
INTERCHANGE
interface of people and network
responsibility
competition
global
initial cost
old
local
visiting
communities
traditional 'communities' eroded by mobility: new ones emerge
contributes to vital urban quality
optimum use of space
potential for rewarding development adjacent to interchange
market forces
disperse at interchange
shape the urban dynamic
social networks intensified and made visible at interchange
financially expedient
house-price increase
reposition city
many jobs created in conjunction with joint devpt.
'society'
become individuals in the network
expectations
desires
needs
decline in local unemployment
local
more commuters into the area
global profits to be channelled back to locale
SOCIAL NETWORKS
work, home, leisure...
individual
a 'social animal'
the most complex unit of any project
redefinition of urban 'context' between the individual and the network
economic expedience
ECONOMIC GROWTH
expands social networks...helps alleviate localised poverty... generates more social inclusion

4.06

THE INTERCHANGE

Transport infrastructure is comprised of networks of routes, lines and linkages for the movement of people and goods. The interchange is a building that links to urban spaces, and creates various conditions for which different modes of transport can link and flow into each other, this interconnection will make navigation within a city far easier and convenient for commuters. The different transport modes that intersect are: train, bus and foot. The interchange is a building that can be labelled as a public forum yet is highly people centred at the same time. This is achieved through meaningful transport architecture that creates psychologically uplifting spaces through design elements such as scale, volume, texture and light to mentions a few. It should celebrate mundane acts and processes of circulation and movement to create spaces that will reduce anxiety among travellers on their daily commute (Edwards, 2011).

The interchange is also a space of social connections. Factors such as Identity and culture play an important role in the type of architecture that is created. It has to incorporate qualities that the urban community can relate to with ease, this will give the community a sense of ownership and cultural identity. The critical regionalism of the building needs to speak to various kinds of people from many communities and cultures in and around Durban, as variously different people are anticipated to use the space, especially commuters from outlying villages and suburbia. In order to achieve a sustainable level for transportation, emphasis needs to be placed on the ecological design of transport architecture. There are very few examples when it comes to single mode terminals. A transport interchange that connects different modes of transport has an obligation to produce transport that is more sustainable through an architecture that is geared towards ecology in the city.

This dissertation aims to establish connections with sustainable transport infrastructure and sustainable architectural design through the form of an inter-modal transport network interchange. This is crucial to urban regeneration as thousands of people are

4.07

meant to pass through this space daily and the methods of successful sustainable eco-design could be carried with each passenger into the home or work place and implemented through more architectural spaces.

Concepts, Ideas and Evolution

The shape and technologies of transport networks that serve stations and terminals are in a state of perpetual evolution. Forces within society affect the results of architectural design of the interchange. These forces are influenced by the cultural and geographical nuances of an urban grain. Growth of the city and transportation has a direct relationship especially through design and location consequences for the interchange. Doxiadis refers to this in his theory of Ekistics (explored later in the document) - a central force informs the surrounding forces of the city, so to will the interchange shift the intensities of the built environment and also the perception of a post-colonial city such as Durban. The interchange acts as a catalyst for the future of Durban progressing as an ecological city. Another relationship is between the inherited transport habits of the city and the need for a low carbon future (Edwards, 2011).

Mobility and the Interchange

In developed cities, mobility takes about an hour and a half everyday for commuters regardless of the mode of transportation taken (walking, cycling, bus or train). The distance travelled by commuters into the city is increasing year by year because of city planning (suburban living), sprawl and the increasing need for access to the city. Public transport is able to take more people further, within a specified time than private means of transportation. Private transportation fuels inefficiencies such as congestion and regulation. The car has proven to be increasingly unsustainable, non-environmental and also antisocial and thus access for the car in urban areas should be restricted. More developed countries are turning to public transportation in their cities because of these inefficiencies (Edwards, 2011). Even with

4.08

greater affluence and flexible lifestyles, European countries have made the jump from private means of mobility to public buses, trains and bicycles as these are characteristics of the early twenty-first century (Edwards, 2011).

This is solely based on the existing grain of the city - to promote density and walkability in the city whereas South Africa, the city of Durban was designed for the motor vehicle, especially for those who had access to private transport methods. This 'motor-town' concept, paired with spatial apartheid, is why the city center is disjointed from the rest of Durban and so lacks life, vibrancy and density. The shift of transport methods is not consistent across cultures and age groups. People between the ages of 25-35 are bound to the idea of independence and the illusion of a wealth through mobility and convenience of private transportation (Edwards, 2011). This misconception has not only segregated us from the city and its amenities but has also segregated our minds - our current generation and those before us - perpetual oppression. After about twenty five years of democracy, the people of South Africa have still not experienced freedom - freedom to access the city and freedom of the mind.

The stigma in Durban is that the poor take public transport and the wealthy can afford to drive. This stigma also includes the lack of safety in bus, train and taxi terminals in which occurrences of theft, rape and violence has taken place. This issue is directly aimed at badly designed terminals that are proven to provoke such negative acts. A main instigator in these badly designed public spaces is the methods of apartheid planning and design. Negative design creates negative spaces that affect the lives of its occupants negatively. It can then be said that public transport is a major obstacle to social change in Durban.

The ritual of travel can be seen as a cultural action as well as a functional necessity. We analyse of sense of worth and class by the way we travel. The role of transport architectural design is to combat the negative images of transport terminals by creating a positive and optimistic vision for public transportation.

4.09

STRATEGIES

for urban design

Due to societal and environmental pressures, the interchange has evolved from traditional single mode transport architecture and the modern interchange acts on behalf of the public rather than the commercial interest. However, the economic benefits from the interchange can be converted into social advantages for less privileged communities, especially in African cities. The interchange of the twenty-first century takes traits and characteristics from the first railway stations which created new urban quarters around the historic cores of the city. This is applicable in site context of *Machinaria*, placed in the centre of the city of Durban with the City Hall, market square and the civic precinct as neighbouring contexts to the interchange. The city as a whole entity gains by the reduction of congestion on the streets, reduction in air pollution and the dependence on the private car (as well as the pressures of having to own a private car) and encourages the middle class to return from the suburbs and reside in the inner city.

Urbanisation is required for sustainable development as it allows goods, amenities, infrastructure and resources to be shared and distributed to a large community of people. The more compact as city is, the more sustainable it is in terms of energy consumption (Edwards, 2011). However, urbanisation on its own is not efficient – investments need to be made in new ways of living, new methods of navigating the city, new ways of working, education and leisure as well as new concepts of urban density (Edwards, 2011).

One may view the transport routes of the city as a series of corridors for migration. This stems from the idea of migration portraying the concept of movement – socially, economically and culturally in order to overcome poverty and decay within the inner city, using the interchange as a conduit for change.

One of the prime interests for sustainable urban development is ensuring that the urban fabric is attractive to all classes and people – a democratic

4.10

design model for the city. Investment in transport infrastructure makes urban environments more attractive and enhances the environmental quality and its social provision (Edwards, 2011). An investment in quality public transportation leads to an upgraded environment with less vehicular congestion, less air pollution and reduced crime levels. This goes alongside the major immediate amenities around the interchange to be upgraded as well.

The concept of a healthy compact city is suggests a liveable urban environment constructed around public transport and since public transport drives an increase in urban densities, it is one of the key entities to achieving lasting urban sustainable development (Edwards, 2011). With an increase in densities, the need for collective public, intermodal transport and a shift from singular transportation modes – private car and singular mode transport stations.

The concept of the interchange promotes the creation of new public spaces – democratic spaces within the city where people are free to meet, exchange ideas and transfer between transportation modes. Creating a walkable city fabric is another concept of a sustainable urban form, as walking provides one of the main means by which transport interconnection can be achieved (Edwards, 2011).

Social sustainability is more likely to be within the inner city or areas where transport interchanges are situated near large housing estates (Edwards, 2011). The future urban proposal for Durban, the Local Area Plan depicts that the Centrum area adjacent to the proposed interchange (*Machinaria*) site will be a mixed use development with a large housing component. This will ensure social sustainability within the inner city of Durban.

It is of extreme importance when designing the interchange for a specific location and cultural society, to consider specific benefits of that society rather than designing a universal solution. This gives the interchange a sense of identity that the community can relate to, be proud of and something

"In many ways, investment in modern public transport is investment in smart infrastructure, as it goes inefficient and more brutal investment in roads and provision for cars. The compact, socially diverse, economically active and culturally rich city of the future is one that sustains alternative forms of transport."— Brian Edwards, sustainability and the design of transport interchanges, 2011.

4.11

that they feel inclined to care for because it gives them a sense of ownership.

Navigating the city of the twenty first century is a matter of integrating a diversity of transport modes and ensuring that the interfaces work well. Spatial intersections of the city are where the transport intersection occur and this is where the interchange resides (Edwards, 2011).

With rising urban densities, new problems and demands of the twenty first century will look towards generating new forms of transportation. Durban's public transportation has been evolving since apartheid (this is discussed in chapter five) and with an increase of population within in the inner city, evolution is necessary. This includes innovations in light rail and BRT systems to name a couple. Technical innovation, the quality and the attractiveness of transport architecture – the interchange of the future – needs to be on a catalytic level if public transport is to attract users away from private, non-sustainable means of transportation.

It is vital that urban planning and transport planning are integrated, symbiotic and that development is created to support transport infrastructure costs (Edwards, 2011). Designing the interchange entails three geometries that require reconciliation – the city, spatial logic and the way in which people move in and around the system.

Edwards has developed a criterion for the design of transport interchanges:

- An interchange should be an uplifting experience.
- There should be interest at the arrival and departure points.
- There should be a welcoming environment.
- Distinction should be removed from front and back.
- Natural light should be maximised and physical enclosure should be reduced.
- Good air quality is essential below and above ground.
- Sight lines should be maximised to aid passenger navigation.
- Transport modes should be seen not imagined (Edwards, 2011).


THE LIVING MACHINE
DA'AN PARK TAIPEI INTERCHANGE
-TAIWAN-
architectural ecology, iconic form, relationship to nature
INTERCHANGE
-UK
site planning, iconic form
GROUND SITE PLAN
1 | 500
PHYSICAL FEATURES
ZONING
TYPOLOGY
ACCOMMODATION

4.12

INTEGRATING

the interchange within the city

The design of the interchange can further aid the urban fabric by promoting cross city movement. This is possible by opening up the interchange to the greater public rather than just the travelling public. This suggests of a major space, open or enclosed through which people are able to flow through or gather within as they wish (Edwards, 2011). This is to emphasise the human public entity rather than the transport system and granting the movement by foot supremacy over the wheel. Cross-city concepts are enhanced if the idea of front and back are removed as the interchange is a structure of multitudinous movements, of threads of people and transport infrastructure that are connected loosely rather than tightly (Edwards, 2011). Placing social objectives before commercial ones help reduce barriers of movement.

Increased movement and movement opportunities in the city creates potential for the city to grow economically. With the interchange, areas that were once perceived as 'backs' are now recognised as 'fronts' (Edwards, 2011), it has the ability to breathe life into underutilised or once dead spaces.

The task of joining the interchange into an existing urban system and movement patterns of the city remain the main objective, whether the interchange is an enclosed or open urban space. It is beneficial if the interchange is positioned along major road systems where the hierarchy of streets and public transport may complement each other (Edwards, 2011).

According to Edwards, the key ingredients for the integration of interchanges into an existing urban system are:

- Safe and secure routes for pedestrians.
- Safe, secure and prioritised cycle ways.
- Formation of civic space around the interchange.
- Creating social interchange spaces for the wider community.
- Ensuring legible connections with other transport modes and civic landmarks (Edwards, 2011).
- Providing human amenities and opportunities for trade around the transport interchange.

4.13

ARUP

model for the interchange

In 2008, one of the major engineering practices and interchange designers, compiled a set of operating themes to guide the thought process of planning and designing the interchange of today:

- Accessibility
- Operation
- Constructability
- Sustainability
- Liveability
- Phasing

Accessibility – this deals with the physical access in the form of the feeder routes (walking, bike, bus, train, etc.) to the interchange.

Operation – the exploration of inter-modality, funding partnerships and the role of retail within the interchange, ensuring that the economic basis is sound and that a good connection between public and private financial interface is reached.

Constructability – the bearing of cost and the timetable of operations.

Sustainability – energy and environmental impact from the built environment is a growing public concern and regulation. Social, economic and environmental sustainability should be bedded into the project at inception.

Liveability – this addresses design quality and social provision. Communication with public advisors and potential developers on periphery sites is essential.

Phasing – Compiling a financial feasibility package to ensure that the project can be achieved over a specific time. Phasing involves the compilation of a stakeholder framework of financial commitments before the project begins.

These themes and principles ensure that major transport infrastructure projects integrate with the wider city beyond the aim of enhancing mobility


Platforms 1b to 12b, 4c
Buses
Taxis
Platform 1a to 12a
Tickets
Way Out

4.14

(Edwards, 2011). Its concerns are also with social provision, economic potential and environmental responsibility – and the growing need for renewable energy technologies at the interchange (Edwards, 2011).

Key passenger needs at interchanges are –

- Safe and secure routes through the interchange.
- Well-lit legible spaces and routes.
- Clarity of transport modes.
- Clarity of signage.
- Attention to disable access and sense limitations.
- High quality materials.
- Attention to physical and psychological comfort.

Key spatial pattern of a typical interchange comprises –

- A large and enclosed ticketing and information area.
- An open external area for inter-modal connection.
- An internal concourse for inter-modal connection and waiting.
- A linear platform.
- A bridge for crossing transport infrastructure.

Key factors in the three dimensional designing of interchanges are –

- Place the most frequently use transport mode closet to the ground level.
- Ensure lower concourses connect well visually with upper ones and with external streets.
- Ensure that the most frequently used transport mode is the most visible.
- Avoid placing a transport mode where it becomes and barrier to another mode.
- Include natural lighting as much as possible, use light wells for subterranean levels.
- Consider the life cycle and energy costs of artificial lighting and ventilation.
- Give equal weight to legibility and route way marking as to spatial function.
- Ensure that a three dimensional space is the medium of physical and visual connection.
- Ensure speed of transfer and exit remains a top priority (Edwards, 2011).

4.15

DESIGN APPROACHES

Detailed design considerations range from: structural design, environmental design and spatial design. Edwards compiles these principles according to the entities above. These principles are imperative to consider when designing the interchange of today and for the future, the relevant principles below are studied and applied to the scheme of *Machinaria*.

Structural design principles to consider –

- Use architectural structure to define key routes, spaces and movement hierarchies.
- Employ structure and natural light to animate spaces.
- Avoid placing columns where movement may be obstructed.

Environmental design principles –

- Maximise natural lighting within the building and subterranean levels.
- Maximise natural ventilation within the building and subterranean levels.
- Use passive design principles for heating, cooling and ventilation.
- Avoid glare by shading direct light.
- Utilise renewable energy in as many components as possible – solar, wind, kinetic and hydraulic.
- Use horizontal components of the building to collect water
- Source materials locally, use local labour.

Spatial design principles –

- Ensure that the interchange works like a machine – a systems that interlinks in symbiosis.
- Ensure legibility of key routes, spaces and transport modes.
- Use the image of the city to create memorable and culturally uplifting spaces.
- Ensure queue areas do not block concourses.
- Link interior and exterior spaces seamlessly.
- Pay attention of the design of the periphery of the interchange.
- Use landmarks to orientate passengers.
- Provide tranquil as well as busy spaces.
- Provide zones for retail.
- Articulate information zones clearly, movement spaces, retail zones and waiting spaces.
- Create meaningful spaces that the community will appreciate and can relate to, culturally. Promote and celebrate the African City.

The role of spatial design in *Machinaria* –

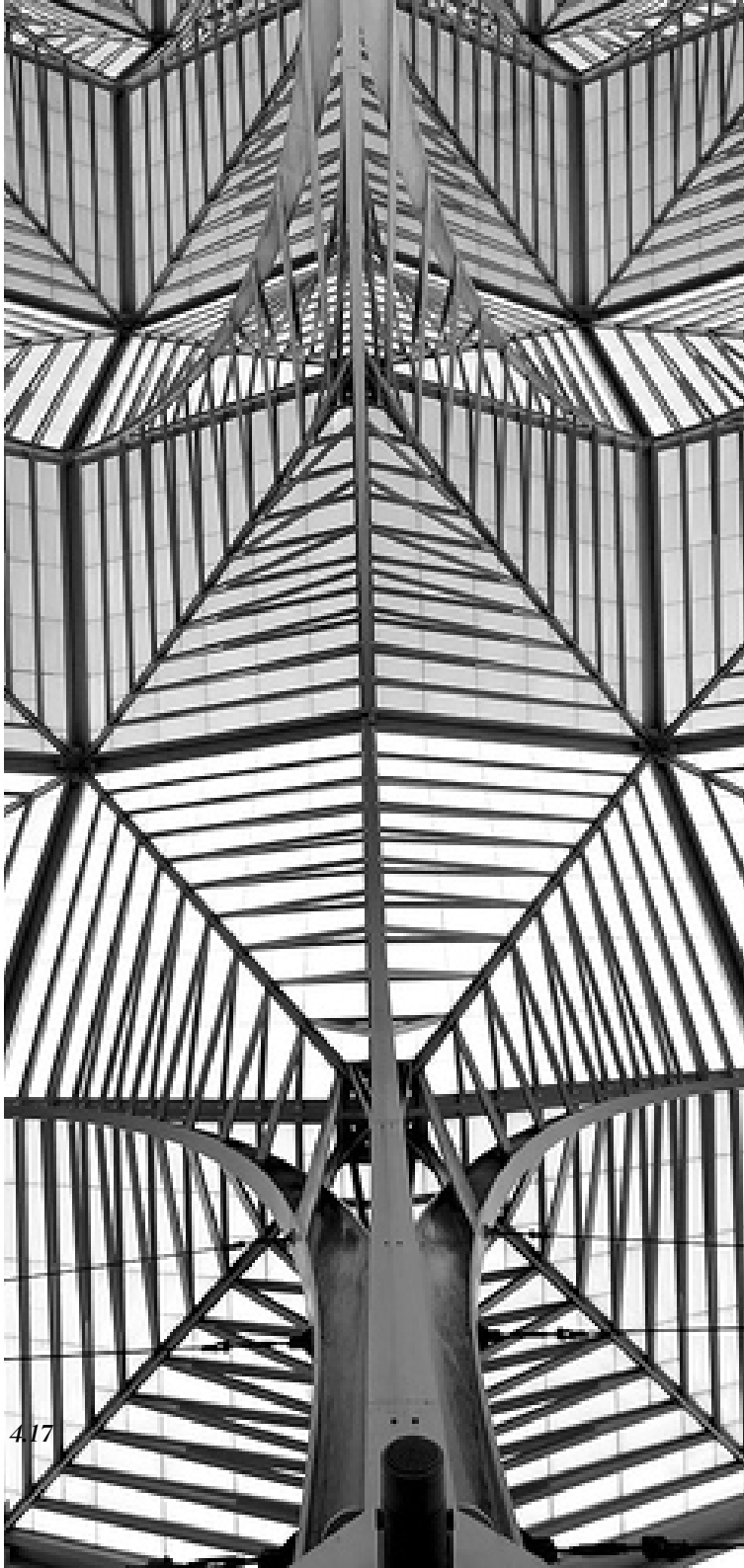
- To differentiate between stakeholder and

4.16

functional interests:

- Travel operation companies
- Infrastructure companies
- Retailers
- Security
- Passengers

- To assist passengers and their comfort:
  - To provide calm areas for resting and waiting
  - To support way-finding
  - To provide sight lines to travel modes and exits
- To mirror function hierarchies:
  - To use space to mirror fictional flows
  - To create character in different spaces
  - To provide clear geometries for movement
- To facilitate change:
  - Shift from colonial to African design
  - Functional change
  - Management change
  - Operational change
- To celebrate public transport and inclusivity:
  - Democratic spaces that celebrate Durban's culture, African traditions and promotes the 'African city'
  - Classless spaces that includes all
  - Architectural space for all
  - Processional routes that are barrier free
  - Quality of design that endures (Edwards, 2011).



5.01 — World Trade Centre terminal, Oculus, New York - Santiago Clatrava

5.02 — Guangzhou Train Station, China

5.03 — Panoramic view of the Southern Cross Station, Australia

5.04 — Interior View of the World Trade Centre terminal, Oculus, New York - Santiago Clatrava

5.05 — Brain Edwards, Author and Architect

5.06 — Diagram explaining the interchange and its systems, from Sustainable Interchanges by Brian Edwards. Edit by Author

5.07 — Atocha Interchange, Interior View. Madrid

5.08 — Lisbon Oriente Station, view of entrance. Santiago Calatrava

5.09 — Machinaria Graphic - Urban 3D Model

5.10 —. Interior view of the Southern Cross Station, Australia

5.11 — Exterior view of the Southern Cross Station, Australia

5.12 — Machinaria Graphic - Urban 3D Model

5.13 — Arup's Moses Mabida Train Station, Durban, South Africa. Photo and Edit by Author

5.14 — Birmingham New Station, Waiting and Ticketing area

5.15 — Guangzhou Station, Train terminal

5.16 — Lisbon Oriente Station, view of terminal platform Santiago Calatrava

5.17 — Lisbon Oriente Station, view of structural forms - Santiago Calatrava

6

Chapter 6 ventures into the urban structure of Durban, the past, present and future state of the inner city is analysed and translated into the design of the dissertation. The study line of Durban's urban form includes:

Past - Ecology and development

Present - the current state of the city

Future - Local Area Plan (LAP) & Machinaria

URBAN | DURBAN

evolution

***6.01** – Illustration : Durban City Hall. By Artist Nikhil Tricam, 2017*

PAST DURBAN

a brief history

6.02

TOPOGRAPHY

The virgin topography of Durban consisted of thick, wild bush, swampy marshlands, a beautiful beach coast, a vibrant port - teeming with wildlife and an alluvial plain. The alluvial plain, on the northern side of the bay, was the highest, driest and most defensible point (for the settlers of December, 1823) available closest to the 'landing bay' – now known as Maydon Wharf. The hard stretch of sandy land, located on the Umngeni alluvial plain, had been scored clean of topsoil due to successive flooding in the area (Frescura, 2013: 13). This plain was slightly raised, about four meters above sea level, overlooked the bay to the south which the bluff provided a lush, green background. The east and west of the plain was bound by marshes while to the south, was separated from the beach by a thick mangrove swamp (Frescura, 2013: 13). To the west, the lush wooded Berea ridge cut off easy access into the interior while and few springs and rivulets flowed. This area is now known as Durban Centrum, Market Square (Frescura, 2013: 13).

STREETS

The very first planning proposal was drawn up in 1835 and involved the setting out of three main streets that ran from east to west and three shorter cross streets that ran from north to south, with a square in the centre, forming a connective grid. The transition from regular, European grid planning, and the irregular waterline of the harbour were formed by a strip of twenty-one elongated rectangular plots from the beach front to Smith Street (Frescura, 2013: 20). This area is the Victoria Embankment (now Margaret Mncadi Avenue). Durban was named after Sir Benjamin D'Urban who was at that time, governor of the Cape.

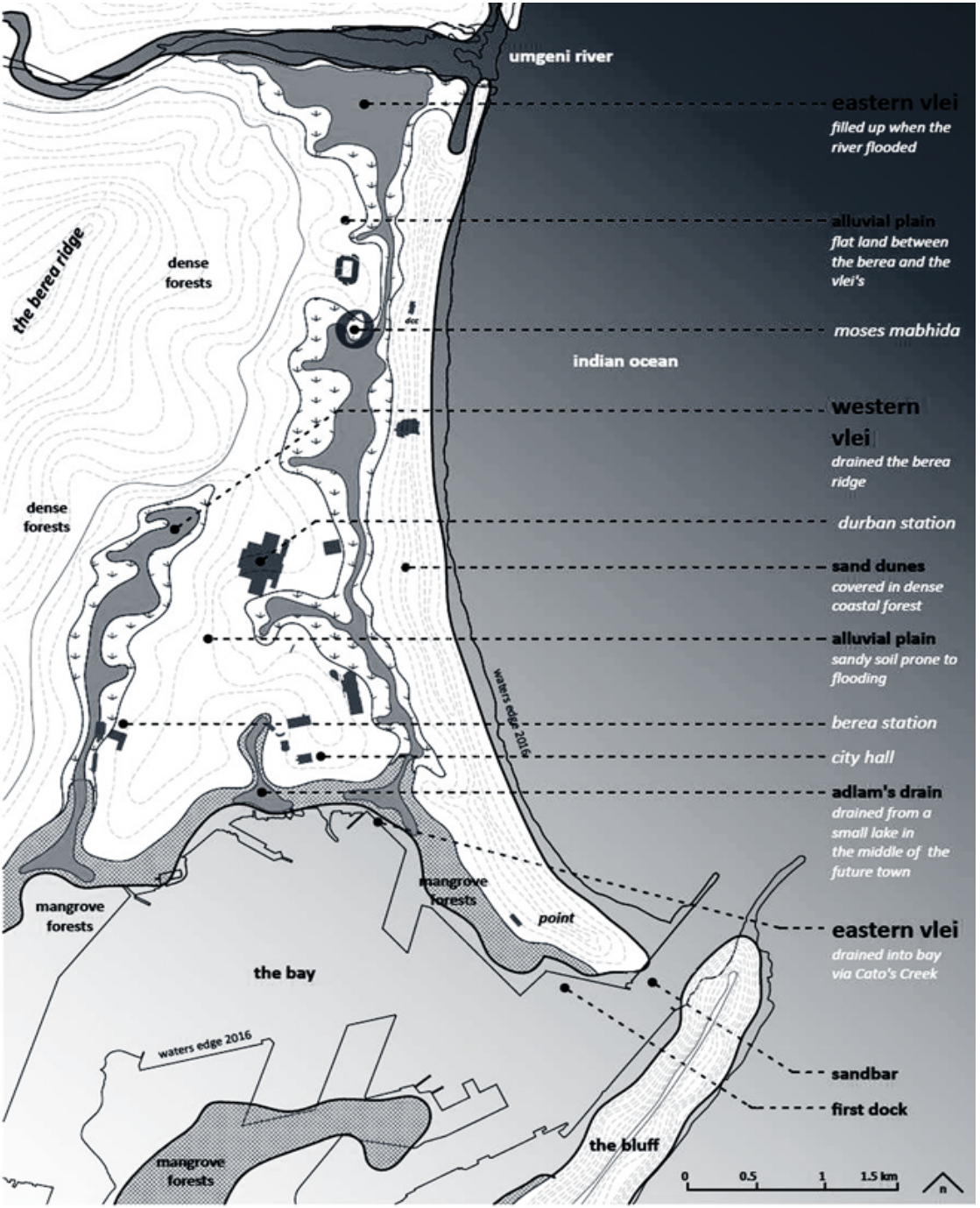
One of the problems frequently encountered whilst building Durban's streets was the high water table and the fact that neither the Eastern Vlei nor the Western Vlei were not finally drained until 1905 (Frescura, 2013: 26). The town's torrential rains, wash-aways where and still are today, a common feature of local life in the area. This meant that the roads were subject to constant maintenance.

DEVELOPMENT

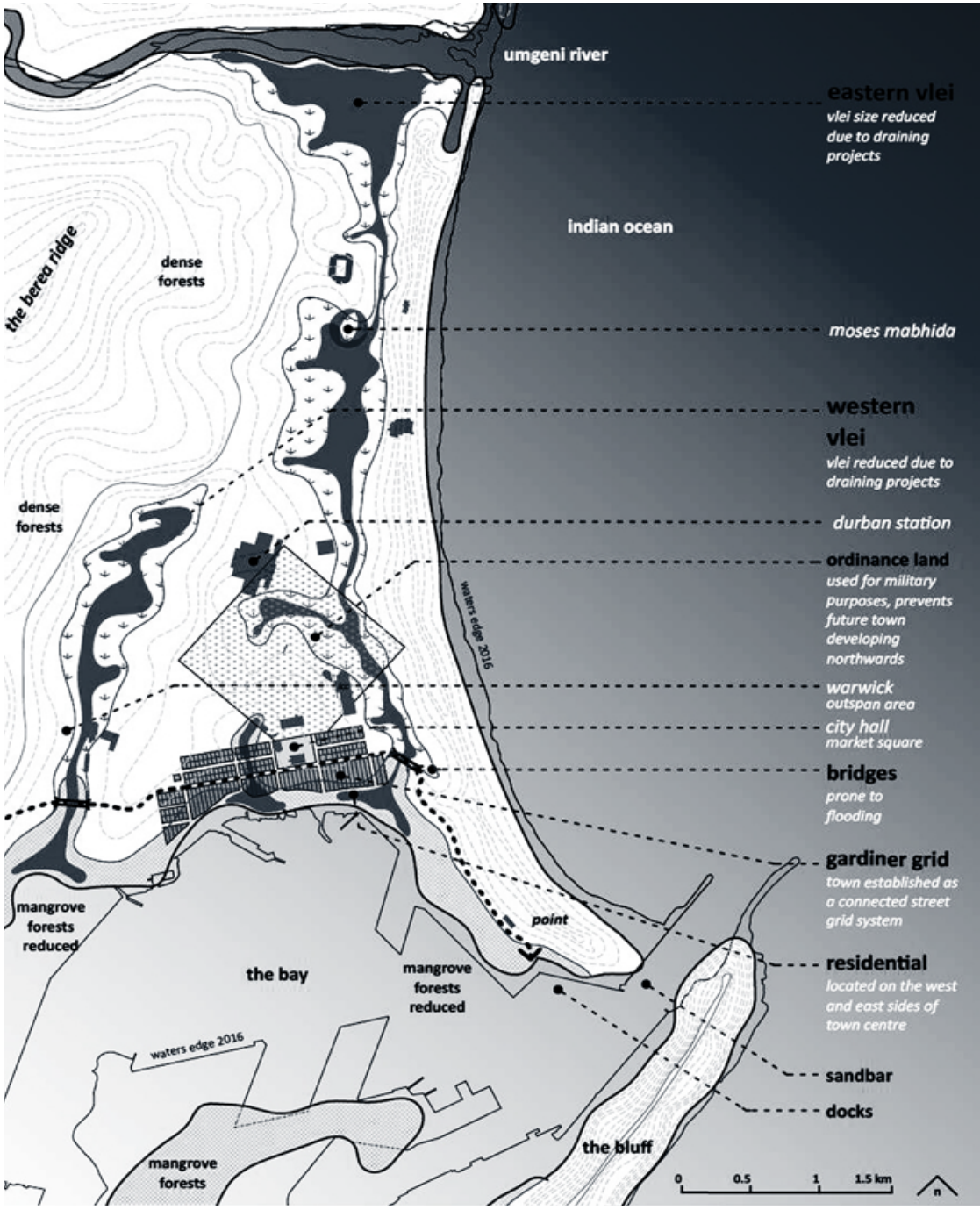
and infrastructure

Due to the increase in population and the growing pressure on the Port of Natal for the importing and exporting of resources, this created the need for an emerging future development of the town of Durban. This started to play an increasingly important role on the economic life of the region. The expansion of the town relied on the existing infrastructure – the harbour facilities and road reticulation (Frescura, 2013: 21). The perpetual growth of the newly founded sugar industry was also dependant on the availability of transportation to cater for the importation of machinery and the exportation of sugar cane products. The effort to colonise the area and to meet local labour needs required an improved system for transportation which would render immigration a more attractive proposition.

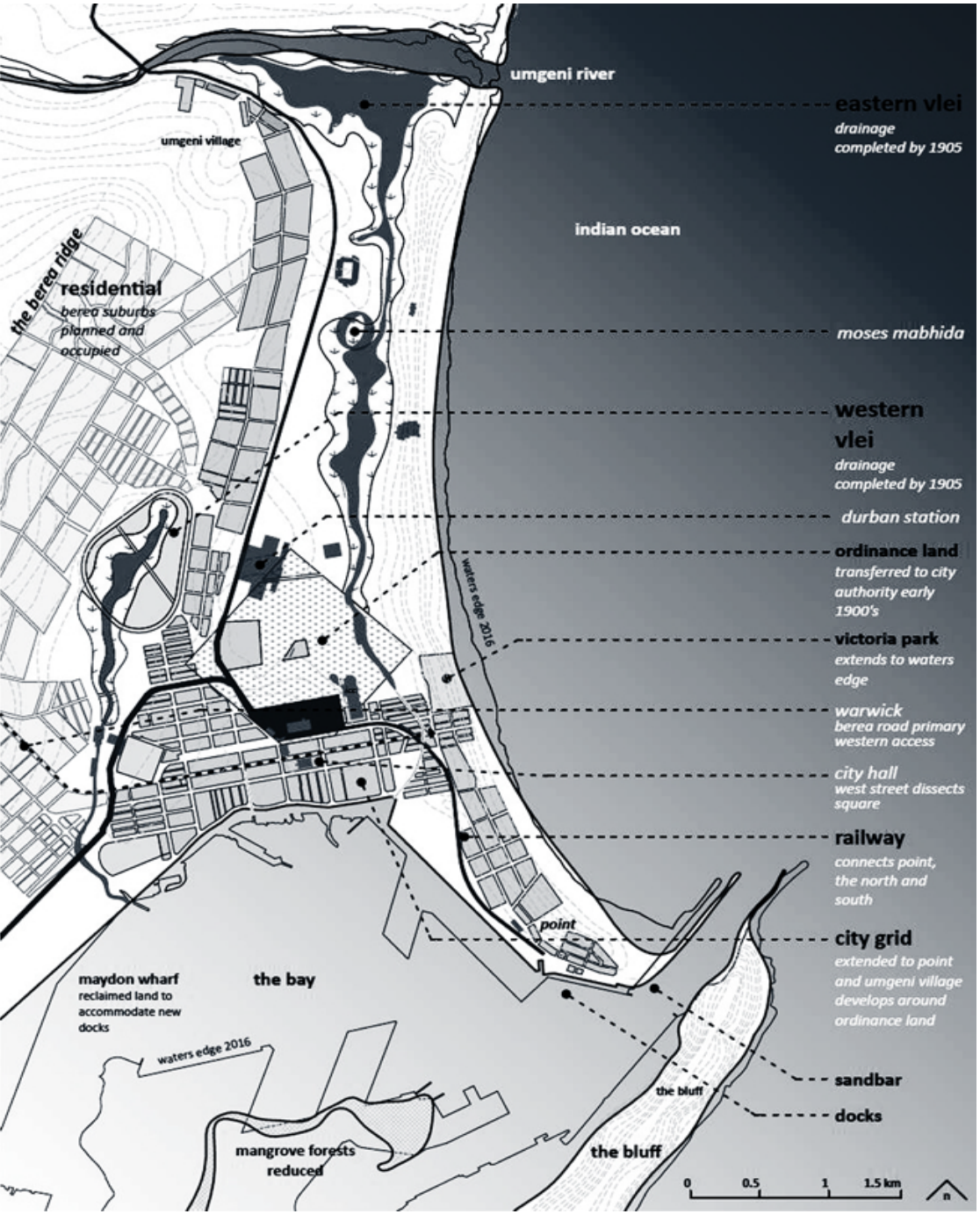
Durban's topography made the imposition of a mechanised form of transportation upon its fabric, a logical step in major physical development in the area (Frescura, 2013: 21). Travel east and west out of the town centre was difficult, barred by two quagmires as well as the eastern marsh standing firmly between the town and the growing harbour facilities.


umgeni river
eastern vlei
filled up when the river flooded
alluvial plain
flat land between the berea and the vlei's
the berea ridge
dense forests
moses mabhida
indian ocean
western vlei
drained the berea ridge
dense forests
durban station
sand dunes
covered in dense coastal forest
alluvial plain
sandy soil prone to flooding
waters edge 2016
berea station
city hall
adlam's drain
drained from a small lake in the middle of the future town
mangrove forests
mangrove forests
point
eastern vlei
drained into bay via Cato's Creek
the bay
waters edge 2016
sandbar
first dock
mangrove forests
the bluff
0 0.5 1 1.5 km
n

6.03


umgeni river
eastern vlei
vlei size reduced due to draining projects
indian ocean
the berea ridge
dense forests
moses mabhida
western vlei
vlei reduced due to draining projects
dense forests
durban station
ordinance land
used for military purposes, prevents future town developing northwards
waters edge 2016
warwick
outspan area
city hall
market square
bridges
prone to flooding
gardiner grid
town established as a connected street grid system
mangrove forests reduced
point
residential
located on the west and east sides of town centre
the bay
mangrove forests reduced
waters edge 2016
sandbar
docks
mangrove forests
the bluff
0 0.5 1 1.5 km
n

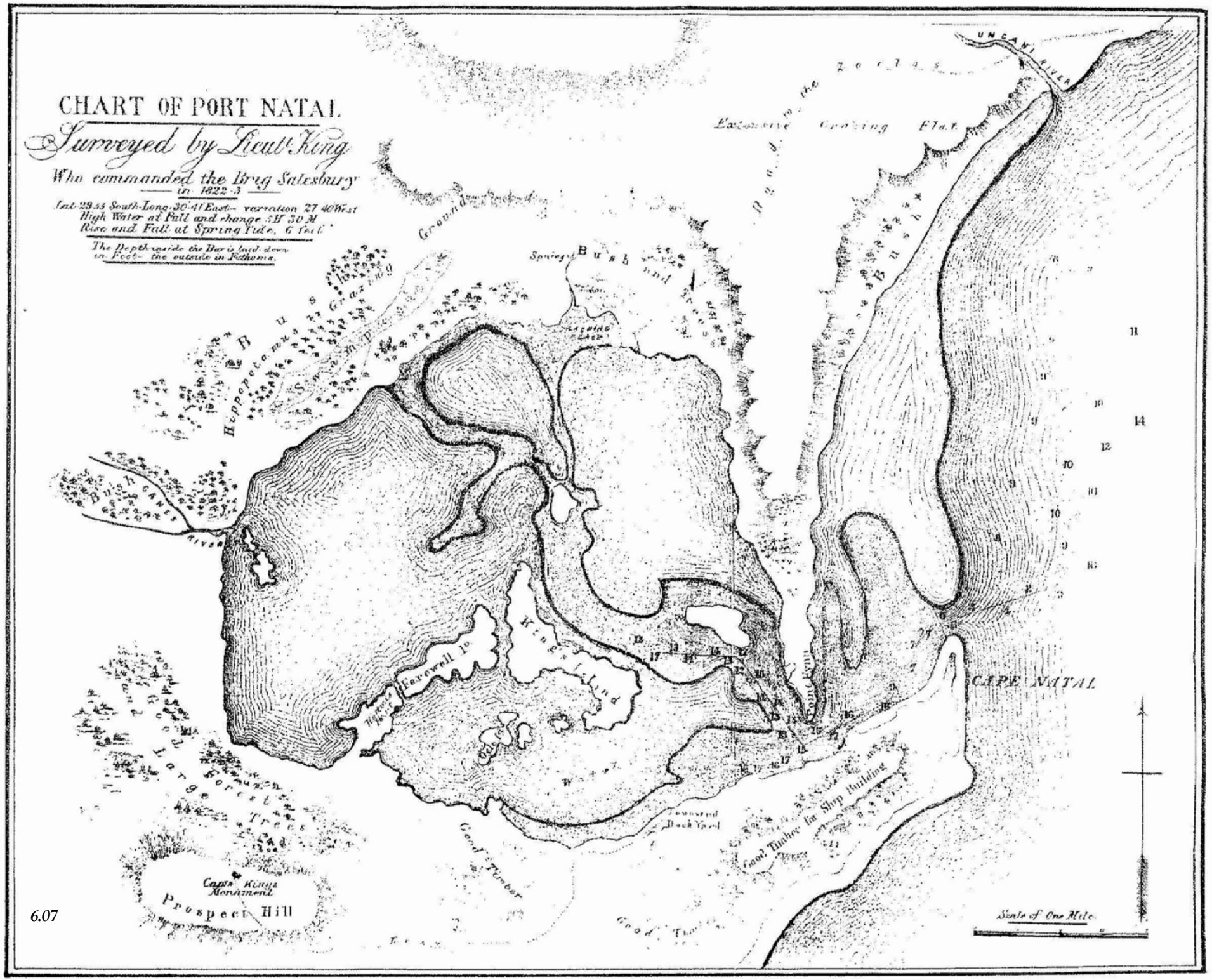
6.04


umgeni river
eastern vlei
drainage completed by 1905
umgeni village
indian ocean
the berea ridge
residential
berea suburbs planned and occupied
moses mabhida
western vlei
drainage completed by 1905
durban station
ordinance land
transferred to city authority early 1900's
waters edge 2016
victoria park
extends to waters edge
warwick
berea road primary western access
city hall
west street dissects square
railway
connects point, the north and south
point
city grid
extended to point and umgeni village develops around ordinance land
maydon wharf
reclaimed land to accommodate new docks
the bay
waters edge 2016
sandbar
the bluff
docks
mangrove forests reduced
the bluff
0 0.5 1 1.5 km
n

6.05


river
rehabilitated mangroves
umgeni river
eastern vlei
flood line indicates natural system still drains into bay via rivertown
burman bush
city grid
northern grid: large blocks and high speed roads standalone development
the berea ridge
indian ocean
residential
mixed use districts providing local amenity
moses mabhida
iconic development
western vlei
remants visible in canals
durban station
ordinance land
mostly government led development
promenade
primary, city wide open space
warwick
city gateway
city hall
colonial city core
railway
servicing port edge = important north south connection
point
city grid
finer grained grid : primarily one way street system
the bay
coastline
subject to sea rise threats
docks
bay edge primarily operational port
the bluff
0 0.5 1 1.5 km
n

6.06



6.07

Illustration 1.1. Chart of Port Natal, surveyed by Lieut King in 1822-23. (Russel, 1899)

"Durban's waterlogged ground was not limited to these two marshes, but included a number of smaller swamps and quagmires scattered about other parts of the settlement, depending both upon the season and the cycle of tides. Parts of West Street and Fields Street (Joe Slovo Street) suffered from poor drainage while Pine Terrace (Monty Naicker Road) was also known as the preferred habitat of many species of water-fowl."
-Franco Frescura - Durban, Once Upon a Time: 24

draining the

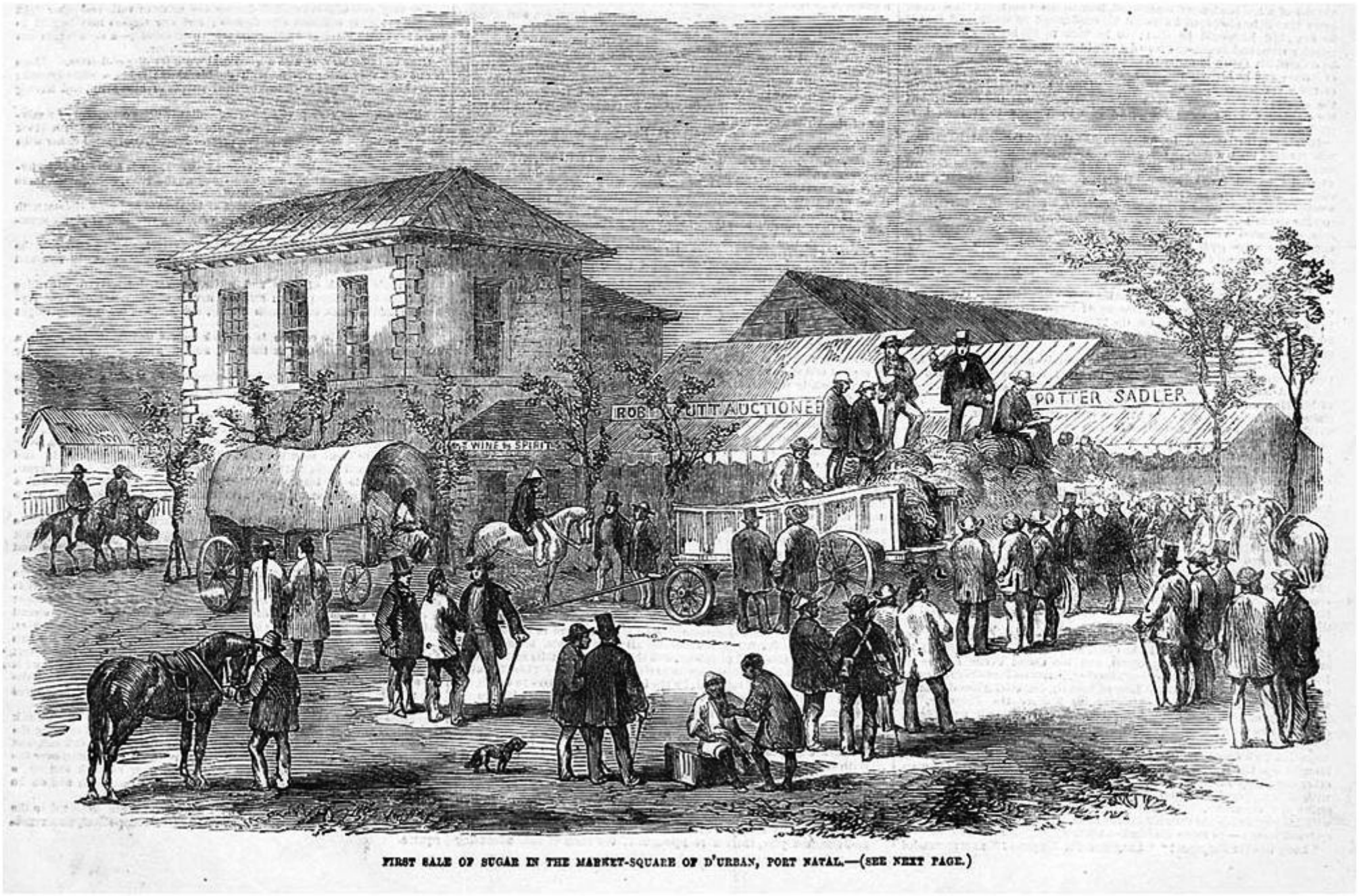
MARSHES

The two marshes, known as the Eastern and Western Vlei, were poorly drained, provided fecund breeding grounds for mosquitoes and thus did not encourage the development of housing in the area (Frescura, 2013: 23). The Eastern Vlei was better drained as it ran into the harbour via Cato's Creek. Hence, the Eastern side of the town was first to develop its business strip along Smith Street, now known as Anton Lembede Street and dwellings of a more permanent nature was built further north (Frescura, 2013: 23). Both marshes, East and West, frustrated the flow of wagon traffic in and out of Durban, in the beginning when the settlement was expanding and pushing beyond the bounds of the original street plan.

Additional drainage works were carried out in 1861 and 1862 in West (Dr Pixley KaSeme Street), Field Street (Joe Slovo Street) and Pine Terrace (Monty Naicker Road) while construction of the drainage on the Eastern Vlei was still being carried out (Frescura, 2013: 24). The process of draining both the Eastern and Western Vleis continued well into the 1900s.

Durban Central began to grow beyond its original boundaries by the 1870s and as work on the Western Vlei progressed, so too did the growth in importance of development to the western side of town (Frescura, 2013: 24). As result of this growth in development, a number of streets were added to the town plan.

The introduction of a constructed wetland that acts as a drain for the city filters the storm water and lifts the load off the water table. This system grants dignity to the natural eco-system that once occupied the land of the inner city.



FIRST SALE OF SUGAR IN THE MARKET-SQUARE OF D'URBAN, PORT NATAL.—(SEE NEXT PAGE.)

6.08

MARKET SQUARE

a brief history

The early history of Market Square can be seen as a microcosmic reflection of the history of Durban (Frescura, 2013: 37). Many of the town's first key events occurred in this vicinity although it took nearly fifty years for its fruition in development that is still continuing today.

Marketing activities took place in two main areas at either end of Smith Street (Anton Lembede Street). The first was formed at the eastern end – this was well drained and close to the point, passengers and imported goods were offloaded and soon became the residential and business centre for Durban (Frescura, 2013: 37). The second location for marketing was near the Western Vlei, butcheries tended to open in this area but the vlei acted as an effective barrier for heavy transport, especially in the wet season. The badly surfaces roads of Durban also added a deterrent to travel through the town and transporters found it more convenient to offload the goods on the western side of the marsh. Here, goods could be either sold to both, wholesale and retail clients or they could be transferred onto lighter vehicles.

During its early years, Market Square harboured precious little marketing spots where wild date palms and wild bananas grew amongst sparse scrub on sandy, undeveloped land.

Market Square grounds were also used for civic 'justice' purposes. In July 1853, the square was a stage for one of Durban's first floggings – displaying corporal punishment at the hands of the military for the crime petty theft (Frescura, 2013: 39). Thereafter, regular floggings for minor offences were impromptu affairs which took place on the present site (Frescura, 2013: 39). During that same month, the public execution of four men and a woman took place at the site, they had been charged with murder.

6.09

PRESENT DURBAN

Durban is faced with the daunting task of addressing the legacies of the racially segregated city model enforced by the apartheid government and planners. The apartheid policy displaced many citizens by creating suburbs exclusively for the black, Indian and coloured populace beyond the bounds of the urban framework. Today, settlements and townships like Umlazi and Kwa Mashu still lie far from economic opportunities that the city has to offer. Commuters are forced to travel long distances by train or mostly minibus taxi on a daily basis.

The present state of the inner city of Durban is largely underutilised, inefficient and lacks common, basic human amenities due to the lack of accessibility. After democracy, majority of the white population migrated north, taking economic value with them. The city presently seems to have lost value in terms of perception and economics. The heart of the city is lost and the once vibrant port city of Durban is disjointed and displaced in terms of its citizens. The inner city of Durban is still racially segregated, with the inner city remaining inaccessible in terms of public transport, a lack of safety and maintenance.

The eThekwini municipality has recognised these issues and so, have set in motion the Local Area Plan.

6.10

THE PRESENT – UNDERSTANDING THE CITY

Today the Inner City of Durban is a diverse and complex part of the city, rich in culture and opportunities. It is characterised by its strategic location both as a major CBD and its Port linkage, significant transportation exchange and networks, accessible metropolitan and local facilities, key sporting and recreation facilities, concentrated and diverse population and activities, as well as complex formal and informal networks and exchanges.

The area fulfils a wide range of roles and functions including:

- The economic hub of the metropolitan area - commerce, port and industry, informal sector
- Tourism
- Sporting and Cultural facilities
- Transport hub, including the Integrated Rapid Public Transport Network
- Range of Housing

- Social Facilities
- Education
- Courts and legal cluster
- Municipal and Government Office and Facilities

A snapshot of the main statistics for the Inner City:

1. Of note is that the current population of approximately 60,000 to 70,000 people constitutes only 2% of the metropolitan population which is very low compared to other Inner City locations around the world.

The average density is slightly higher than the rest of the city, the average household size slightly smaller and the average person residing in the Inner City slightly better educated that than in the rest of the city. There are better employment rates than average and household income levels are increasing, however, just fewer than half the population earn below R3,200 per month.

CONTEXTUALISING REGENERATION OF THE INNER CITY OF ETHEKWINI

The Spatial Development Framework of eThekwini Municipality (2013-2014) identifies the Inner City as the urban core and the gateway to the greater city of Durban. This core has experienced a significant negative cycle of business flight, disinvestment in privately and publically held residential and commercial built form and well intentioned, but poorly coordinated public interventions which have in turn resulted in an underperforming Inner City economy and an area in decline.The need to revitalise the Inner City, realising the true value of the existing assets and in turn creating the opportunity for new investment has been identified as a key requirement of the LAP and Regeneration Plan.

6.11

FUTURE DURBAN

planning for the city

THE LOCAL AREA PLAN

The information that follows hereunder is based or is the Local Area Plan for the Inner City of Durban and has been drawn up by a team of Urban Planners (Urban Solutions) and members of the municipality. This plan has been presented to the municipality of eThekwini, as the future plans for the Inner City of Durban, KwaZulu – Natal (2016).

Machinaria, as a thesis project for the Masters in Architecture programme at UKZN, Durban, is proposed by the Author as a catalytic plug in to the Local Area Plan. Many concepts, principles and design objectives are in line with the aims of Machinaria is used to have a better understanding of the Interchange, the importance of public transport in a once segregated city and the need to create a more compact, walkable city that caters for all its citizens – through the lens of a realistic, urban design process.

INTRODUCTION

the local area plan

PURPOSE OF THE LOCAL AREA PLAN

The United Nations estimates that 71,3% of the world population will live in urban areas by 2030 and that by 2050, 80% will be urbanised. 64% of the youth live in urban areas – in other words the population in urban areas is getting larger and younger (Integrated Urban Development Framework COGTA, Sept 2014). The country finds itself in an economic crisis with falling economic growth, jobless growth, and increasing unemployment. The urban centres, especially the metropolitan areas dominate the country's economy and thus offer the best employment opportunities. However, our cities remain segregated and sprawled. National government has therefore identified the regeneration of inner cities as a policy priority providing potential for access to employment, reduced transport costs, a range of housing opportunities.

In addition, within the Durban metropolitan area, the value of business property assets is the highest in the Inner City area and the area generates a significant portion of the rates base of the city. Coupled with this there has been a recognition that urban growth amplifies climate change risks and reducing urban risk is therefore critical to sustainable urban development. The Inner City area is thus a crucial area for the growth and development of the City and needs the requisite attention to retain and attract investment into the future.

Within this context the purpose of this Local Area Plan (LAP) is to create a vision and framework to direct the regeneration of the Inner City of eThekwini. The Local Area Plan will provide the primary spatial vision for the Inner City area and become a coordinating and integrating tool that directs municipal department activities and expenditure and provides the private sector with direction and confidence in the future growth of the area. The LAP describes, in writing, pictures and drawings, the potential future of the Inner City, giving reasonable certainty and predictability for potential investors, developers, business owners and landowners, and attracting future residents and tourists. Whilst the purposes of the Plan are many, it primarily gives a clear direction for positive change, indicating what is appropriate and necessary to revitalise the City.

The overall goal of the regeneration plan that will follow from the LAP will be to retain and grow investment and people in the Inner City, optimising the assets of the area within a context of challenges such as a stagnant national economy, high unemployment, aging infrastructure, urbanisation, new communication technologies and changing ways of doing business, climate change, and energy constraints. The regeneration plan must support the role of the Inner City as the safe, vibrant and accessible; literal and symbolic centre of eThekwini.

This document is future oriented and visionary, and represents an ultimate development scenario for the entire Inner City area that ultimately could become a vibrant, walkable, mixed use, economic hub accommodating some 450,000 residents and 250,000 additional jobs.

The eThekwini Long Term Development Plan (2010) highlights the vision for the eThekwini Municipality as: ***"Durban – Africa's most Caring and Liveable City"***

This will be achieved by the key strategic priority areas of

- Creating a *SAFE* City
- Promoting an *ACCESSIBLE* City
- Creating a prosperous city where all enjoy *SUSTAINABLE LIVELIHOODS*
- Celebrating our *CULTURAL DIVERSITY, ARTS AND HERITAGE*
- Ensuring a more *ENVIRONMENTALLY SUSTAINABLE* City

	EIGHT POINT PLAN	DESIRED OUTCOME
1.	***Develop and Sustain our Spatial, Natural and Built Environment.*** The goal of this plan to lead, direct and manage the spatial, built and natural environment to ensure the sustainable and integrated growth and development of our Municipality for the benefit of all its citizens.	Citizens will be able to access and use resources to meet their needs without compromising the amenity for others and the resource base of the Municipality in the present and in the future.
2.	***Developing a Prosperous, Diverse Economy and Employment Creation.*** The goal of this plan is to develop the economic wealth of the eThekwini Region for the material well-being of all its citizens.	Strong economic growth, sustainable job creation and poverty alleviation.
3.	***Creating a Quality Living Environment.*** The goal of this plan is to promote access to equitable, appropriate and sustainable levels of household infrastructure and community services, and facilitate access to housing.	Appropriately serviced and well maintained, quality living environments.
4.	***Fostering a Socially Equitable Environment.*** The goal in this plan is to promote and create a safe, healthy and secure environment.	All citizens living in a safe, healthy and secure environment.
5.	***Creating a Platform for Growth, Empowerment and Skills Development.*** The goal is to establish eThekwini as a learning city which uses knowledge management techniques and processes to enhance the skills base of the citizenry as well as share good practice with other municipalities.	· A skilled and capable citizenry, within the eThekwini Municipal Area, that shares in and contributes to the economic expansion and growth of the region; · A skilled work force that delivers effective and quality services to the citizens of eThekwini Municipality; · A learning city.
6.	***Embracing our cultural diversity, arts and heritage.*** To create a city where people interact creatively to stimulate economic growth, social cohesion and unity in diversity.	People living vibrantly and productively in an attractive and healthy environment.
7.	***Good Governance and Responsive Local Government.*** The goal is to ensure a strong, caring and democratic institution to promote and support a consultative and participatory local government.	· All citizens embracing, practising and benefiting from the concepts of Good Governance; · A stronger, more efficient public service which is capable of developing and implementing policy and delivering better services to all people at all levels; · Better and more transparent public management; · More participative and responsive Municipality, particularly at all levels; · A Municipality which prevents, and fights corruption and waste at all levels; · A Municipality where all inequalities of the past are eradicated. ·
8.	***Financially Accountable and Sustainable City.*** The goal is to maximise the Municipality's financial resources to ensure long-term financial viability and sustainability.	Confidence of all internal and external stakeholders in municipal financial management; Excellence in the service delivery of municipal financial services; Compliance with prevailing municipal financial legislation

6.12 *– Table of the 8 point plan for Durban's Urban regenerative programme. Source: LAP, 2016*

- Fostering a *CARING AND EMPOWERING* City

The IDP highlights the key challenges facing the municipality as:

- High rates of unemployment and low economic growth
- High levels of poverty
- Low levels of skills development and literacy
- Limited access to basic household and community services
- Increased incidents of HIV/AIDS and communicable diseases
- Loss of Natural Capital
- Unsustainable developmental practices
- High levels of crime and risk
- Ensuring adequate energy and water supply
- Ensuring food security
- Infrastructure degradation
- Climate change
- Ensuring financial sustainability
- Ineffectiveness and inefficiency of inward-looking local government still prevalent in the Municipality.

To address the challenges listed above the Municipality's delivery plan is organised into eight separate but related plans. The plans, programmes and projects are supportive of each other, to ensure greater impact in delivery and, its goals and outcomes are achieved. The LAP responds directly to these goals through the cross cutting themes and spatial principles.

The Spatial Development Framework vision (2013) is that:

"by 2030 a socially equitable, environmentally sustainable and functionally efficient Municipality that bolsters its status as a gateway to Africa and the world".

This will be achieved by implementing the following principles implemented in terms of the Framework Plan illustrated below:

- Principle of environmental sustainability
- Principle of Spatial concentration (efficiency)
- Principle of economic potential, co-ordinated planning and implementation
- Principle of Balanced and Sustainable urban and rural development (equity)

The Central Spatial Development plan highlights the Inner City as a metropolitan node linked by a number of corridors and notes specifically the following:

- Promoting tourism and mixed use development in the inner city, the beach, sports and business and heritage areas in particular.
- Promotion of densification within the central region especially along public transport nodes and corridors.

The eThekwini Built Environment Performance Plan (BEPP) has been prepared in response to the National Policy directives to promote Integrated City Development. The ICDG Guidelines (2013) note that the "***challenge is build more sustainable, productive, liveable and inclusive cities. This requires metros to more actively integrate public investments in the built environment***."

In this context the 2012 BEPP for eThekwini identifies the following challenges:

- Urbanisation has been one of the most significant demographic and settlement trends over the past few decades.
- The average residential densities of the

6.13

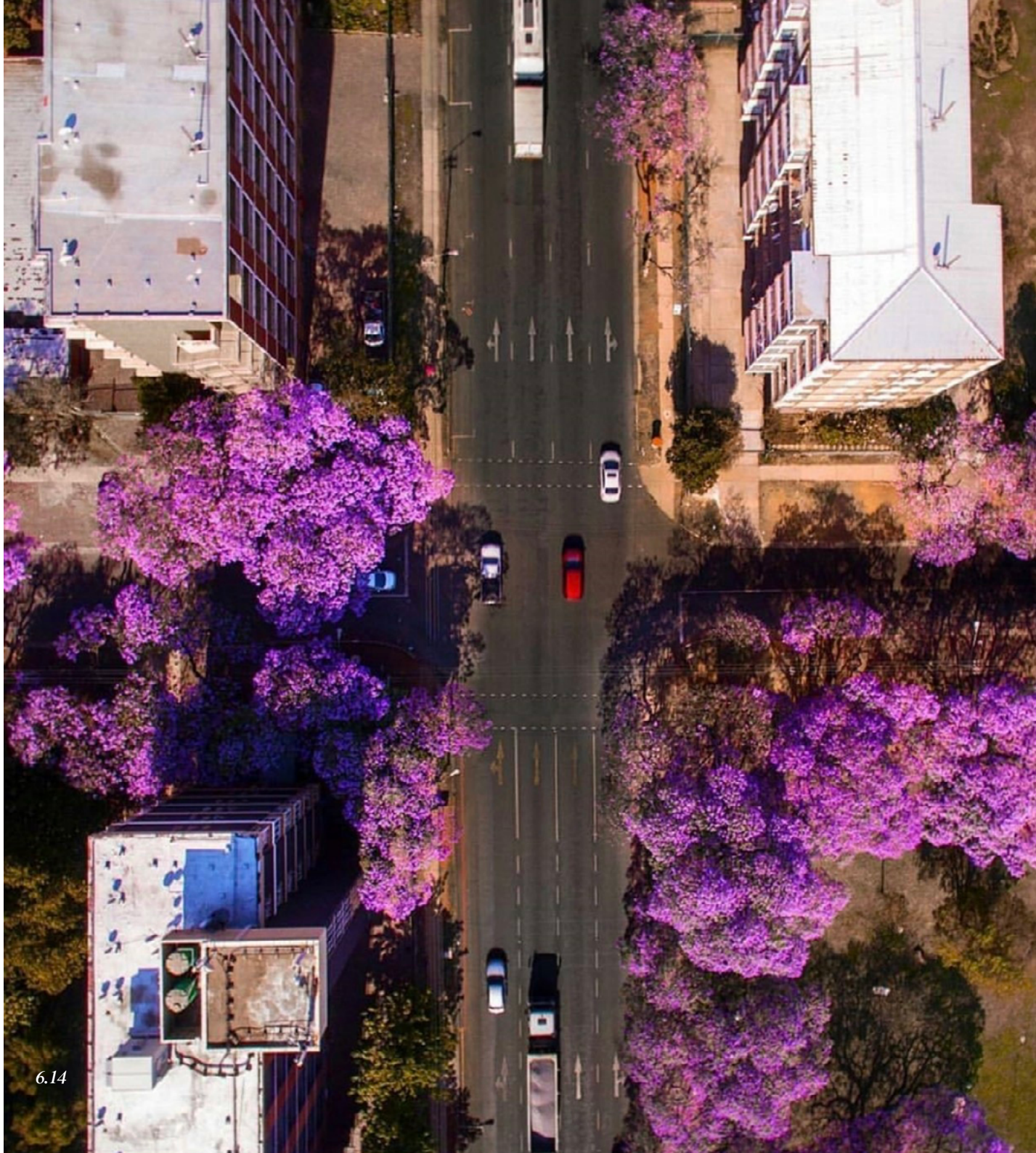
metro as a whole are generally too low to sustain public transportation and other infrastructure, or to promote the municipal economy.

- Availability and cost of well-located vacant land and underdeveloped sites is a serious problem especially because the sustainability of settlements depends strongly on their location and accessibility.
- Densification and extension of existing informal settlements is ongoing.
- Funding constraints include the absence of a densification subsidy, and insufficient funds for local infrastructure.
- The demand in the low-income sub-market is very significant.
- Informal settlements in urban areas are the largest challenge
- Hostels are a major challenge.
- Some Bad Buildings exist in the inner city.
- The rural low-income demand is significant, and is expected to grow
- Development of services and social facilities is often not aligned to Greenfields housing

projects.

- Formal property markets are not working efficiently for the low income and affordable housing income groups.
- Although no conclusive figures are available it is commonly held that the unmet demand is also significant in the affordable housing sub-market.
- The rental market is significant.
- As in most SA cities, jobs are not where the people live, and vacant land for housing is not where the jobs are.

In order to direct investment in the City to achieve the objectives of building more sustainable, productive, liveable and inclusive cities the BEPP identifies various zones of investment. The Inner City falls within the Prime Corridor, Public Transport Truck Zone which has been identified for maximum expenditure to achieve the desired outcomes.



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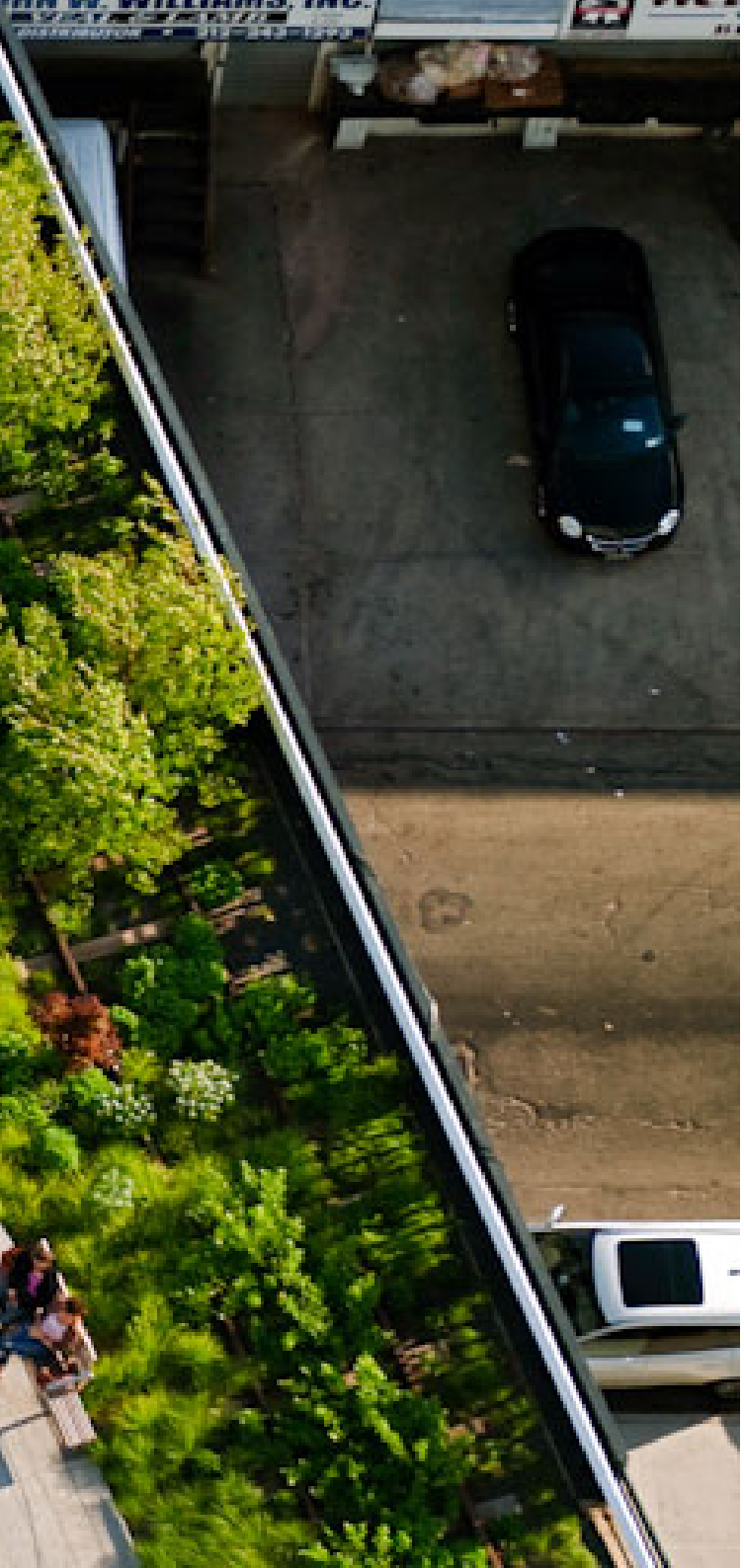

THE 2040 VISION FOR THE INNER CITY OF DURBAN

Within this policy context for future development, the vision for the Inner City of eThekwini has been proposed as follows:

By 2040 the Inner City of Durban will be

Africa's leading, most vibrant, liveable, walkable City Centre providing economic, residential, sporting and leisure opportunities for all

CONNECTED

The Inner City will be connected to the rest of the city via new and reconfigured, pedestrian friendly streets, new pedestrian and cycling networks, improved and varied public transport choices and an upgraded public realm. In 2016 31% of all trips into and out of the CBD were made by Private vehicle, 46% by public transport, 0% by bicycle and 22% walking. By 2040 the IRPTN network will have reached the Inner City and the people mover system will have been expanded to provide an Inner City distribution network which will have reduced the dominance of taxis and cars in the Inner City.

THREE CROSS CUTTING THEMES

In development of the Local Area Plan is based on three important cross cutting themes

1. Future development should be based on the lessons from the past i.e. why did the Inner City area develop as it did and what lessons does this have for future planning, as well as an understanding of the current Inner City area
2. All planning and regeneration must be firmly and completely based on a solid understanding of the drivers of economic growth and focus on promoting these elements if regeneration is to be successful
3. All future development proposals must be resilient and sustainable to ensure that plans are not contributing to climate change and may in fact mitigate some issues

6.16

SPATIAL JUSTICE	SPATIAL SUSTAINABILITY	SPATIAL EFFICIENCY	SPATIAL RESILIENCE	GOOD ADMINISTRATION
Improved access to land, Inclusivity, Flexibility and Appropriateness for management of land and land use	Financial, Agriculture, Environmental, Land Markets, Infrastructure and Social Services Densification	Optimise exiting Resources and Infrastructure, Minimise Negative Impacts, Procedures are Efficient	Flexibility of systems to ensure sustainable livelihoods and for those most likely to suffer economic and environmental shocks	Integrated Approach to land use and land development; Sector co-ordination, Timeous decisions, Transparent public processes, Empower people

***6.18** - Spatial Land Use Management Act, Act No 16 of 2013 – Development Principles*

IMPORTANT ROLE OF THE INFORMAL ECONOMY

The informal economy plays an important role in sustaining the livelihoods of vulnerable groups and providing an entry point into the formal economy for emerging small businesses. There is a vast and growing literature on the understanding of the social, economic and spatial aspects of the informal economy and the complex and interwoven networks that exist between informal workers and the formal economy. Informal trading activity, service provision and even light manufacturing all feature in the Inner City. In many cases, these informal workers operate out of their homes or as undocumented piece workers and their space requirements are not easily discernible but accessibility and connectivity are key determinants of location potential, particularly for traders.

Land located close to economic opportunities is usually the most expensive land, and therefore the market tends to work against providing such land to low-income groups. Inadequate access to well-located urban land has immediate and long-term economic and social implications not only for those excluded, but also for the sustainability and efficiency of the overall urban environment, and for the overall social fabric of the city.

The emerging spatial responses designed to address constraints facing the informal economy are designed to support and protect the informal sector in suitable trading areas in identified:

- Streets with wider-pavements
- Around public transport hubs and other facilities with high levels of pedestrian movement
- Market spaces

Trading areas should be clean, secure and well managed with access to safe and hygienic ablution facilities, clean water and lockable storage. To facilitate the provision of suitable services, specialised markets should be identified. These markets have the advantage of clustering complementary products and services and centralising facilities such as food preparation areas, cooking facilities, storage facilities, access for supplies and other support services that are unique to different goods and services. In addition to support for informal sector, these activities should be well managed to avoid conflict with other city users.

6.17

"Cities must urge urban planners and architects to reinforce pedestrianism as an integrated city policy to develop lively, safe, sustainable and healthy cities. It is equally urgent to strengthen the social function of city space as a meeting place that contributes towards the aims of social sustainability and an open and democratic society." - *Jan Gehl (2010) "Cities for People" Island Press*

MAKING THE INNER CITY SUSTAINABLE AND RESILIENT

According to the Brundtland Report (1987) Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Resilience is a relatively new term that is gaining traction in the urban development field and is defined as the capacity of individuals, communities, and institutions within a city to adapt to various stresses and shocks that they face and be able to not only bounce back but to 'bounce forward' to a better improved state. eThekwini Municipality of one of 100 cities participating the 100 Resilient Cities Programme (www.100resilientcities.org). It is expected that a resilience strategy will be developed as part of this initiative in 2016. The focus areas that have been identified for this strategy are:

1. Bold and Participatory Governance

2. Knowledge-centred City

3. Innovative Place-making

4. Sustainable and Ecological City

5. Catalytic and Transformative Economy

6. Equitable and Inclusive Society

This component of the Inner City LAP specifically addresses the focus area of a Sustainable and Ecological City. Other resilience focus areas such as innovative place-making and catalytic and transformative economy are addressed in other components of the Inner City LAP.

Key issues that will need to be addressed in the LAP to ensure a sustainable and resilient inner city are:

1. Management of development adjacent to the beach

2. Minimising flooding and flood impacts

3. Managing the heat island effect

4. Reduction of GHG emissions

5. Improved waste management

6. Enhanced biodiversity

In addition to large scale flood events, since the Inner City is low lying and prior to development had a number of vleis it is frequently subject to smaller scale flash floods when the storm water system is unable to cope adequately with intense rainfall events. *– Machinaria proposes a new, constructed wetland in the heart of the inner city to help cope with storm water attenuation and flooding in the Inner City.*

Considering the risk associated with the 1:100 flood area the Inner City LAP will not allow for new development in the flood area that are intended to have a long life span and are not designed to cope with flood events. In addition, the Inner City LAP will protect existing open spaces that play a role in flood attenuation in the inner city and promote the use of sustainable drainage systems approaches in new developments and replacements of existing infrastructure.

6.18

A). MANAGE THE HEAT ISLAND EFFECT

Durban has a sub-tropical climate and climate change predications for Durban suggest that the annual average temperature will increase by between 1.5°C and 2.5°C by 2065 and by between 3°C and 5°C by 2100 (Golder Associates Africa, 2010). In this context it will become increasingly important to manage the heat island effect in Durban. The heat island effect refers to the phenomena where built up areas are significantly warmer than rural areas. The main cause of the urban heat island effect is the role that urban surfaces play in retaining heat from the sun. Waste heat from air-conditioning can also be a contributor.

To manage the heat island effect, the Inner City LAP will:

1. Promote the use of reflective materials in buildings

2. Increase the amount of natural vegetation including roof and vertical gardens

3. Promote the use of energy efficient and alternative forms of air-conditioning

- The introduction of a constructed wetland in the built-up environment of the inner city will promote a cooler climate as well as the creation of a natural eco-system within the inner city.

B). REDUCTION OF GHG EMISSIONS

Cities in South Africa are significant sources of Greenhouse Gas (GHG) emissions. According to the 2012 GHG inventory for Durban the municipal area emitted over 29 million tonnes of CO2e (eThekwini Municipality, undated). Two of the main sources of these emissions are electricity use (accounting for 43% of emissions) and transport fuel (accounting for 37% of these emissions). Since electricity is generated outside of the municipality by Eskom and transport fuel is imported into the country the energy intensive nature of the Durban economy also represents a considerable loss to the local economy. Recent research into the energy future of eThekwini Municipality has found that "*the overall cost to Durban's inhabitants of a low-carbon way forward is lower than the Business as Usual scenario … An energy efficient path will save the local economy R 15 billion by 2020*." (Sustainable Energy Africa, 2014).

To support an environmentally and financially sustainable future it is important that the Inner City plays a role in facilitating a low carbon future. To promote a reduction in GHG emissions the Inner City LAP proposes densification of the inner city, the extension of non-motorised transport and public transport connections and the establishment of a walkable city. In addition, the Inner City LAP also supports the Implementation of high levels of energy efficiency in homes. *– Sustainable and resilient architecture, a constructed wetland and using technology to create a bio-mechanical architecture will contribute, if not mitigate some of the GHG emissions in the inner city.*

SPATIAL RATIONAL

– four principles that will guide the spatial development of the inner city

The spatial logic for regeneration of the Inner City is grounded in the policy context, the understanding of the economic drivers of future growth as well as the vision that has been developed for the future of the area. The spatial logic itself is expressed in terms of spatial principles which will guide the development of strategies (what to do), the spatial framework (where will it happen) and projects (specific implementable actions). The principles all contribute to urban regeneration.

6.19

PRINCIPLE 1:

A). PROMOTE A CONNECTED CITY

All cities throughout the world have developed around a set of interconnected streets and the spaces they form. The greater the connectivity the higher the intensity of development. Similarly, the Inner City of Durban has developed around an interconnected grid of streets within the core CBD area.

The area to the north of the Inner City is, however, disconnected from the west by the railway line and Umgeni Road. This area remains underdeveloped but provides a massive opportunity for the growth of the Inner City area. The CBD core also suffers from congestion at certain times of the day and ongoing regeneration and densification requires a reconceptualization of the road network and public transport system as well as elevation of non-motorised transport in importance.

Key to unlocking development is therefore defining the current network and creating new connections around which cities naturally grow.

The core of this principle is therefore to:

- Define an expanded Inner City mobility network for pedestrians, cyclists, public transport and cars.
- Link the Berea to the Ocean with new connections that overcomes access barriers to stimulate development potential.
- Extend the grid of streets to the north.
- Develop a range and variety of street types, global connectors to local streets to pedestrian and NMT networks.
- Allow the Inner City to start at The Umgeni River.

The proposals include

- Reconfiguring the existing road network to a two-way system and changing the function of the M4 and M12
- Adding new primary and secondary roads
- Adding a network of new local and frontal streets
- Prioritizing some areas for pedestrian movement

These proposals combine to promote a new connected Inner City.

B). CONNECTIONS AND TRANSPORT

Based on improved connections the Inner City future transportation system will:

- Meet the needs of all citizens, providing integrated connections to meet local, regional and international expectations.
- Ensure equitable distribution of space for all users.
- Be convenient, safe and attractive and therefore unlock densification strategies.
- Contribute to a reduction in Durban's total greenhouse gas footprint and minimise increases in transport related air pollution through the reduction in travel requirements, increased use of non-motorised transport options and increased use of public transport rather than private transport.

In order to meet the growing demands, the transport interventions are hinged upon:

- Maximising efficiency of existing systems.
- Enhancing existing systems and networks by the creation of new key linkages.
- Promotion of non-motorised transport and public transport with supportive land-use development.
- Reducing the need for travel and reducing travel distances to amenities.

The non-motorised transport elements include:

- The creation of two NMT axes that link the City in an east-west and north-south direction, along Dr Pixley Kaseme (linking the Beachfront in the east with Warwick in the west) and Masabalala Yengwa Ave (linking the Sports Precinct in the north and Victoria Embankment in the south) respectively.
- The creation of a supporting NMT network that links these axes to the remainder of the City and the Berea.
- The restructuring of all road space to ensure all modes are provided for as well as landscaping elements.

The key mobility corridor elements include:

- The development of a ring road system to alleviate congestion in the core of the City whilst maintaining mobility to access various other parts of the City.
- New links to the Berea improve overall accessibility of the City and reduce the burden on existing links.
- Creation of park and ride/park and walk systems along key mobility corridors, linking to public transport and NMT infrastructure.
- The creation of an institutional framework to deal with freight and parking in the City.

The public transport elements include:

- The IRPTN Program (both rail and BRT) is the vital transport element to support growth and development in the Inner City, providing local and regional access to the City.
- The expanded Inner City Distribution System will provide internal circulation and distribution in the City.
- The City-Airport link, from the Cruise Terminal, via Centrum and ICC, Sports Precinct and uMhlanga to King Shaka International Airport provides access for international visitors.
- These transport elements are to be integrated into a Central Transport Terminal on the Centrum site.

c). CONNECTIONS AND DEVELOPMENT POTENTIAL

Making new connections in the form of streets and paths allows developable land parcels to become a part of the expanded city grid. Smaller land parcels allow diversity, flexibility and fine grained development.

A mobility concept with higher mobility edges and a grid of connected streets creates a hierarchical framework of connections within and between neighbourhoods. This allows for diversity between neighbourhoods – including socio-economic diversity. Development must be mixed-use. Larger scale non-residential social facilities e.g. schools, sport fields etc., will be located on mobility routes. High intensity commercial and residential will be at neighbourhood centres, and higher proportion of residential use will locate on access streets. The mix of uses and density/intensity will respond to the public transport system. Focus densification in and around public transport stops and corridors. The most affordable and highest density accommodation will be concentrated adjacent to public transport, at the inner city scale, e.g. Warwick Precinct, as well as at the neighbourhood scale.

PRINCIPLE 2:

A WALKABLE CITY

The second major principle upon which the LAP has been developed is the notion of the walkable city. Observing how cities develop and function all over the world, it has become clear that they develop around a set of walkable neighbourhoods with a core of higher density commercial, residential and social facilities radiating out to a distance of about 400 meters which is a comfortable 5-minute walking distance. These nuclei then tend to form at approximately 800 meters apart. The walkable city concept also promotes integration, the transfer of ideas, the expression of culture, a sense of belonging and ownership, pride and passion for a city, promotion of health, increase of property values, and attractiveness of the city for residents, users and visitors alike.

Durban is no different to other cities and has developed in this same manner. The darker purple areas indicate the walkable neighbourhood centres of higher intensity development. Centres such as Davenport, Musgrave, Cowey, and Windermere have all developed along this pattern. Similarly, in the Inner City Mangrove Centre and the intersection of Pixley Kaseme and Sylvester Ntuli/ Mahatma Gandhi Road have developed in this manner. The core retail/commercial area of the CBD functions as a larger centre serving the wider region.


WINNER
BEST
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WHERE
MAXIMUM
PERFORMANCE
LIVES
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MAMMA
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6.21

PRINCIPLE 3:

LAND USE INTENSITY

- ensure a city for all, promote integration and inclusivity

The connected walkable city will be one that promotes integration and provides opportunity for a wide range of people and businesses by:

- Increasing the range of residential opportunities and encourage densification.
- Promoting diverse and varied land uses that increase the variety and range of choice for all residents, businesses and visitors.
- Ensuring the Inner City provides social services, entertainment, recreation and sporting facilities for the wider city and region.
- Promoting the inner city as the cultural, civic and legal centre of the region.
- Increasing cultural, heritage and tourism development in the core.
- Designing the public realm to support the 24 hour city.
- Ensuring open spaces are multi-functional and relate to relevant amenities such as schools.

The planning of this integrated city is based on the concept of identifying areas of greater and lesser land use intensity, rather than dictating where actual land uses should be located.

Residential accommodation will be part of mixed use neighbourhoods where local neighbourhood centres provide support for the daily needs of residents. A diverse range of varied land–uses must be promoted. The walkable neighbourhood structure provides a flexible spatial planning framework that with precinct specific form based guidelines will guide development decisions.

The increase in residential density and the number of residential opportunities will be a major focus of new development. Supporting land uses are required to fulfil the needs of the residential population. Cultural, Health and Educational land users will be integrated into the regenerated and expanded city. Shared spaces such as parks and squares will cater for a range of uses including sports facilities for inner city schools. Commercial and retail uses will be allowed to develop in the right places both on the ground floor and vertically, in mixed use buildings and neighbourhood. Land-use mix is proposed as average targets, rather than prescribed uses in specific locations.

A wide range of residential opportunities must include and integrate all ethnic and socio-economic groups. Associated public spaces and amenities must accommodate a range of cultural practices.

6.22

PRINCIPLE 4:

REALISING THE POTENTIAL

– regenerate and expand within a sustainable framework

The final principle focuses on realising the potential of the Inner City to regenerate and expand. This fundamental principle requires that the actions, programmes and projects that are identified to regenerate and expand the city are guided by and located by the overall spatial framework that is provided by the principles outlined above (connectivity, walkability including the public realm and integration). Without this co-ordinating framework, actions and projects will be ad-hoc and unfocused, often designed with the best intentions but not contributing to the overall success of regeneration.

Realising the potential requires

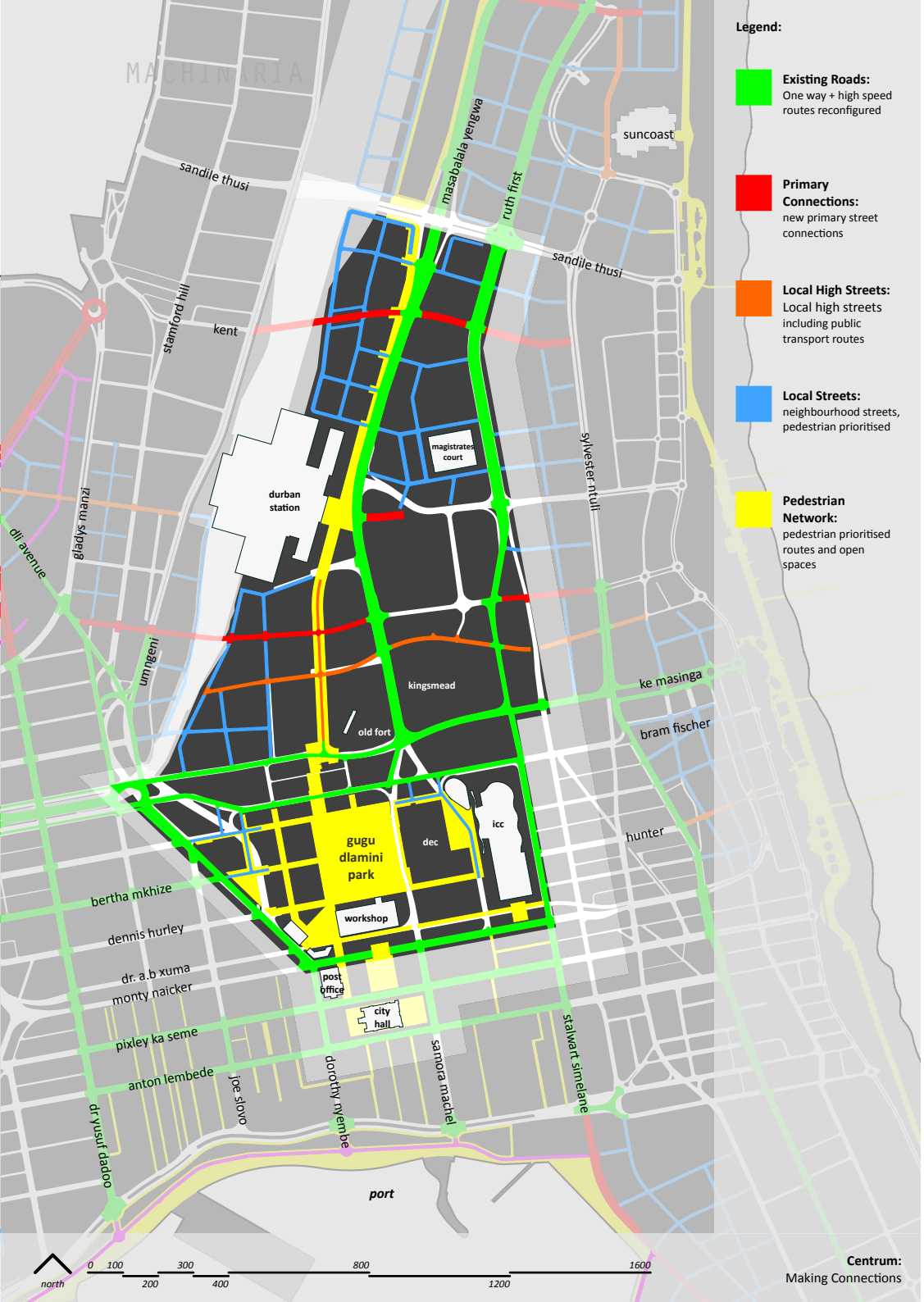
- Regenerate the city by integrating all projects within the Local Area Plan spatial framework.
- Integrate planning and implementation to maximise efficient and resourceful use of development budgets.
- Ensure development certainty by the adoption of the plan by Council, communicating the spatial framework and regeneration plan widely and making the municipal officials accountable for implementing the plan.
- Promote shared or coordinated public and private development.
- Adopt a holistic approach to development e.g. Combine public and private initiatives into single projects where the public supports private sector initiatives to upgrade buildings and properties through complimentary public realm upgrades that are managed through collaboration and partnerships.
- Locate small, short term projects in larger, long term projects.
- Assess and encourage/incentivise contributions to the public realm by private development.
- Promote and develop the public realm as a place of human and ecological resilience.
- Allow and promote improved energy efficiency and adoption of renewable energy where possible.
- Allow and promote improved water conservation.
- Locate all new infrastructure with a planned life of over 50 years inland of the High Water Mark modelled assuming 1000mm of sea-level rise.
- Implement a policy of managed retreat with regards to any infrastructure in coastal risk zones. This means that when any infrastructure needs to be revamped in the normal course of maintenance or as a result of storm or sea damage it should be relocated further inland.
- Preserve existing sand dunes and coastal vegetation to assist in defending against the impacts of sea-level rise and coastal storms.
- Implement measures that reduce the heat island effect.
- Incentivise the implementation of Sustainable Urban Drainage Systems in new and existing developments.
- Implement Smart infrastructure which utilises advanced technology to monitor energy and water use in real time and is able to meet user needs in a more efficient and responsive manner, reducing network wastage and maintenance of assets.

6.23

URBAN LOCATION

The Centrum precinct, located within the inner city of Durban, from inception of the town, was seen as a major civic zone. - the heart of the city. Through spatial segregation and apartheid planning, the heart of the city has been lost, leaving the Centrum and Inner City, underutilised and inefficient.

Flanked by four major roads - Soldiers Way, AB Xuma, Bram Fischer and Stalwart Simelane Street, the Centrum site could be a major Mixed Used and Mixed Zone Development – this could mean a new heart for a developing African City. With existing zoning comprising of business and civic spaces, one significant amenity that is scarce is that of public transportation. The birth of public transportation in such an area, the possibilities of development will blossom and grow exponentially.



Centrum:
Making Connections

6.24

CENTRUM

For the purposes of this LAP, what is commonly thought of as the Centrum precinct has been extended northwards beyond the municipal precinct, to the M17 (Argyle Road), to include the large parcels of state owned land and government functions. The precinct is bounded by the railway line to the west, Stalwart Simelene Road to the east, and Monty Naicker Road to the south.

ROLES:

STRATEGIC

The precinct includes the ICC, the municipal precinct and various other public administration functions, which define its current key strategic roles. In a future expanded Inner City, the Centrum and Gugu Dlamini Square would be the civic and symbolic centre of the City. The Umgeni Station, and the proposed IRPTN terminus on the northern edge of the park suggest a strategic transport role that can be strengthened.

ECONOMIC

Currently the primary economic role of the precinct is as the local and international convention hub, and the range of commercial and retail is also significant. The civic and public administration strategic roles are also integral to the economic roles. In the future, the re-configured KE Masinga/Braam Fischer Boulevard will unlock economic potential, as will the implementation of the IRPTN, and the re-development of the centrum site around Gugu Dlamini square.

SOCIAL

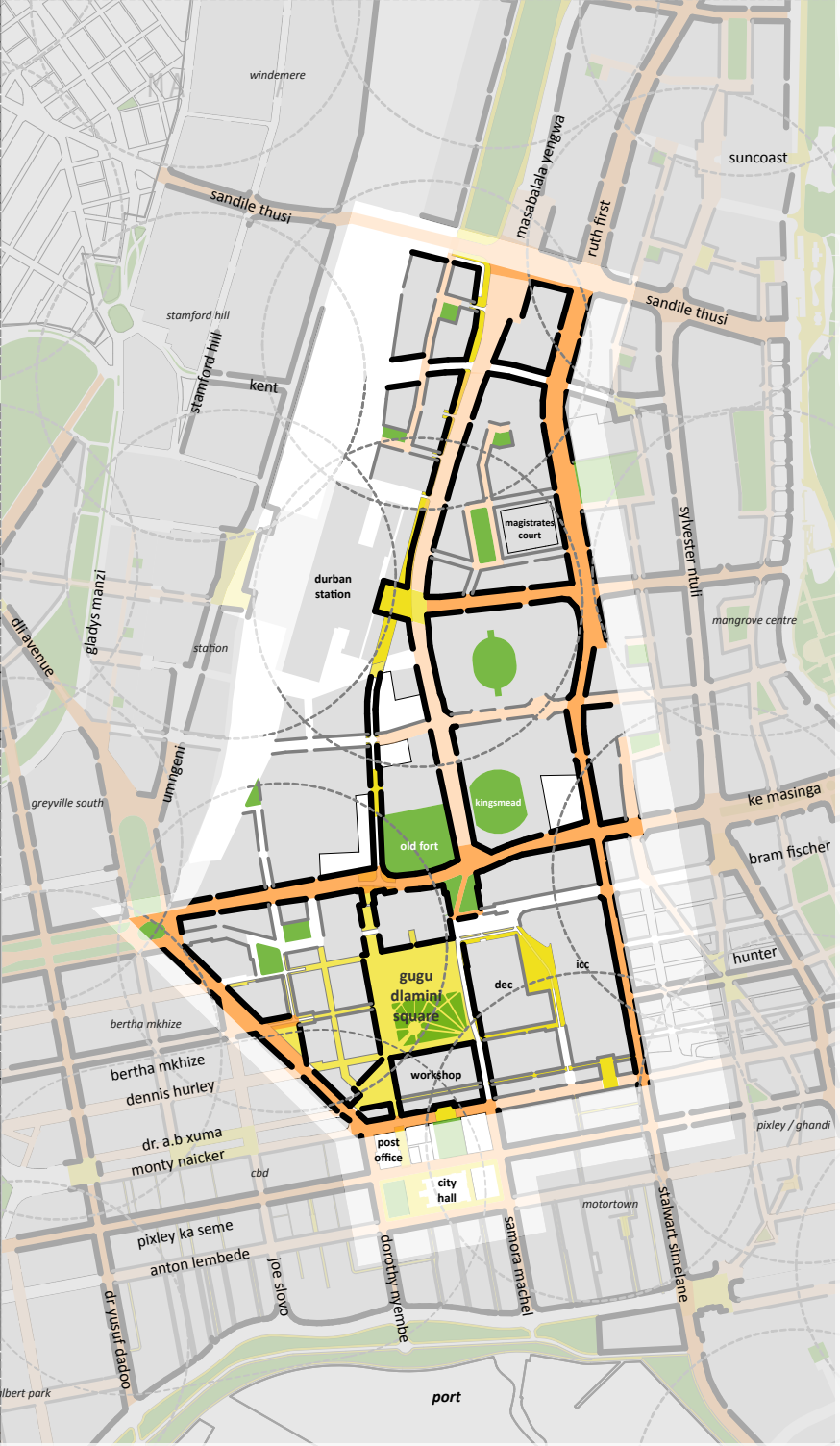
The current recreation and sports roles of Gugu Dlamini Park, and the cricket stadium are important. Old Fort Park has potential but is underutilized. In the future expanded city, the role of the precinct, and Gugu Dlamini square in particular, surrounded by significant metropolitan scale social facilities such as the proposed library, is as the symbolic centre of the City.

ECOLOGICAL

The precinct does not play a major ecological role, although reducing the amount of hardened space and increased landscaping would enhance the ecological role through increased storm water attenuation, and biodiversity, as well as reduced heat island effects.

KEY IDEAS

- Make a new pedestrianized north-south connection between the City Hall, through the centrum and the municipal precinct, to the Durban Station
- Re-configure KE Masinga and Braam Fischer roads as the main central city boulevard
- Re-configure the centrum site as the City's main public square surrounded by significant social and public facilities as per the Centrum urban design framework
- New connections over the railway lines
- Set up the reconfigured connection from the centrum all the way to Warwick along Bertha Mkhize Street
- Major public realm upgrading including the introduction of indigenous vegetation and micro-green spaces into the public realm.
- Implement the IRPTN proposals
- Release land for fine-grained, perimeter block, mixed use green/brown field/infill/ conversion development in support of creating high density, integrated walkable neighbourhoods.



The proposed public realm of The Centrum is anchored by,

Reconfigured **pedestrian prioritised streets** that accommodate a variety of transport modes

A **pedestrian only network** of squares and promenades that link the existing city spaces to the station and further north to the river

A **network of large and small parks**: some existing and some new. Larger parks in front of existing public buildings (Magistrates Court) and smaller local parks at the heart of future residential dominated districts

Development that defines the public realm: Buildings line the edges of the streets and spaces, defining the spaces between them, a clear edge between public and private space

Gugu Dlamini Square is the primary public space in the centre of the inner city

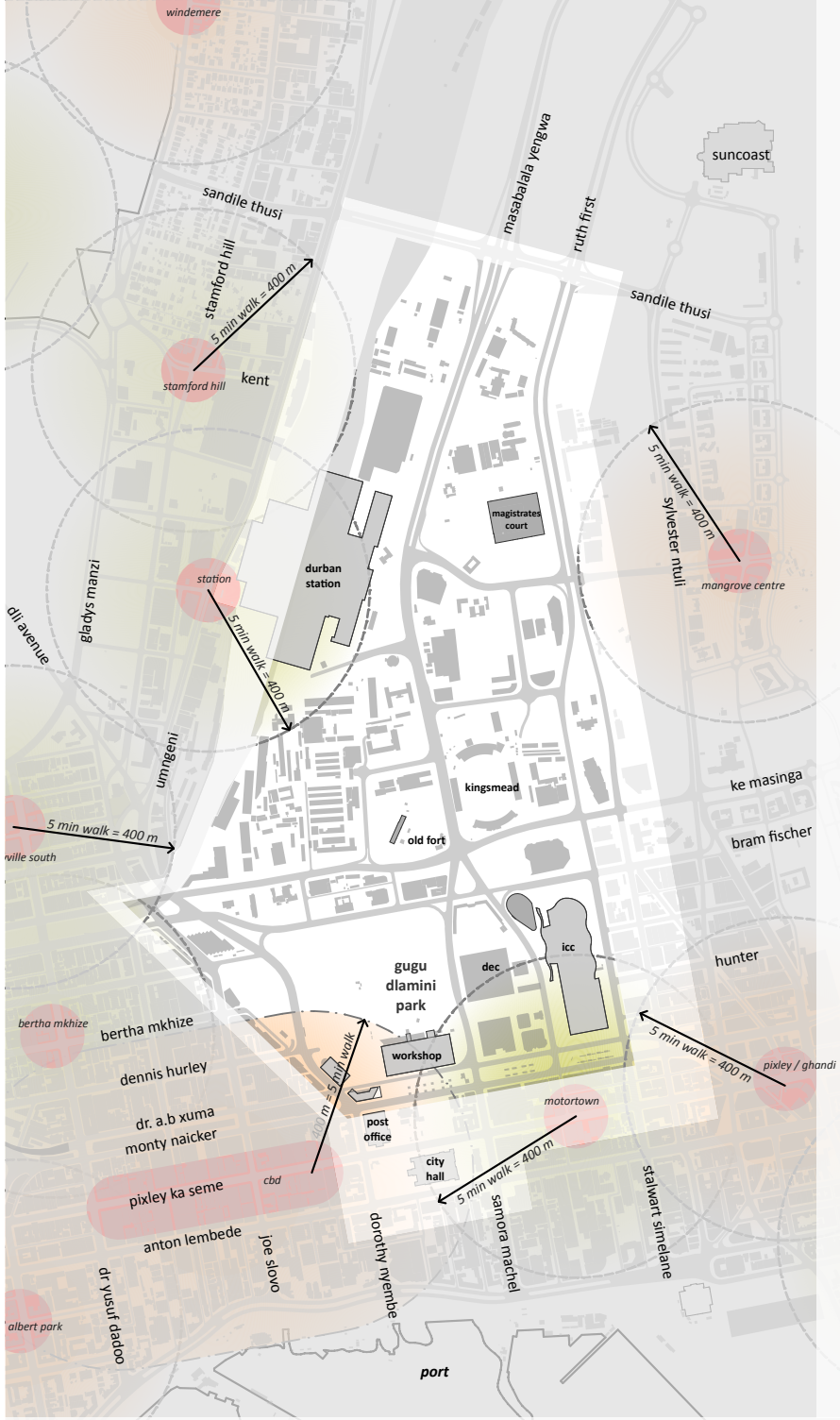
Lined by the redeveloped DEC, The workshop Retail Centre, new public buildings on the west and the IRPTN terminus development on the north

Pedestrian routes connect to the ICC, to the grid of existing streets and to the city hall

The pedestrian network is extend north to the station and beyond

north 0 100 200 300 400 800 1200 1600

Walkable Centrum:
The Completed Public Realm



The Centrum is an **island** of inaccessible , inward focused , large footprint developments: a direct result of the ordinance lands ceded to the municipality in the early 1900's.

the site is **surrounded** by a structure of accessible, walkable districts and neighbourhoods that are characterised by a **grid of interconnected streets and spaces** between buildings: a characteristic that **allows a multitude of movement choice** to local residents and visitors

land uses respond to this natural movement economy to make a walkable structure that chafes and develops over time

without a grid of connected sreets the Centrum is essentially a series of islands within a larger island: only accessible by car and disempowering for pedestrians

The Centrum has the potential to

- allow the city to **develop** to the north: **expanding the core** of the city so that it connects to the station
- be part of an expanded **walkable** structure of the city
- incorporate a mix and variety of **residential densities**
- extend the **variety** of urban experiences and places in the inner city centred around the existing government complexes
- make a **public realm** that is designed for pedestrians first: an inner city promenade that is part of a network of public spaces knitting together,

the existing city and development to the north of Sandile Thusi Road

the beach to the berea across the railway line and through the station

north 0 100 200 300 400 800 1200 1600

Walkable Centrum:
The Existing Walkable Structure

A network of **Reconfigured, Primary, Secondary, Local Streets and Pedestrian Prioritised Open Spaces** are proposed in the Local Area Plan. This network is shown in black in this plan overlaid on the existing network of streets.

This new grid of interconnected streets and spaces allows the extension of the existing walkable city structure to the north.

New local district centres are proposed

1

on the northern edge of Gugu Dlamini Square, providing amenity for an increased residential population on the larger blocks between Soldiers way and K.E. Masinga Streets, above the western end of the IRPTN Terminus, on the walk north towards the station

this local district centre has the potential to extend east along the northern edge of fugu dlamini square, opening onto the square, providing amenity throughout the day to commuters and visitors. an active 24/7 square in the heart of the city

2

on the redeveloped eastern side of the station complex, providing amenity to both the commuter and a new local residential population

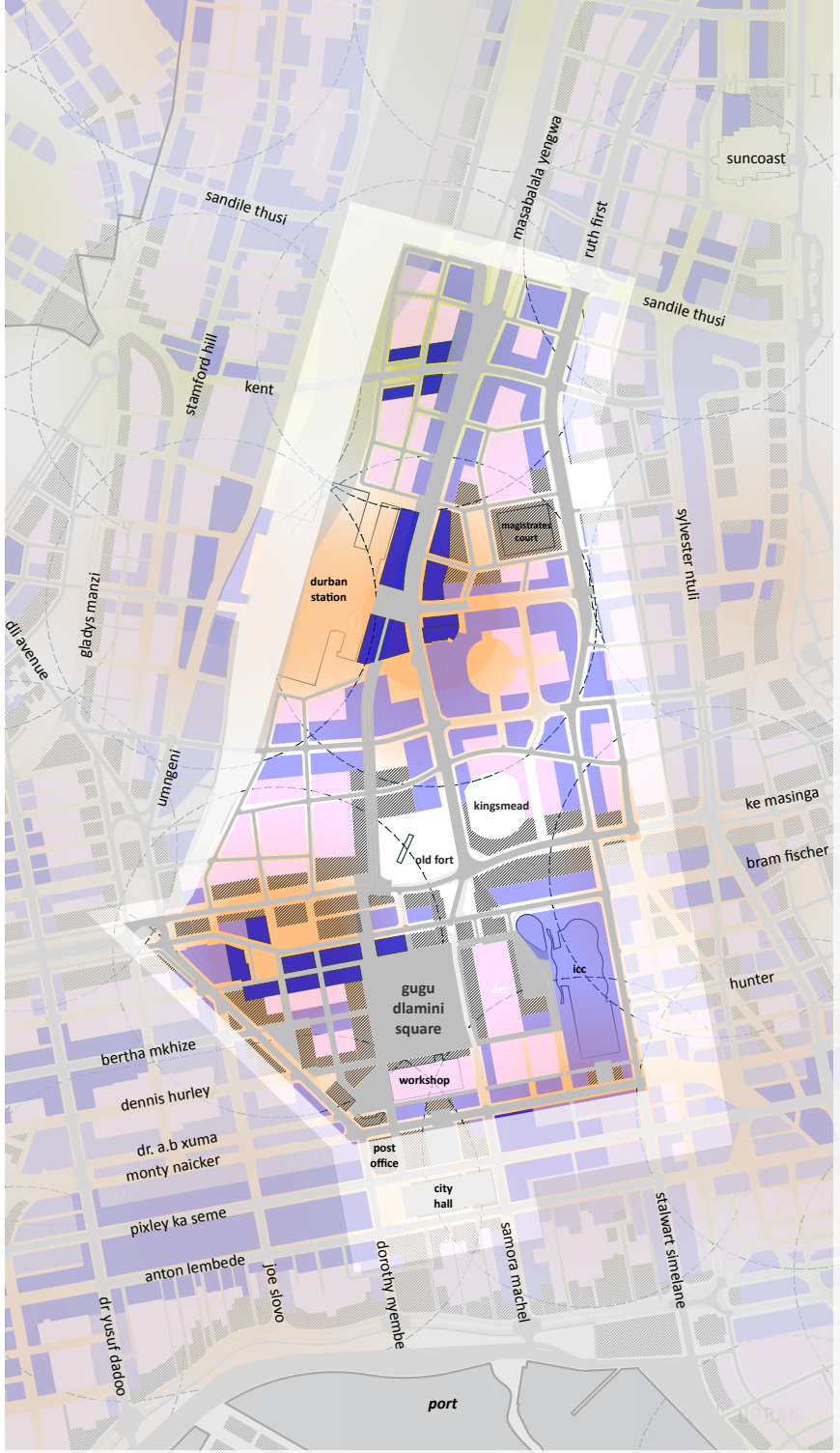
the development around the station should extend to the street edge and open out onto the street at ground level along pedestrian routes: an urban response is required to make this a successful environment

3

at the new connection across the railway line, kent road to masabalala yengwa, serving high density residential developments along masabalala yengwa north towards the station: a local focus to this district centre should extend to the main street and the primary pedestrian route to the north

6.27

Walkable Centrum:
New Local District Centres



Legend:

- **High Intensity**
- **Connecting**
- **High Value**
- **Infill**

Proposed future land use Intensities are defined by

- the potentials of the connected **grid of streets** and open spaces
- located in relation to proposed **local district** centres
- adjacent to the new **public open space** network of parks and squares

6.28

Centrum:
Future Land Use Intensity Plan

6.29

6.02 - *Durban's first form of public transport was a coach service between Durban and Pietermaritzburg. Durban Inner City, 1898. Source: Online, 2017.*

6.03 - *eThekwini Inner City 1823. Source: Urban Solutions.*

6.04 -*eThekwini Inner City 1845. Source: Urban Solutions.*

6.05 - *eThekwini Inner City 1898. Source: Urban Solutions.*

6.06 - *eThekwini Inner City 2016. Source: Urban Solutions.*

6.07 - *Illustration: Chart of Port Natal, showing marsh areas and the natural topography of Durban, 1823. Source: Online, 2017.*

6.08 - *Illustration: First sale of sugar in the Market Square, D'Urban, Port Natal. 1825. Source: Online, 2017.*

6.09 - *Illustration of the Old Durban Station and Post Office, located in the Inner City, Centrum. By Artist Nikhil Tricam, 2017*

6.10 - *Durban City Hall. Phtotgraphy by Frans Marx, 2017*

6.11 - *Southern Facade of theWorkshop Shopping centre located in the Inner City of Durban, Centrum. Source: Author, 2017*

6.12 - *Table of the 8 point plan for Durban's Urban regenerative programme. Source: LAP, 2016*

6.13 - *Wan Chai District, Hong Kong. Showing densities in Urban Hond Kong. Source: Archdaily, 2017*

6.14 - *Aerial plan view of a street in Pretoria, known as the jacaranda city. Source: About South Africa, 2017*

6.15 - *Aerial view of the NewYork Highline showing urban regenerative design. Source: Online, 2017.*

6.16 - *Warwick, Durban - Muthi Market - depicting informal trade in South Africa as one of the major economic drives for Durban. Source: Online, 2017.*

6.17 - *NewYork Highline showing elements of urban ecology. Source: Online, 2017.*

6.18 - *NewYork Highline showing elements of urban ecology. Source: Online, 2017.*

6. 19 - *The City of Durban meets the City of Port Elizabeth. Showing regional road connections. Source: About South Africa, 2017*

6.20 - *Russia, Moscow. Urban bus stops at night, Edited by Author. Source: 21depth, 2017.*

6.21 - *Urban Activations in walkable areas in NewYork City. Source: Archdaily: 2017*

6.22 - *Wan Chai District, Hong Kong. Showing densities in Urban Hond Kong. Source: Archdaily: 2017*

6. 23 - *Urban site plan of the Durban inner city. Author 2017*

6.24 - *Urban road connection plan of the Durban inner city, showing the site location - Centrum. Source: Author, 2017*

6.25 - *Centrum Road Connections. Source: Urban Solutions, 2016.*

6.26 - *Walkable Centrum, the completed public realm, proposal by Urban Solutions, 2016.*

6.27 - *The ExistingWalkable structure of the Centrum. Source: Urban Solutions, 2016.*

6.28 - *New Local District centres for Centrum. Source: Urban Solutions, 2016.*

6.33 - *Urban plan of the inner city of Durban with proposed Machinaria - Interchange. Author, 2017.*

7

Chapter 7 explores the South African railway stations of today. Concepts of spatial apartheid, spatial perception and spatial evolution are examined within the design, layout and current usage of the stations. The primary building of study is the ***Berea Station*** located in Warwick, Durban. The study is conducted by the Authors physical experience of each of the Stations.

Featured South African Stations:

Durban Station
Moses Mabida Station
Gautrain Park Station

CASE STUDY

of south african stations

7.01 *- Present day Warwick Junction - the African City within a post apartheid city. One of the most densely populated areas in the inner city, showcasing the vibrancy and culture of Durban. Photo: Author, 2017*

7.02

7.03

7.04

apartheid and

SPATIAL EVOLUTION

Although apartheid was abolished in the early 1990s, scars of deliberately planned and concretised social dysfunction through human oppression and segregation are difficult to overcome or heal. We see these social scars still visible today within our society. Our perception of space, economics and social interaction is disjointed as reminisce of spatial oppression. As South African architects and future developers of a once segregated city, the scars of oppression have to be nursed and healed over time through systems that promote social regeneration as well as learning from the past to form an efficient future for Durban.

7.05


25 INTERNATIONAL AWARDS ONE CHAMPION TASTE
Black Label
Enjoy Responsibly Not for Sale to Persons Under the Age of 18
M4 s
South Coast
Maydon Road
R102 s
Sydney Road
Williams Road
ICC
20 FEB
RTT
LOOK BEFORE YOU
CROSS

CASE STUDY:
BEREA STATION

warwick, durban

During the apartheid regime Warwick junction was a trading area that all races used. This was unique as the apartheid regime demanded segregation, especially through public transport facilities.

The Durban Council saw future plans for Durban being a city for whites, with non-whites entering the city through a control point along the periphery. In 1968 futuristic spatial planning frameworks for public transport routes and nodes through rail and bus stations reinforced and further entrenched the city into the racial segregation of Durban's public transport system (Rosenberg, 2013: 43). These transportation plans sought for the main mode of non-white transport be that of rail as many townships and industrial areas were planned along rail corridors, making them favourable for a successful rail transit network.

"The expected locational pattern of residential and industrial areas together with future road and rail links between them could well reduce the need for many non-Whites to enter or transverse the central area. At present, practically all major road, rail and bus lines between the northern, southern and western areas pass through, or near, the central area). Large scale development of shopping and other central area facilities in non-white townships, together with any official policies which would make it more difficult for non-whites to visit the City centre and its facilities would still further reduce the need." — Holdfords report (Rosenberg, 2013: 43).

The Berea Station, located in Warwick Junction was completed in 1980, it was envisioned to facilitate over 155 000 non-white labour force passengers of the inner city during the apartheid regime. The Durban Station, located in Umngeni was to facilitate the white population. Though the Berea Station was said to be a mixed race transport facility, platforms for whites only at one end of the building that linked to the inner city bus loop. This was meant to frustrate the linkage of the black labour force into the inner city. The Berea Station acted as a drawbridge between the 'White' Inner City and the mixed race Warwick Junction.

This is still apparent today. The displacement of races may be juxtaposed, with the majority of the white population migrating north and taking with them economic and retail value, the black populace moved into the inner city predominantly for work. The spatial evolution of a building born of oppression and segregation, the manifestation of dark, heavy and melancholy spaces can only grow into a maze of negative qualities and devalue. Today the Station is


7.07
BEREA STATION
SITE - MACHINARIA

rarely used for its prime purpose – a train station - as crime in this area have brewed and developed into fatalities over time. The heavy, harsh and brutalist concrete walls, the restriction of outdoor visibility and the only daylight lighting through high slivers of clerestorey windows make the station hunting grounds for criminals and gang members.

The taxi rank on the Brooke Street end of the building brings in hordes of commuters into the station, ironically, these commuters are too afraid to use the train station for its actual purpose. Trains in Durban, in general have had a harsh stigma develop over time. Reports of mugging, rape and even killings in train carriages, rail yards as well as stations, have grown over the years. Many commuters are choosing the only other available mode of public transport, the mini bus taxi, to commute from outer lying suburbs and settlements to Warwick and the inner city for work.

Architecture: brutalism lends itself as a powerful civic architectural aesthetic that doesn't indicate the grandeur of the old central Durban station but rather a dominance and oppression; holding a robust sense of materiality through various masonic finishes of concrete and face brick. There is also a lack of natural / well-lit spaces, making the interior very isolated from the surrounding area, creating a disconnect for the building users. The vertical in-situ concrete finishes throughout also tends to create a chiaroscuro that harshens the interior light quality.

Original function vs new function

Originally a public transport node to service the black labour force for the city without the freedom to proply access the city – this issue is present today. The Berea station now is predominantly a trading hub for small vendors and the *Camebridge Supermarket*. It is a thoroughfare for commuters using minibus taxi services found on the Brooke Street end of the site, going into Warwick or Central Town.

Urban connection

The station acts as the primary link to the CBD, at the edge of the city. There is a need for a public transport facility within the inner city – that penetrates the barrier created by the rail yards - to service the labour force but also to draw in consumers and reinstate the economic value of the inner city.

Transport architecture in Durban needs to be re-imagined. Robust, brutalist buildings that are poorly lit promote harsh environments that are inhumane and could result in under-utility and degradation of the urban fabric. There is a need for an architecture that promotes accessibility, democratic spaces, safety and serviceability to the inner city. It is envisioned that this type of human orientated transport architecture could revive the state of the inner city, create a pulse and breathe life into it once again.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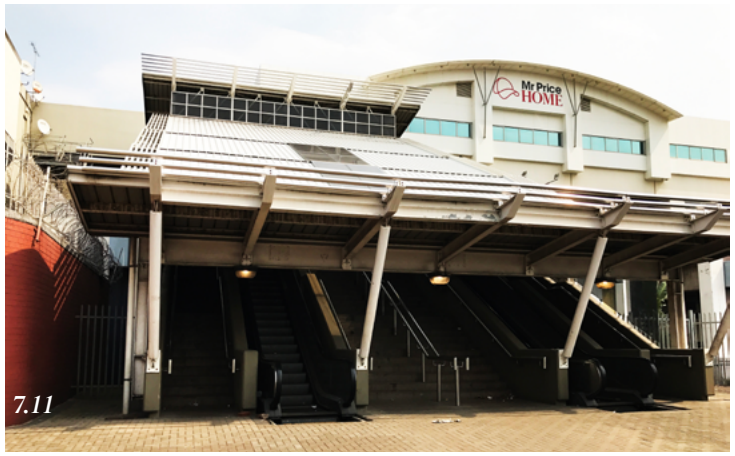

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DURBAN STATION

Designed by Stauch Vorster Architects and constructed in the late 1970s, the Durban Central Station once was a beacon and landmark for Durban. With its overpowering scale and robust brutalist architecture, the Station was built for control and exclusivity. Platforms dedicated to 'classes' rather than demographics were established. The Durban Central Station was meant to be the 'white' counterpoint facility to the multi-race Berea Station. Its presence, compared to the design of the Berea Station, was far grander, far larger, yet amenities were much more human related. The construction completion for both stations where roughly around the same timeline. After democracy, the Durban Central Station was underutilised due to most of the white populace leaving the inner city and migrating north. The Berea Station, however, went through a parallel transformation and evolved into one of the major routes into the inner city, at the time due to the high amounts of the black and Indian population occupying the inner city of Durban.

Human scale and proportion is ignored rendering the space inhumane and disproportionate. The Umngeni Road entrance of the Station has an entirely different atmosphere to the inside of the Station, with traders and consumers filling the space and providing vibrancy to the area - a complete juxtaposition to the NMR Road entrance. Today, the Durban Central Station sits more or less empty, unmaintained and has reinstated its title as the white elephant of the city.

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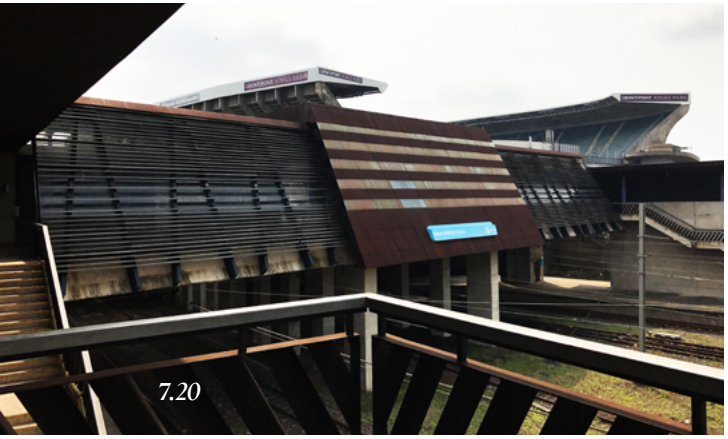
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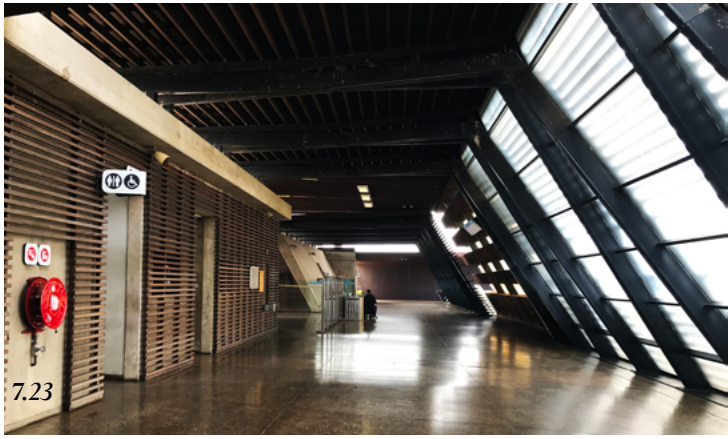
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MOSES MABHIDA STATION

The Moses Mabhida Station, located just under a kilometre to the Moses Mabhida Stadium, was designed by Arup Interchange Design and is meant to link the new King's Park sporting precinct and the Umngeni Rail corridor. Construction of the station was completed just before 2010 and its role was to serve as a transport hub for the spectators of the 2010 FIFA World Cup matches in Durban.

Arup's aim was to set a new standard for transport architecture in Durban as well as South Africa. A new form of transport architecture that engulfs Durban culture as well as creating a safe and 'light' architecture that is democratic and human in its approach – a design with dignity. Perhaps the architecture is reflected in the fact that the station usage fluctuates according to the events held at MM stadium, it is not an everyday architecture, in terms of the materiality and has somehow become an occasional aesthetic. Architecture should not just be for special occasions.

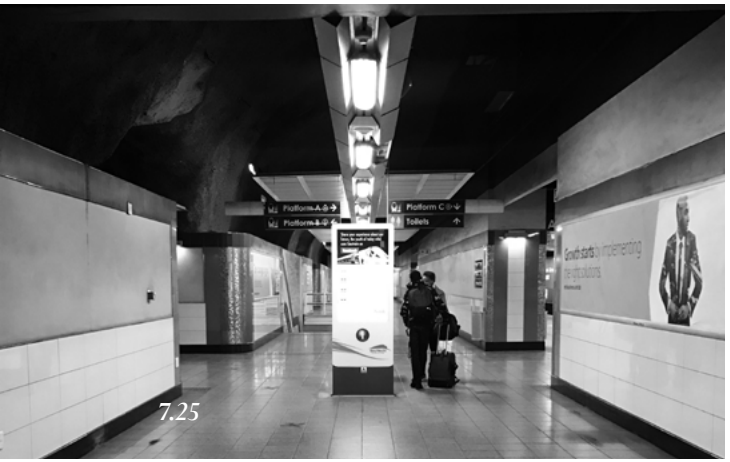
"South Africa's historically segregated planning policies have has long lasting impacts on the urban realm. In this context, the Interchange Design teams focus is to use public transport to stitch together the public realm, creating opportunities for urban and social regeneration."

The aims for *Machinaria*, as a public transport interchange in the inner city of Durban are very similar to that of the design of the Moses Mabhida station. However, the MMS is largely underutilised and has yet to help change the perception of public transport in Durban, especially that of rail commute. Although an attractive piece of architecture with a beautiful palette of raw materials (Wood, Corten Steel and Concrete), the station still seems to lack certain elements of African elegance and human amenities.

The fact that the commuter carriages themselves have yet to be properly maintained, with broken or missing windows and doors and a lack of security on the trains, both elements – stations and trains – need to be maintained and designed with dignity. The MMStation is a fine example of a need in shifting the paradigm in Durban's public transport realm.

It could be argued that it seems to be a minimal function building, with just the bare necessities to handle somewhat large crowds for short periods of time at intervals, as it has a fairly wide promenade outside to allow for temporal trade and possibly street markets en route to the stadium. The station does seem to respond solely to MMS and doesn't have a great link with the lower Berea.

7.24



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7.29

GAUTRAIN

park station

Park station is the most southern Gautrain station situated adjacent to Metrorail's Johannesburg Park Station in Braamfontein. This underground station is located diagonally beneath Smit and Wolmarans streets. Construction completion of the Gautrain stations recorded around mid 2011.

Gautrain is a private institute and so ticketing is above the general commute costing in South Africa. The business class in Johannesburg makes up a large part of the institutes clientele. Many of the working class cannot afford to travel on the Gautrain and so the stations as well as the institute have become an exclusive, classist system that the middleclass to wealthy utilise.

Apart from being exclusive, the stations harbour large, inhumane spaces with little or no amenities. The only services available to a commuter, whilst on a voyage are the tellers or the ablutions. The Gautrain system and stations, although efficient and well utilised, have imperialist qualities, lack human amenities and harbour inhumane spaces that do not promote social interaction.

7.30

7.02 - *The dark and dangerous platforms of the Berea Station. Poor light quality and little security. Photo: Author, 2017*

7.03 - *The Rail yards of the Berea Station was designed primarily as a barrier between Warwick and the Durban Central Business District. Photo: Author, 2017*

7.04 - *The pedestrian Bridge designed by Design Workshop, adjacent to the Berea Station, connects the Music Bridge and the Muthi Market in Warwick Junction. Photo: Author, 2017*

7.05 - *Commuters, traders and passers-by pause to watch a religious sermon or tradition music video on the concourse of the Station. Traders now occupy the Station, providing amenities for those passing by. Photo: Author, 2017*

7.06 - *South end of the Berea Station showing the rustic and robust concrete facade, giving the feeling of heaviness and isolation. Photo: Author, 2017*

7.07 - *Locational map of the Berea Station in relation to the dissertation site, Machinaria. Authors graphic, 2017*

7.10 - *The underutilised platforms of the Durban Central Station is well lit due to light wells that let in natural lighting. Photo: Author, 2017*

7.11 - *Entrance of the Durban Central Station with exposed and broken service motors of the escalators, unmaintained and very isolated. Photo: Author, 2017*

7.12 - *Entrance lobby of the Durban Central Station. As seen, vacant yet grand in scale and volume. Photo: Author, 2017*

7.13 - *One of the vast, underutilised concourses of the Durban Central Station. Little or no amenities and a low volume gives the space a sense of isolation. Photo: Author, 2017*

7.14 - *Platform level with metro train. Broken or missing doors and windows of the train make it unsafe for commuters to travel. Photo: Author, 2017*

7.15 - *Umngeni Road entrance of the Station has an entirely different atmosphere to the inside of the Station, with traders and consumers filling the space and providing vibrancy to the area. A complete juxtaposition to the NMR Road entrance. Photo: Author 2017*

7.16 - *Empty platforms for the Durban Central Station. Photo: Author, 2017*

7.17 - *NMR Avenue facade of the Durban Central Station. Brutalist, pre-cast concrete architecture. Photo: Author, 2017*

7.18 - *Northern facade and Entrance of the Moses Mabida Station. Photo: Author, 2017*

7.19 - *View of concourse 2, linking to the platforms, with the Kings Park Rugby Stadium and the Moses Mabida Stadium in the background. Photo: Author, 2017*

7.20 - *South facing facade of the Station. Materials used are Corten Steel, Concrete and Glass. Photo: Author 2017*

7.21 - *Concourse Stairs linking to the platform areas below. Photo: Author, 2017*

7.22 - *View of the platform area from concourse area. Light weight and open platform provides surveillance and safety for commuters. Photo: Author, 2017*

7.23 - *Open, Naturally lit concourse area of the Moses Mabida Station. Photo: Author, 2017*

7.24 - *Panoramic view of the south facing facade of the station, the Moses Mabida Stadium and the train platforms. Photo: Author, 2017*

7.25 - *Information boards on the platforms of the Gautrain Park Station, Johannesburg. Photo: Author. 2017*

7.26 - *The Gautrain, taken at the OR Tambo Station. Photo: Author, 2017*

7.27 - *Tall, fast escalators at the Gautrain Sandton Station. Photo: Author, 2017*

7.28 - *View of the open volume at terminating on ground floor, almost the height of a high-rise building, taken from the lowest floor of the station, gives an indication of the depth the rail lines go. Photo: Author, 2017*

7.29 - *Busy platforms of the Gautrain, Park Station. Photo: Author, 2017*

7.30 - *Entrance of the Gautrain, Park Station located in Braamfontein, Johannesburg. Photo: Author, 2017*

8

Chapter 8 is dedicated to conducting analysis of existing projects and interventions based on the theories and concepts examined in this document. The selected works are opted for in favour of their ability to incorporate these theories and concepts into their designs and are used as guides for the design of the Interchange (*Machinaria*). This chapter is comprised of four categories of precedent studies namely:

urban precedent which relates to the theory of urban ecology,
architectural ecology which deals with immersive, experiential space,
programmatic precedent which focuses on the layout and a
technical precedent which proves as a working example of bio-mechanical architecture.

PRECEDENT

exploring architecture

***3.1** – Rail tracks at night, seen as a negative barrier yet harbours a distinct ambiance.*

CURITIBA

Theoretical Precedent - *Urban Ecology*

Client

City of Curitiba

Project Location

Curitiba
Brazil
South America

Design Team

Jaime Lerner - Architect & Mayor

CURITIBA, Brazil

In 2010, Curitiba was presented the Global Sustainable City Award, which recognises cities that excel in sustainable development. Usually, it is much easier for developed cities to invest in sustainable planning measures to establish sustainable urban development and it was against the norms for a developing city in Brazil, with low income levels to achieve this. This is due to the planning systems implemented by Architect-Mayor, Jamie Lerner, for the BRT system in Curitiba.

Bus systems form a versatile and flexible mode of public transportation in terms of passenger count, access needs and unlimited destinations in and around the metropolitan areas. Although the flexibility benefits are greater than that of taxis and private means, conventional bus systems in congested urban streets is not feasible. Thus the aim of a Bus Rapid Transit (BRT) system is to improve the public transit operating speed as well as reliability on dedicated bus routes therefore eliminating any delays.

Curitiba has developed a successful model Bus Rapid Transit (BRT) system that plays a great role in making this a more liveable city. The city has the most heavily used yet affordable transit systems in the world. The buses run as frequently as every 90 seconds and the stations are convenient, attractive and comfortable to use. Many of these are traits of a subway system – vehicular movement uninterrupted by traffic signals and congestion, collections of fares prior to boarding and a quick flow of passenger loading and off -loading. This system has reduced the amount of air pollutants and has provided affordable transportation for seventy percent of commuters in Curitiba. This model would flourish in a city such as Durban. The social and economic implementations that Curitiba has overcome - the model that is designed in accordance to these issues may be adapted and applied to the fabric of Durban's urban and environments. Affordable transportation is one of the primary amenities citizens crave, as many urban employees live on the outskirts of the city and are required to commute to work and back home on a daily basis. An affordable, logical, safe and accessible multi-modal transport interchange will help commuters socially and economically.

The evolution of Curitiba's BRT system

In 1991, Curitiba's BRT stations were revamped with a futuristic glass tubular unit and soon became a new symbol of progress for the Brazilian city. A focal point for the city's bus network would be Rua Padre Anchieta, one of the hierarchical thoroughfares in Curitiba. Two tubular stations sit in the middle of the street (Figure 3.2), raised off the ground to line up with bus floor levels which make it more accessible for wheelchairs and is protected from natural elements and open onto the two-way bus express lanes. These lanes are reserved solely for long red buses that dash past congested motor traffic and efficiently shuttle passengers on and off the stations on outward folding ramps. These stations can be found throughout the city.

Contrary to the image of these stations that have become a distinct symbol for the city, these units were initially a cost-cutting measure for the city. The model was implemented as a faster and more efficient way to move people in and around the city through a mass transit system that was inexpensive. This revolutionised transport systems, not only for Curitiba but for many developing cities that could implement this model in their urban environments.

With a surge in population growth, initially city officials were planning to make the city more like Brasilia, the nation's capital. Roads and avenues were to be widened and the city center was meant to be adapted so that the car would be the primary mode of transportation in the city. However, these plans were discarded

3.3

when architect, Jamie Lerner became Curitiba's major in 1971. Lerner began work immediately on making Curitiba more liveable for its citizens through a bold and innovative model. He created a pedestrian mall in the city centre instead of widening roads. With a high water table similar to Durban, the city would flood so he dammed small streams and turned them into parks that became ponds during the wet seasons, instead of creating concrete drainage canals. Yet his most catalytic implementation was that of the city's new bus networking system.

Lerner saw the need for mass transit and paired it with the potential he saw in what was considered a dated mode of transport, the bus. The creation of a subway line would prove to be too expensive and out of the question of the city's economic standing. He created a system that gave buses the functional advantages of urban train systems. Dedicated bus lanes within the city's main arteries with stations placed at points of intersecting routes. This allowed buses to run at a similar speed to that of light rail yet at a lower cost. Lerner made a deal with private bus operators to fund the creation of the new infrastructure while they would provide the buses in exchange. With this deal in place, the first BRT lanes of Curitiba cost fifty times less than a rail system.

Initially, the first line that was opened in 1974 was not very successful but gradually became more popular with residences. Lerner created the Rede Integrada de Transporte (Integrated Transport Network) to manage the system more efficiently as new routes were added and Intelligent Transportation Systems (ITS) were soon incorporated. The BRT system began to show its full potential and by 1993, it managed to carry 1.5 million passengers daily. The creation of his tubular stations came about around this time in 1991 and today there are about three hundred and seven stations throughout the city. The city of Curitiba became the world's first system with the Bus Rapid Transit Network.

The success of BRT has spread as far as the United States, China and South Africa (Reed, 2015). Although this progression has been slower in Durban than other cities in South Africa such as Cape

3.4


3.5


Entrada
Sentido > Santa Cândida
BD106

3.6


CURITIBA

3.7


Entrada
Sentido > Terminal Centenário

3.8

"The BRT system and cycling can and should work together to provide better mobility options for the city."

- Alexandre Costa Nascimentio, editor of a Curitiba Cycling blog (Reed, 2015).

Town's MiCity BRT and Johannesburg's Rea Vaya. GoDurban is only yet to reveal itself to the public. Not to mention the short life span of the People Mover system. A confused bus system that brought many broken promises to the city, its failure has resulted in a continuation in the lack of sustainable public transport within the city. Without a home or even a system that is dedicated and serious towards public transit and urban accessibility, short lived solutions will be the fall of the city.

Yet, as the BRT became an international wonder, it started to face issues back in Curitiba. In 2012 it was reported that the BRT

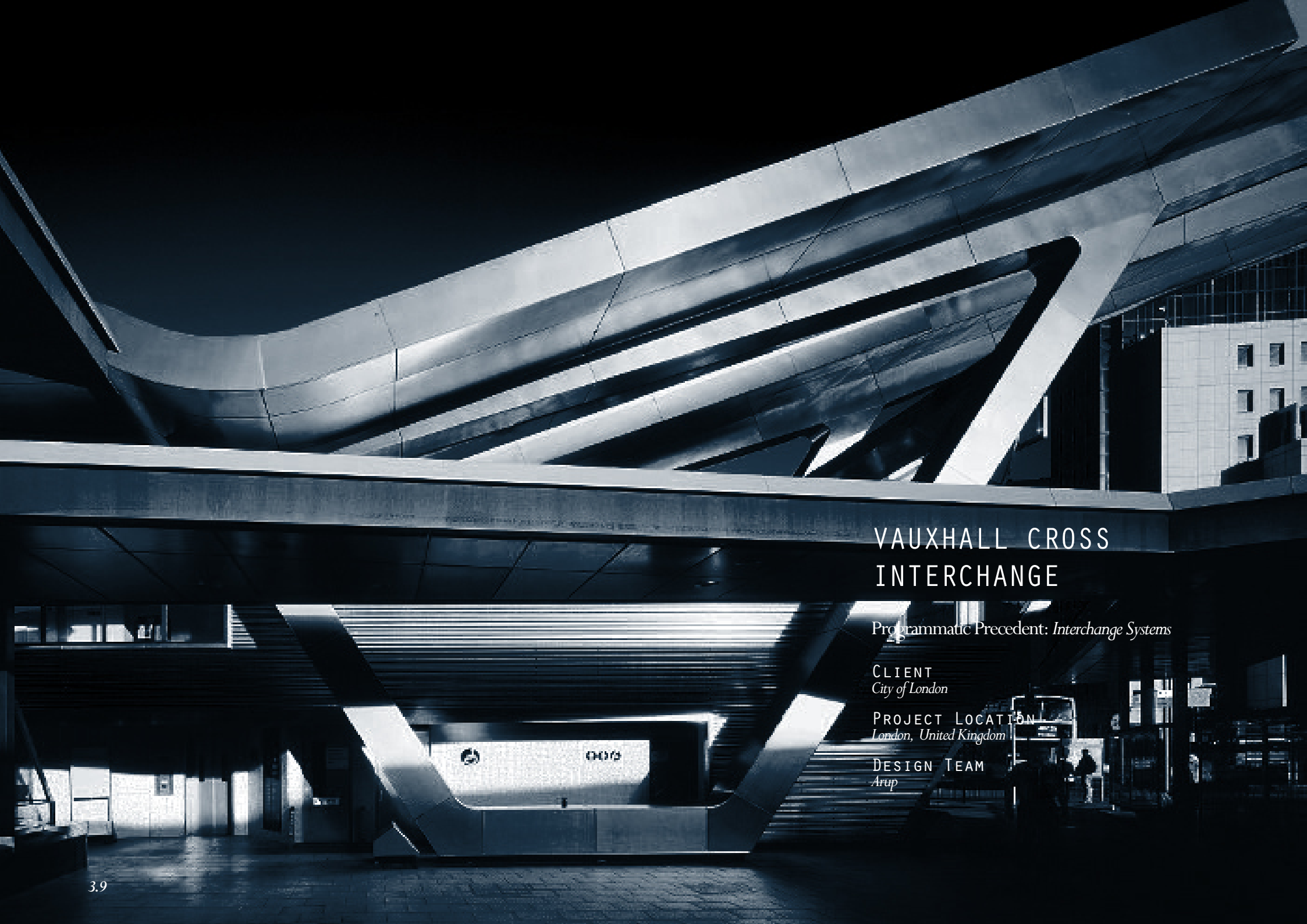
was declining in usage and the use of private transport methods climbed. The stations were reported to have done a poor job in protecting passengers from rain and extreme temperatures.

Curitiba's population, now swollen to 1.8 million, more than four times what it was when the BRT was first introduced. Despite the success of the BRT, mobility remains to be an issue and the city had made plans for the creation of a subway. With this spike in population and an increased need for urban accessibility, the city is forced to introduce the rail system in order to maintain a healthy connection with commuters and public transportation within the city, especially with outer lying areas and suburbia.

This has stemmed the rise on bicycle usage in the city as well and so the city is proposing a new bicycle master-plan. The bus system may be an asset to this plan.

Despite the issues that linger over the system, BRT has become a cultural touchstone for Curitiba. The city's cultural ministry has set up the Tuboteca, a book exchange program integrated in the bus stations and to add to the status of the tubular stations, as the city's symbol for sustainable progression, the airport gift shop is built as a replica of the BRT station (Reed, 2015).

Concepts of integrated urban systems ecology such as BRT and ITS were analysed and applied to the design and decision making process of Machinaria. Lessons on urban and universal accessibly, the need for inter-modality in transport systems as well as design for the public realm were understood and applied to the design.



VAUXHALL CROSS INTERCHANGE

Programmatic Precedent: *Interchange Systems*

Client
City of London

Project Location
London, United Kingdom

Design Team
Arup

VAUXHALL CROSS INTERCHANGE, London

Designed by Arup Associates, the Vauxhall Cross Bus Interchange is located just south of central London. Primarily a Bus Interchange, over fifty thousand commuters pass through the space on a daily basis, making use of about two thousand bus movements, the seven-hundred and thirty over-ground rail networks and seven-hundred and twelve tube trains that stop at the interchange everyday (). The interchange aimed to improve cyclist and pedestrian access in the area and direct access from bus interchange to the underground station removed street level pedestrian and vehicular conflicts. As a result, it has become London's second busiest bus interchange (Edwards, 2011). The interchange has become a well known urban landmark with its dynamic sculptural form. Portraying static motion with the image of a 'ribbon', the structure is clad in stainless steel with two dramatic elevating cantilevers on the southern end.

Form and Function

Passengers are protected from the elements with a linear twelve by twenty meter canopy. This sculptural canopy has become the emblem of the area and the project. The undulating canopy is eloquently lit and so, acts as the landmark or beacon for the facility. The troughs in the canopy marks the areas where seating is available and the crests indicate where the double-decker buses stop. To avoid obstructing movement and to prevent crannies for muggers, the canopy makes little contact with the ground. This also helps aid the elderly and disabled users with legibility. The structure of the canopy is made of two 'I' beams of repeating modules. Community consultation was an essential component for the design which highlighted the need for safely, shelter, retail and toilet facilities and an architectural figure that the community could be proud of. The result of these requirements was a fusion of engineering, architecture, public art and a sustainable transport interchange that helping regenerate this area in London.

The site, an island between two wide and busy roads was a concerning factor for the scale of the road provision around the site and the design for pedestrian friendly interchange. Despite these concerns, the Vauxhall Bus station has increased in usage by forty percent since the opening of the interchange in 2005, reflecting the importance of public transport interconnectivity for a better quality of urban life. The design was done under the watchful eye of the community of the area and crime prevention experts who requested open visibility for surveillance by transport staff, night time lighting and good levels of transparency (Edwards, 2011). With the growing success and positive impact of the Vauxhall Cross Interchange, adjacent areas are being upgraded faster and improving other transport facilities in the area is being proposed.

Sustainability and the Interchange

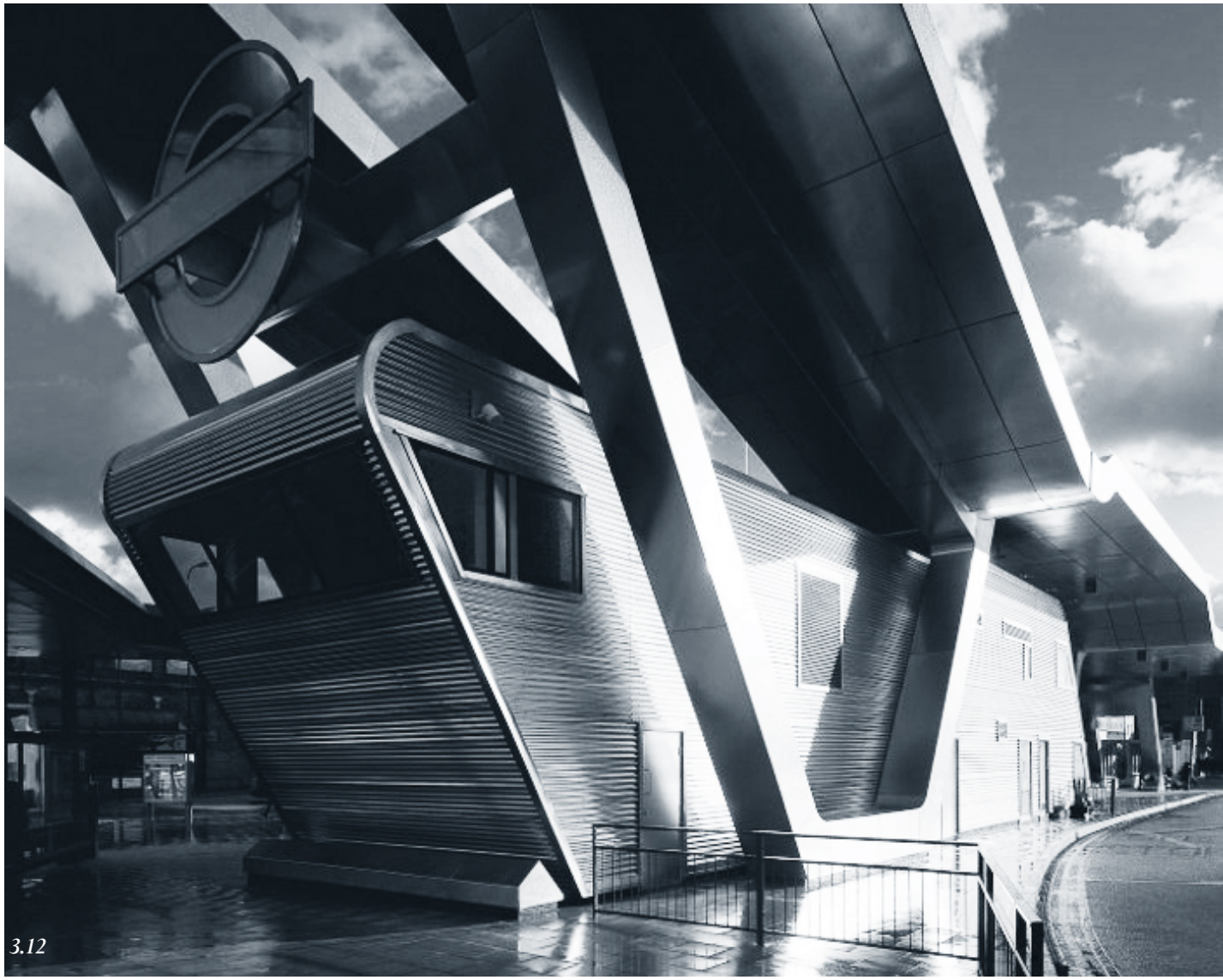
Although the sustainable contributions aren't overwhelming, it is a good example of how sustainability and the design of transport interchanges can fuse for a more successful ecologically inclined built form. A high-efficiency, state of the art photovoltaic system, comprised of one-hundred and sixty eight technologically

3.10

3.11

advanced cells, has been incorporated into the design of the two soaring split cantilevers to the south end of the building. This provides the interchange with a significant portion of its electrical needs (). A digital display keeps commuters updated with the interchange's efficiency, the amount of solar energy being used and the amount of carbon is being offset.

The overall scale of the building, sustainability component, linearity of the site and the systems design are analysed in this precedent.Vauxhall Cross's dramatic and dynamic sculptural form is also an important design factor for rejuvenation in the urban landscape of Durban inner city and is applied to the design of the Interchange (Machinaria).



3.12

DA'AN PARK STATION

Conceptual Precedent - Ecological Architecture

Client
City of Taipei

Project Location
Taipei City, Taiwan

Design Team
Che Fu Chang Architects

DAAN PARK STATION, Taipei

With a metro system that has been running for about twenty years in Taipei's capital city, the former station design was just like another matchbox station that would appear in any city, with little or no interaction to its immediate environment. This soon changes after the installation of a new, ambitious line was proposed to the city. The unique site of the proposed station is part of the city's largest green space, the Daan Forest Park, a great opportunity to establish a new form of Metro Interchange design.

The design of the interchange blurs the barrier between built-form and park, incorporating the Daan Forest Park into the overall scheme of the interchange and it has a direct and mutual relationship with the green space. The aim of the proposal is to transform the Metro from the mundane transport services into a dynamic city hub that connects man and nature in an environment that stimulates porosity. The method of embedding the station into the park has created a lively environment in the green space which used to be a low-active area. The station benefits from the park by having a more harmonious linkage to nature and the park is more active, leading commuters to varied destinations in the area.

Landscape and built-form merge to create a harmonious connection between man, nature and architecture. The double storey building harbours an island platform underground and has a naturally lit hall by means of two light towers and a light hallway that doubles up as the entrances to the station. The station also has an underground parking lot for commuters. An open, sunken semi circular atrium steps down to the platform and extends the landscape underground. This opens up the underground metro, bringing through sunlight and fresh air to the commuters waiting for their train. The surrounding forest absorbs noise made by the trains as well as creating a calm ambiance for commuters. Travelers are naturally drawn to their biological instinct - to the sunlight, sounds of nature and the pleasant breeze from the park. This seamless transition between inside and outside brings in the many benefits of incorporating nature and architecture, creating a pleasant experience for the traveler along their journey or destination.

Ecology refers to the environmental systems in a space but it also refers to the spatial relationships between buildings and their adjacencies and the social relationships that result from those.

Ecology speaks about the natural systems that are created between

3.14

3.15

3.16

3.17

the users of a space and the animate and inanimate components that form and populate that space. The objective is to redefine the urban ecosystem by re-imagining the relationship between the users and the urban spaces in which they exist.

Principals of ecological design and spatial experiences through a biologically inclined environment, the seamless transition between inside and outside and man and nature are applied to the design of the Interchange (Machinaria).

3.18

ECO-MACHINE & LIVING MACHINE

Technical Precedent - Ecological Machines

Design Team

John Todd Ecological Design & Living Machine®

"The solutions for the future are going to depend on us becoming attuned to the natural world when we shed our hubris and become integral with the larger ecological forces that sustain us. Our only hope for a transition to a stable future is one in which we embrace the best of indigenous wisdoms around the world with the legacy of a modern biology and ecology, the two together should provide the template for the future of humankind."

John Todd - John Todd Ecological Design

The Living and Eco-Machine are new age solutions to waste water treatment which use natural ecosystems to clean polluted water. This system consists of multiple ecologies that work congruently to break down water contaminants and is able to convert sewage sludge and storm water into fresh water. The part natural and part man-made design establishes ecosystems between microbial species and plants as distinct treatment zones (Chen, 2008). Specific plant and fish life are used to consume different impurities found in polluted water whist producing beneficial nutrients back into the water and oxygen, into the air.

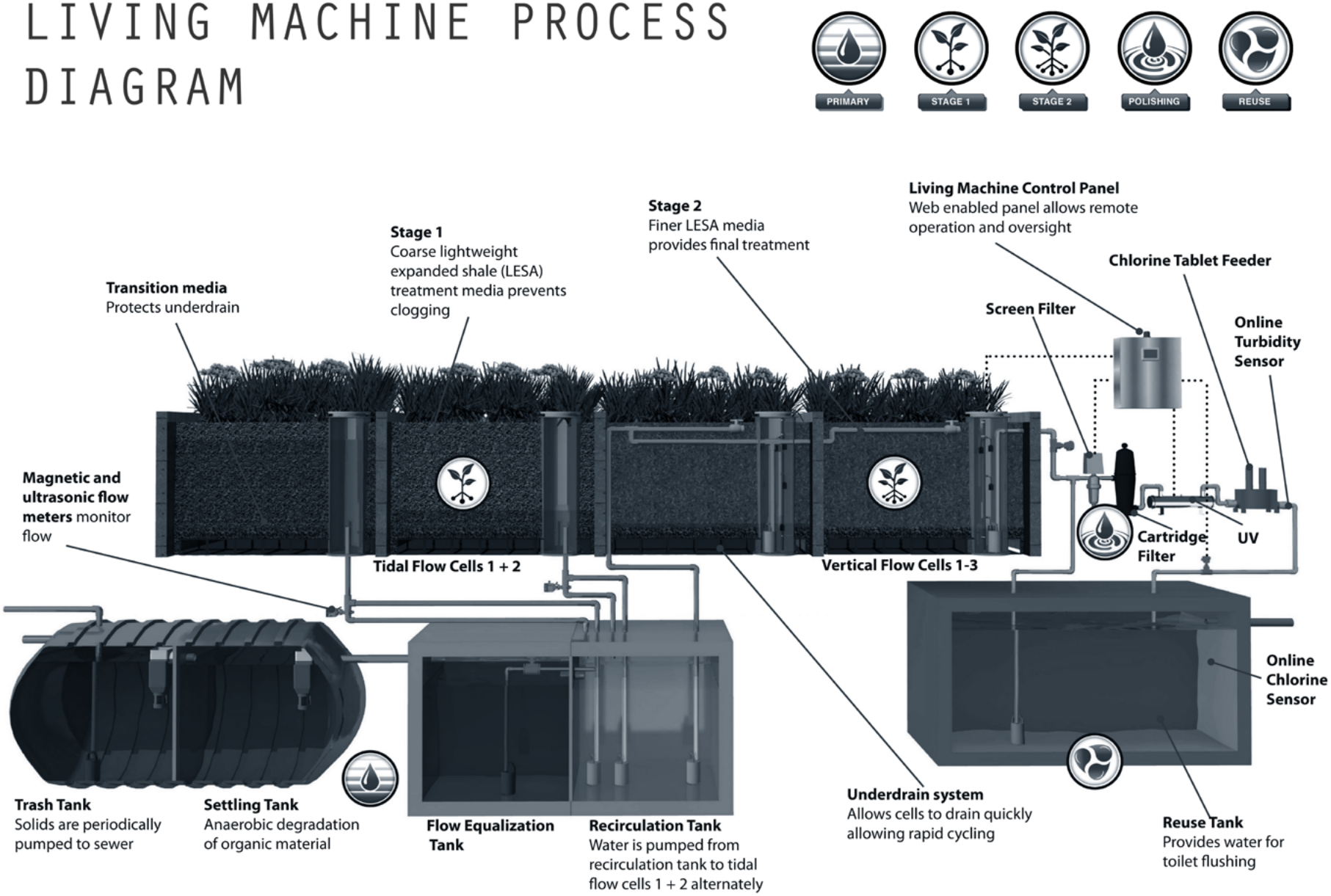
One of the many projects completed by John Todd: *High Altitude Constructed Wetland in Colorado* recognised the concept of using constructed wetlands to treat waste water. Wetlands have evolved through centuries to purify contaminated water and produce a high water quality. Harnessing the complex ecologies found in wetlands and such natural systems and constructing wetlands in urban environments help purify storm water and waste water. Todd has done numerous Eco-Machines and Living-Machines around the world, from designing ecological systems for poultry companies dumping waste into rivers, to Eco-Machines that decontaminate and purify urban waste (Todd, 2002).

The Bulrush is one example of plant life found in these natural systems has the ability to consume impurities such as petroleum, a very useful and resilient biology that will help purify waste water in the urban environment (Todd, 2002). Plants consume carbon-dioxide, which eighty-five percent is produced from urban transportation (Edwards, 2012) as well as human and fauna respiration, and so, the introduction of natural wetlands into the urban fabric will help reduce the carbon density within the city, creating a cleaner, more beautiful natural environment for human enlightenment.

The marriage of man-made construction and natural systems is proof that the future of sustainable design lies in the construction of living machines. Constructed wetlands are now common in the United States with various sites to treat municipal waste water and sewage, airport run-off, urban storm water run-off (Todd, 2002).

Living Machine® is a bio-mechanical water treatment company from Charlottesville, USA that uses ecological systems and modern technology to treat waste water in schools and urban municipalities all around the United States.

LIVING MACHINE PROCESS DIAGRAM



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"Living Machine® Technology blends cutting-edge science and engineering with plants and beneficial bacteria to efficiently treat and reuse wastewater, providing lasting water solutions for communities everywhere. Based on the principles of wetland ecology, our patented tidal process cleans water, making the Living Machine® the most energy-efficient system to meet high quality reuse standards. The Hydroponic Living Machine has withstood the test of time, with systems remaining in operation for close to two decades."

- *Living Machine® (2012)*

Concepts of Bio-Mechanism, constructed ecological wetlands to purify waste water within the urban fabric, beautifying the city through ecological transformation and creating ecosystems that work through symbiosis to achieve a harmonious ecological urban system, are applied to the design of the Interchange (Machinaria).

3.22

Figures - Curitiba

8.2 - Urban Curitiba - image depicting the natural systems integrated into the landscape of the city to facilitate issues of flooding whilst beautifying the city and creating green relief spaces for public interaction.

8.3 - Interior view of the tubular bus stop designed by Jaime Lerner

8.4 - BRT system with dedicated feeder bus lanes and tubular bus stops.

8.5 - Ticketing systems similar to that of train systems.Transaction of tickets are done prior to boarding the bus, allowing a smoother transition flow between commuter and bus.

8.6 - Image of Curitba's BRT system, tubular bus stops and public spaces designed by Architect and Mayor Jaime Lerner.

8.7 - Bus Station act as docking stations for bicycles, promoting inter-modality

8.8 - Tubular Bus stations

Figures - Vauxhall Cross Interchange

8.9- The dramatic and sculptural form of the interchange gives it a unique identity and is a landmark to the community.

8.10- Image depicting the vibrancy of a once derelict and crime ridden area, now lively and busy at all times due to the introduction of the interchange.

8.11 - Sculptural form of the Vauxhall Cross Interchange was designed pragmatically, indicating stops for double decker buses and regular buses.

8.12 - Stainless steel is the primary material of the interchange, showing traits of dynamism and futurism.

Figures - Da'an Park Station

8.13 - Aerial View of the Daan Park Station showing integration between built form and surrounding natural system within the urban fabric of Taipei.

8.14 - Off-street entrance to the station with glass curtain wall allows air to flow through the space.

8.15 - Aerial view of the station.

8.16 - Platform waiting area is naturally lit, spacious and open to double volume.

8.17 - Evening shot of the station from park area.

8.18 - Platform level incorporates a featured fountain and pond with open atrium to allow air flow and integrate the park into built-form.

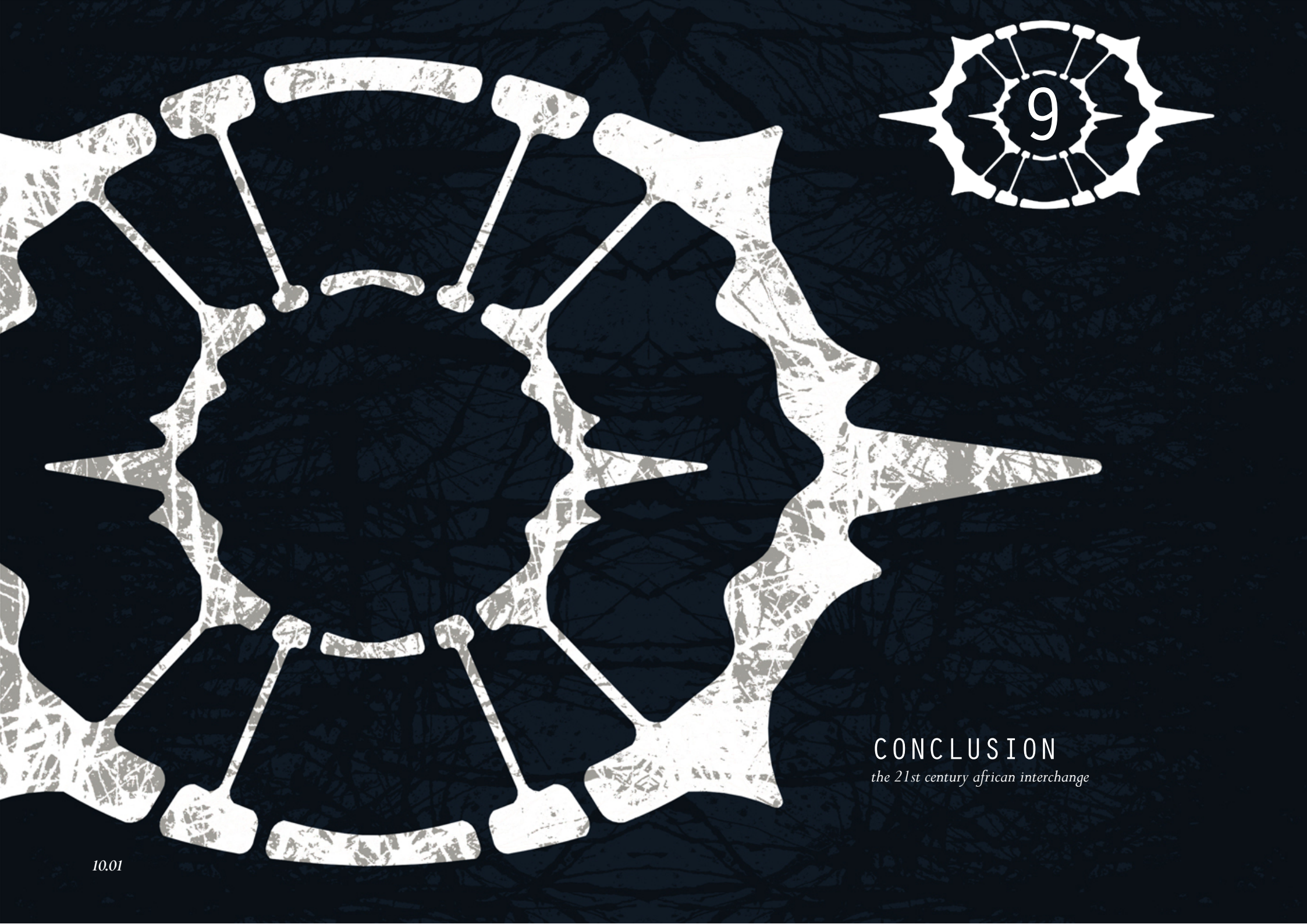
Figures: Eco and Living Machine

8.19 - Bio-Mechanical waste water treatment designed by Living Machine® incorporates hydroponics to purify water.

8.20 - The Living Machine® process diagram indicates the process of polluted water filtering through the Living Machine.

8.21 - Bio-Mechanical system designed by John Todd Ecological Design to purify river water that has been polluted by a poultry farm.

8.22 - "The Living Machine" a design by John Todd Ecological Design (JTED) - a waste water purification system that uses bio-mechanical techniques to decontaminate water.



9

CONCLUSION

the 21st century african interchange

10.01

machinaria

DECELERATION

"…The 21st century is an extraordinary time - a century of extremes. We can create much grander civilizations or we could trigger a new Dark Age. There are numerous ways in which we can steer future events so as to avoid the catastrophes that lurk in our path and to create opportunities for a better world. A revolutionary transition is ahead of us… this could be humanity's last century in which civilization sets sail towards a far more spectacular future."

James Martin - the meaning of the 21st century, 2006.

The 21st century is era of endless opportunity and possibilities. With advances in technology, scientific and medical research, almost nothing is impossible. It is also the era of exponential population growth and with that, the exponential consumption in resources and ensuing waste. In an attempt to alter these global climate and cultural depletions, the way in which we design buildings also needs to be re-scripted.

Machinaria finds value in the lost, disjointed Durban Inner City, and proves that the urban wastelands which are hidden within our cities may be rewoven as part of a dynamic urban fabric. Creating architecture as living machines, natural and social environments become an inherent part of interchange and public space, and the machines for living which define an industrial past, may be re-scripted as biological mechanisms for the future.

Machinaria establishes a precedent for 21st century transport architecture in an African context, and proves that this new typology has the potential to reconnect - to the mis-conceived ritual of transportation, to the lost voices of the urban landscape, to the search for a new urban identity in a post-apartheid African city, and to the natural ecologies which are present, just beyond the reach of present-day human habitats.

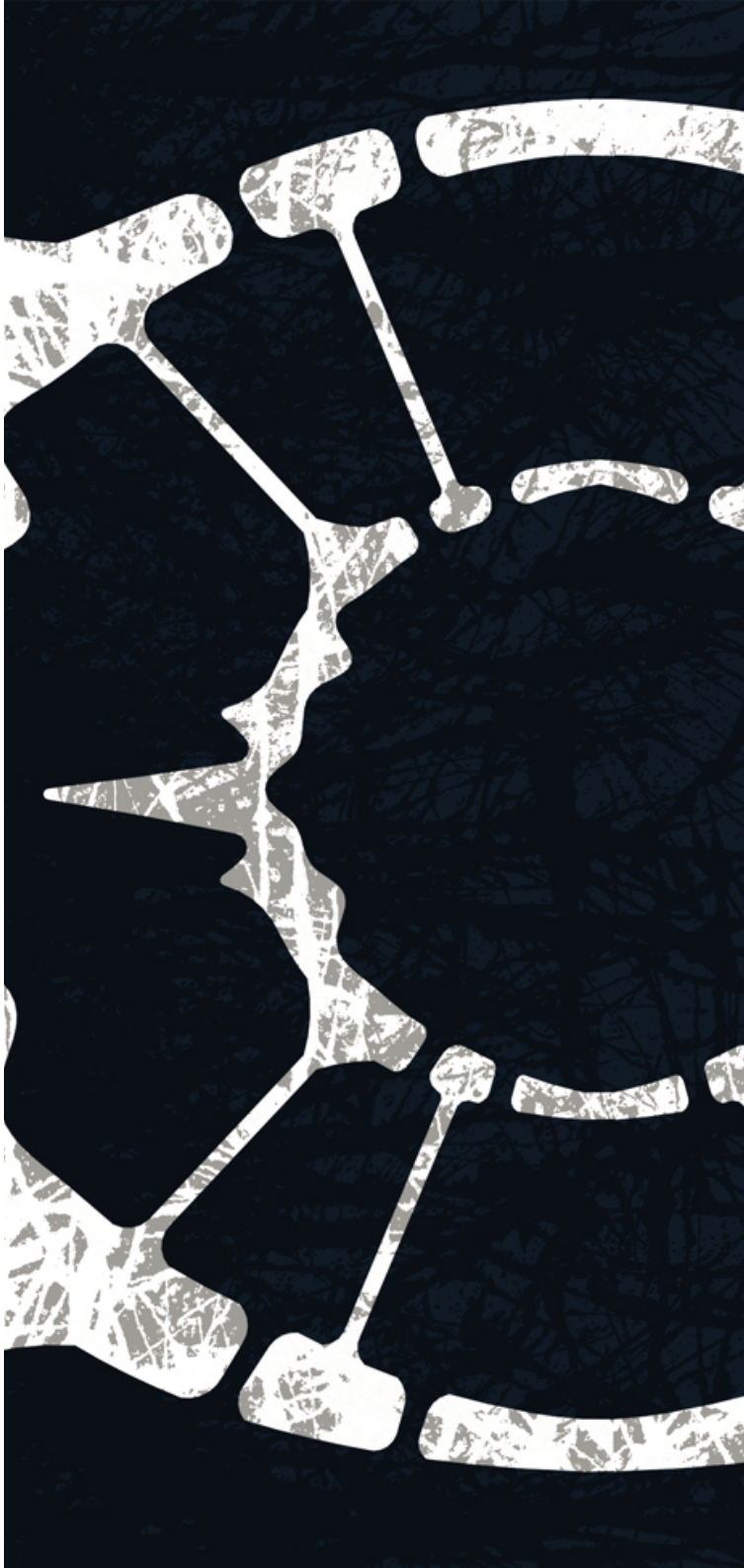
One of the most pressing concerns we face today, is how the industrial forces which made the 21st century possible – both in technological advancements

as well as ecological crisis – will sit within the systemic, hybrid world, emerging before us (Frenay, 2006: 37). Nothing comes without a price and so, a system where waste and by-production is almost eliminated needs to be established. Another issue is the state of our Inner City, Durban. Undervalued and underutilised, after the apartheid era, the city has lost its identity and so, its heart. African vernacular architecture holds a close and sacred relationship with ecology. This is the missing link to creating an African architecture that reinstates the identity of Durban being and African city as well as the link between the built environment, nature, resilience, technology and sustainability – a bio-mechanical architecture.

In an age of exponential population growth, resource - and spatial consumption, and consequent waste, the path to a resilient future is not clear yet. As architecture enters a new age of discovery, the potential for projects like Machinaria exists everywhere: wastelands and industry are strewn across our cities, hidden just beyond view, and offer unexplored landscapes for architectural experimentation. As we enter uncharted territories and face new global challenges, architects are given the opportunity to participate in the construction of a new world order. The way in which we make space today, will determine the way in which we live tomorrow. The future is in our hands.

Machinaria will explore the nature of bio-mechanics and apply those principles found in nature as well as mechanics, to form a new architectural typology for the future of Durban – promoting Durban's once ecological topography as well as linking architecture back to the roots of African elements in design. A responsive architecture that is resilient to social as well as natural cataclysms that we face today and anticipate for the future.

Transport Architecture will be re-imagined as a 21st century African hybrid of both mechanical and natural systems: *Machinaria* – architecture as a living machine.



M A C H I N A R I A

N A D I Y A H M O O D L E Y

F I N A L D E S I G N A N D D I S S E R T A T I O N , U K Z N 2 0 1 7

MACHINARIA IS THE THEORETICAL EXPLORATION OF TRANSPORT ARCHITECTURE ACTING AS A LIVING MACHINE (THE MISSING LINK BETWEEN TRANSPORTATION AND SUSTAINABLE CITY FORMS), UNDER THE OVERALL CONCEPT THAT ARCHITECTURE MAY HAVE ON THE DEVELOPMENTAL, SOCIAL AND ECONOMIC STATUS OF A CITY - ESPECIALLY AN AFRICAN CITY IN THE 21ST CENTURY.

- INVESTIGATING TRANSPORT ARCHITECTURE AS A KEY DRIVER FOR DURBAN PROGRESSING AS AN ECOLOGICAL CITY.

Towards the design of an inter-modal transport network node

transport architecture
ecology

symbiosis
bio-mechanics

living machine
human space

ARCHITECTURE AS THE LIVING MACHINE:

embracing the technological age to create a responsive architecture (climate, pollution, light and air) through bio-mechanical systems. An existential architecture in the image of Man

URBAN MACHINE:

an architecture that promotes urban systems. architecture as a public domain that connects, filters and responds to the urban condition

BIO-MECHANICS

Mechanical systems promote movement - **movement** turns to **progress** - the **human skelleton** is fine example of Bio-Mechanics

PROBLEM STATEMENT

21st Century Durban - the city is **undervalued**, **inaccessible** and **underutilised** due to the repercussions of **spatial apartheid.** the city's identity is lost and her heart, displaced.

21st Century Earth - **climate change** threatening our environments, with technological advances, architecture is viewed as a **mechanical tool** for human and environmental **survival**

WHO

Humans in Transit

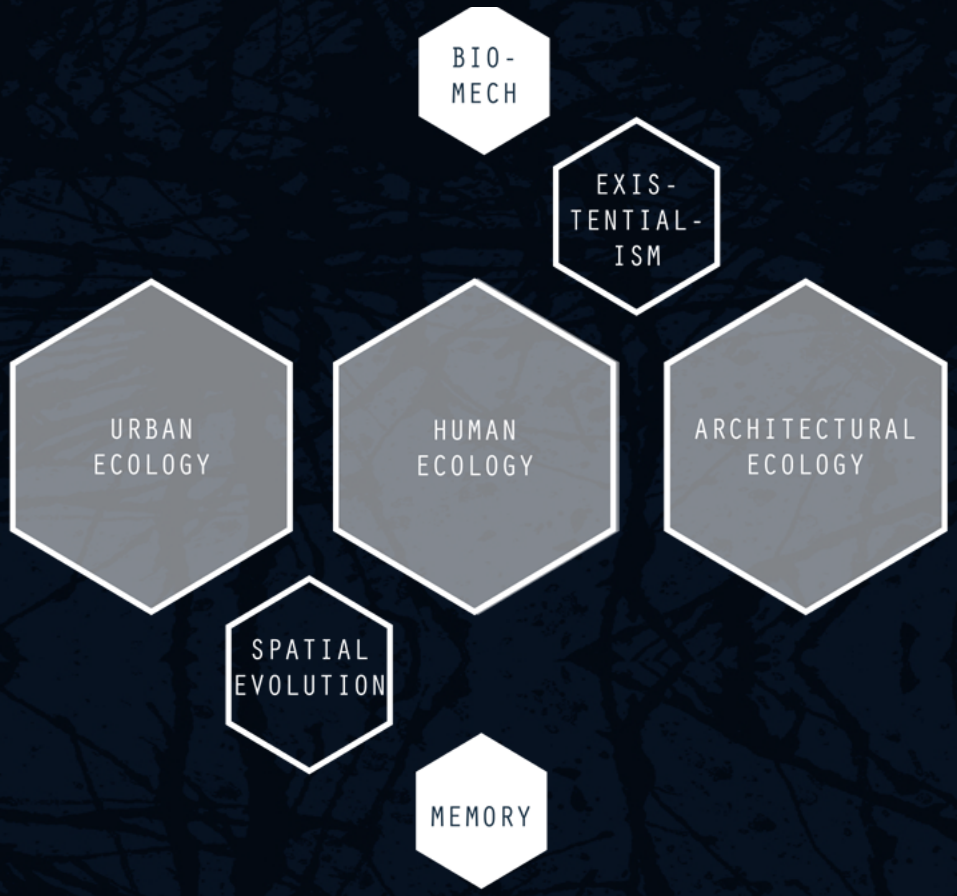
FUTURE - development users due to increase in density and amenities in the city - Humanising labour force experience.

WHAT

Inter-Modal transport interchange. bus, train, non motorised transport

WHY

Urban accessibility
Need for density and efficient public transport systems within the inner city. Need for a democratic city layout and amenities for all. Need for sustainable, ecological, responsive architectural systems.



AIM

by **2040** the eThekwini Municipality will enjoy the reputation of being **Africa's most livable city**, where all citizens live in harmony. this vision will be **achieved** by growing its economy and **meeting people's needs** so that all citizens enjoy a **high quality of life** with **equal opportunities**, in a city that they are truly proud of.

eThekwini Vision 2014

CURITIBA -BRAZIL

urban ecology, systems ecology, spatial form

VAUXHALL CROSS INTERCHANGE -UK

spatial relationships, linear form and site planning, iconic form

DA'AN PARK TAIPEI INTERCHANGE -TAIWAN

architectural ecology, iconic form, relationship to nature

THE LIVING MACHINE

enhancing architectural design and detailing through the ecological mechanics fond in nature - filtration, purification and sustainability

BRIEF

CLIENTS

PHYSICAL FEATURES

light and organic - mechanical form. portal frame structure with light skin

ZONING

civic - transport - service to the public

TYPOLOGY

inter-modal transport interchange

TRAIN - BUS - TAXI

ACCOMMODATION

Common Area: Ground floor

Central Information Centre
Waiting Areas
Ablutions
Ticketing Offices

Bus Component

BRT - Go Durban
People Mover
Ticketing Kiosk
BRT Management Offices
Rest rooms for drivers
Security Offices

Bicycle facilities

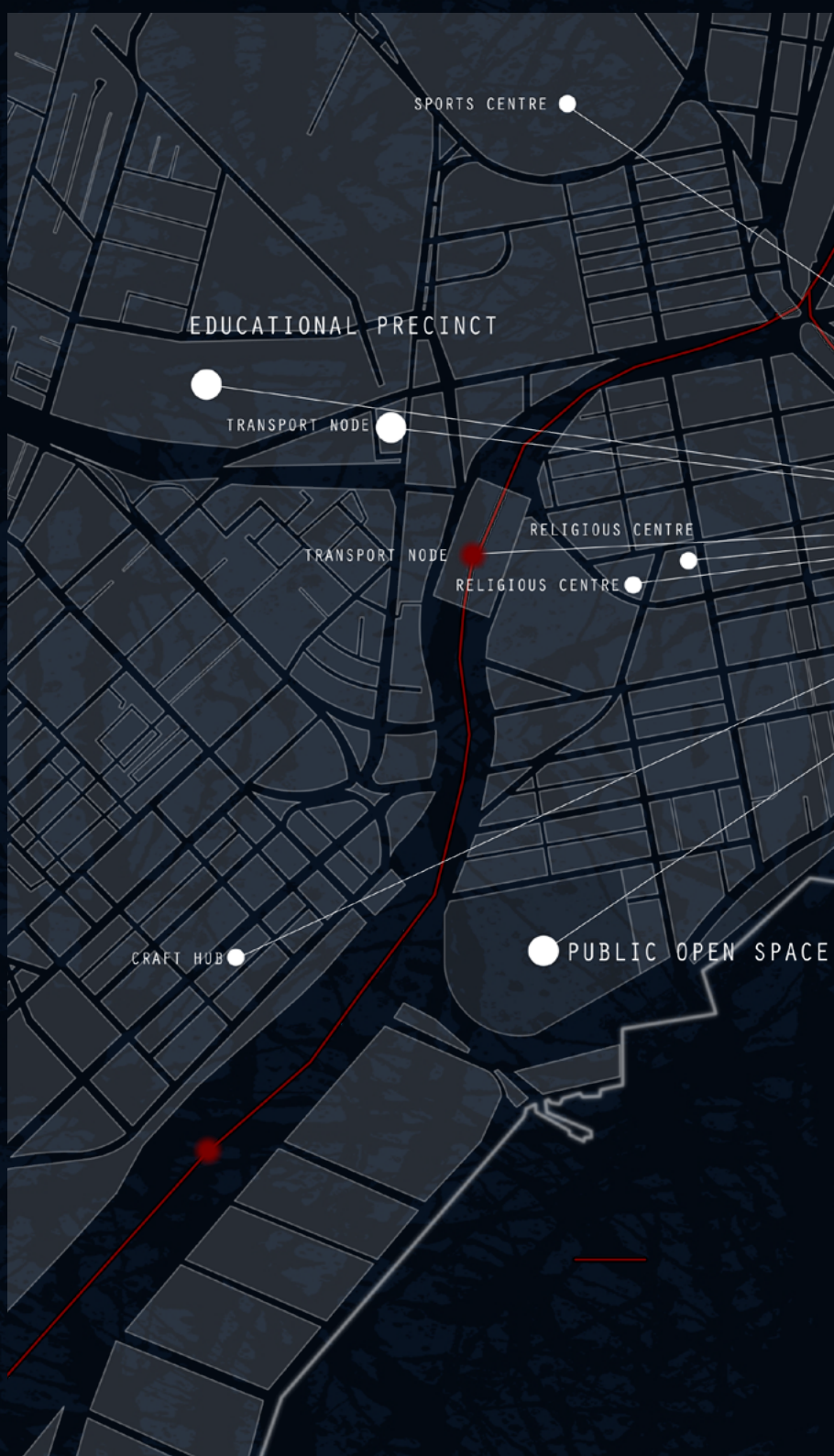
Bicycle storage
Bicycle hire
Admin Office
Maintenance

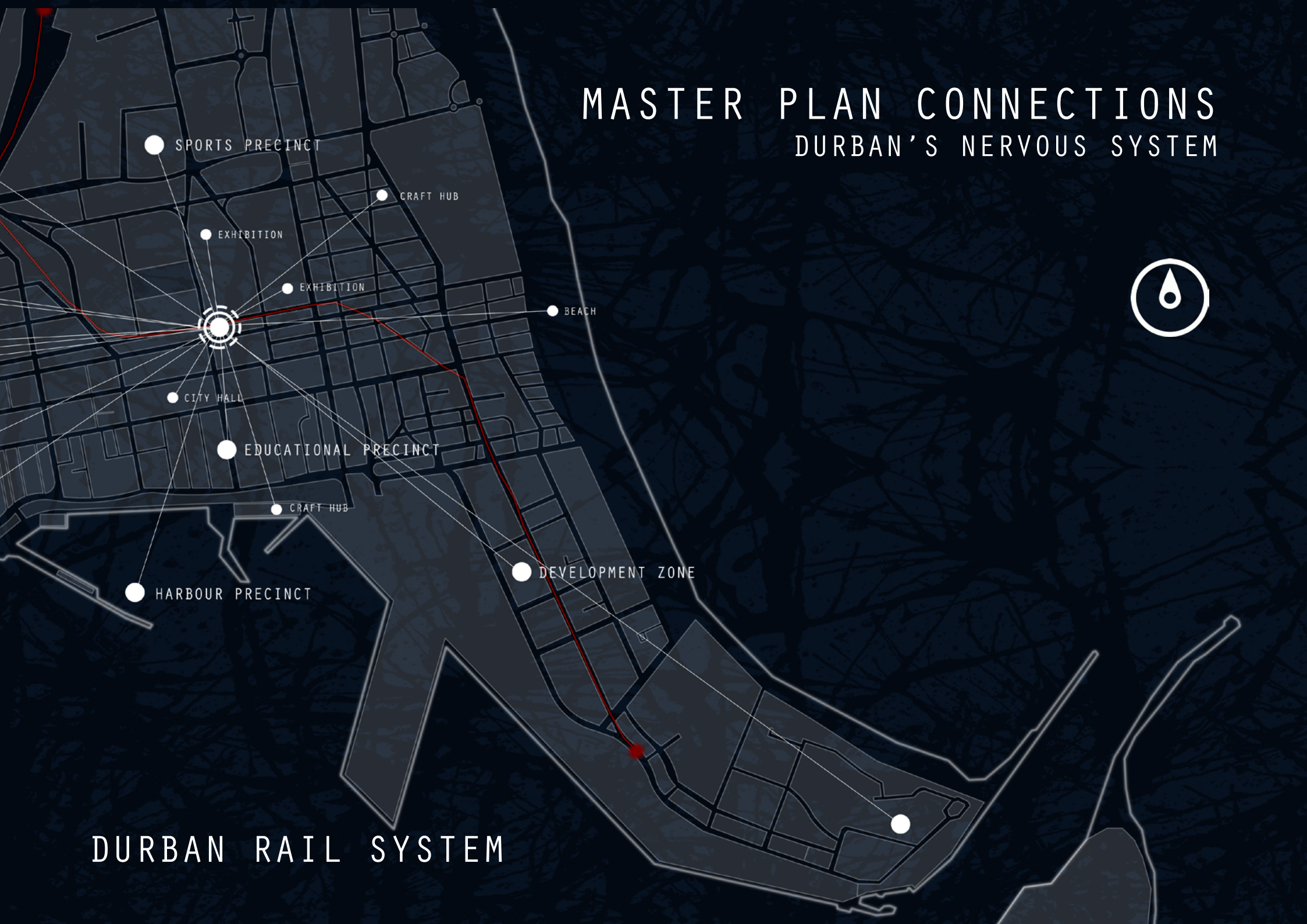
Lower Level Train Platform Rail Component

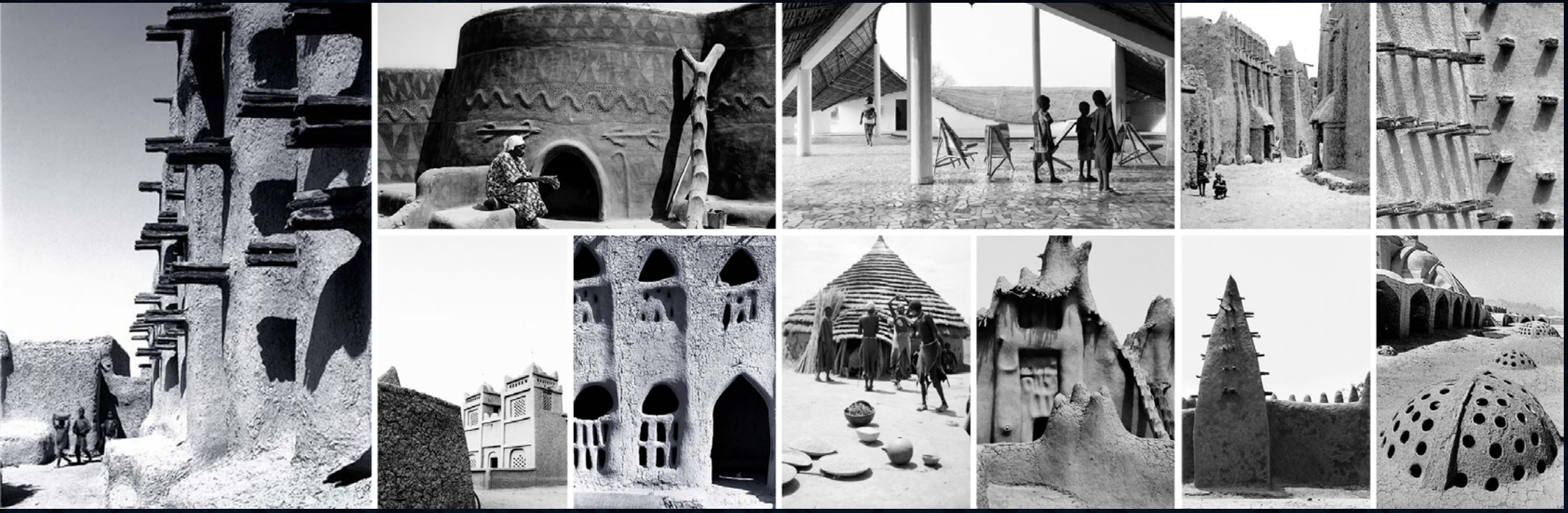
Station Hall
Ablutions
Ticketing
Seating
Platforms
Kiosks

Taxi Component

Management Offices
Ablutions for drivers


SPORTS CENTRE
EDUCATIONAL PRECINCT
TRANSPORT NODE
RELIGIOUS CENTRE
TRANSPORT NODE
RELIGIOUS CENTRE
CRAFT HUB
PUBLIC OPEN SPACE


MASTER PLAN CONNECTIONS
DURBAN'S NERVOUS SYSTEM
SPORTS PRECINCT
CRAFT HUB
EXHIBITION
EXHIBITION
BEACH
CITY HALL
EDUCATIONAL PRECINCT
CRAFT HUB
DEVELOPMENT ZONE
HARBOUR PRECINCT
DURBAN RAIL SYSTEM



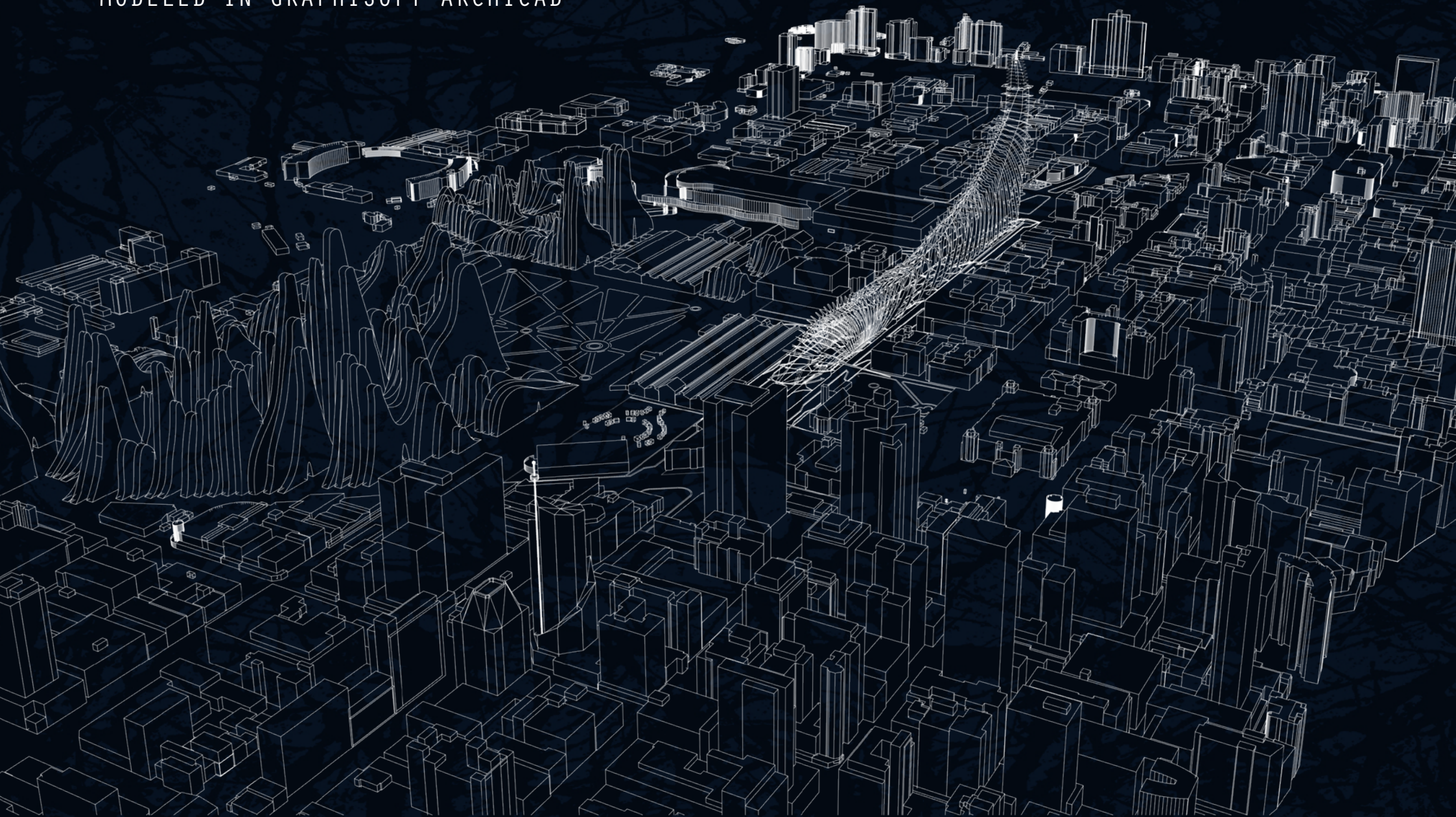
BUILDING TECHNOLOGICAL ADVANCEMENTS

AFRICAN RENAISSANCE

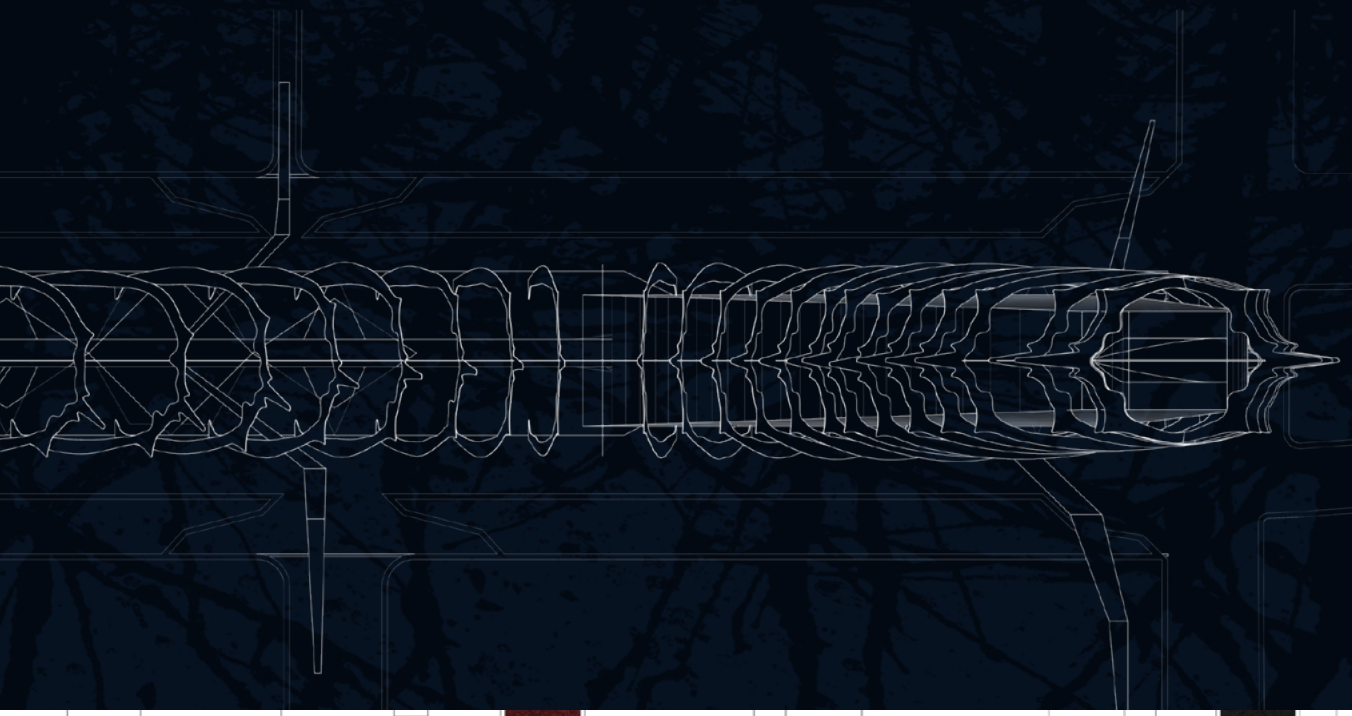
RECLAIMING DURBAN’S IDENTITY AS AN AFRICAN CITY

URBAN AERIAL VIEW

AND PROPOSED URBAN DESIGN
MODELED IN GRAPHISOFT ARCHICAD



GROUND SITE PLAN
1 | 500

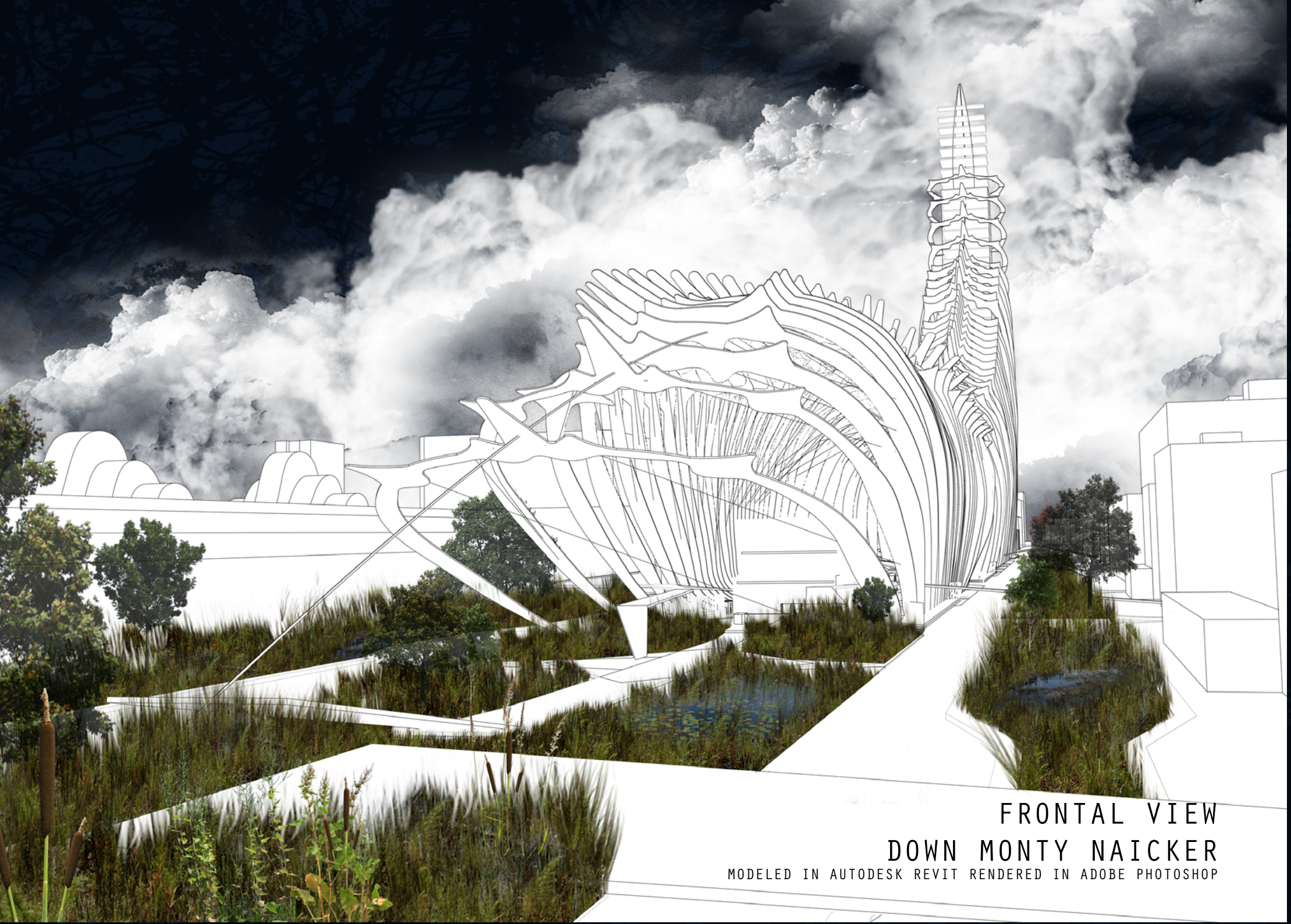


INTERCHANGE TOP VIEW

1 | 500

MODELED IN AUTODESK REVIT

RENDERED IN ADOBE PHOTOSHOP



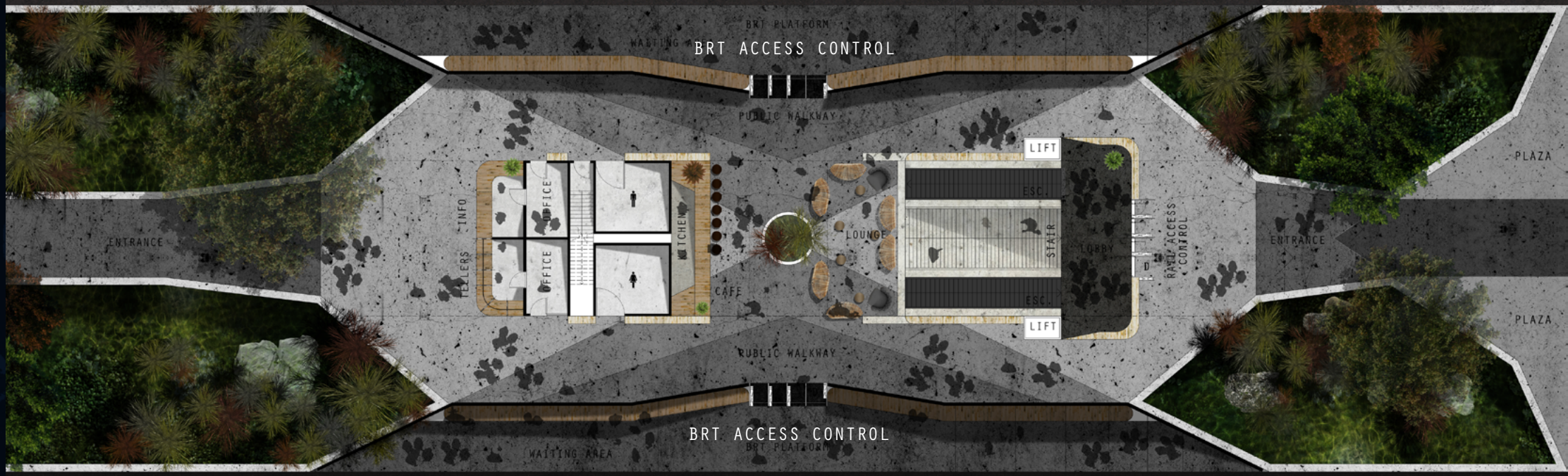
FRONTAL VIEW

DOWN MONTY NAICKER

MODELED IN AUTODESK REVIT RENDERED IN ADOBE PHOTOSHOP

BRT EAST BOUND (POINT/BEACH FRONT)

DR A B XUMA



MONTY NAICKER

BRT WEST-BOUND (WARWICK,BEREA,SUBURBIA)

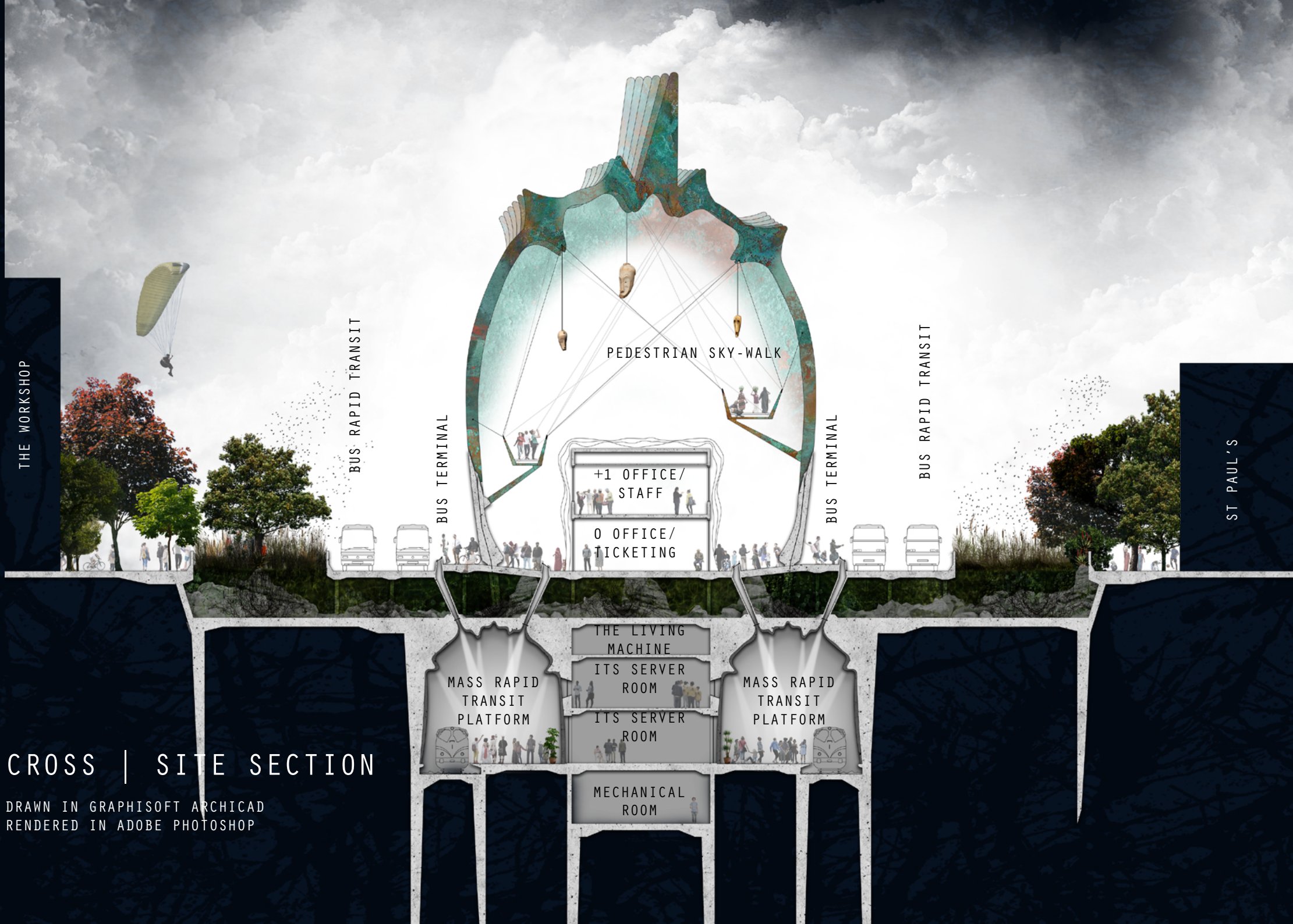
GROUND STATION 01 PLAN

MODELED IN AUTODESK REVIT
RENDERED IN ADOBE PHOTOSHOP

INTERNAL VIEW

DOWN MAIN PROMENADE

MODELED IN AUTODESK REVIT RENDERED IN ADOBE PHOTOSHOP



CROSS | SITE SECTION

DRAWN IN GRAPHISOFT ARCHICAD
RENDERED IN ADOBE PHOTOSHOP

MODELED IN AUTODESK REVIT RENDERED IN ADOBE PHOTOSHOP

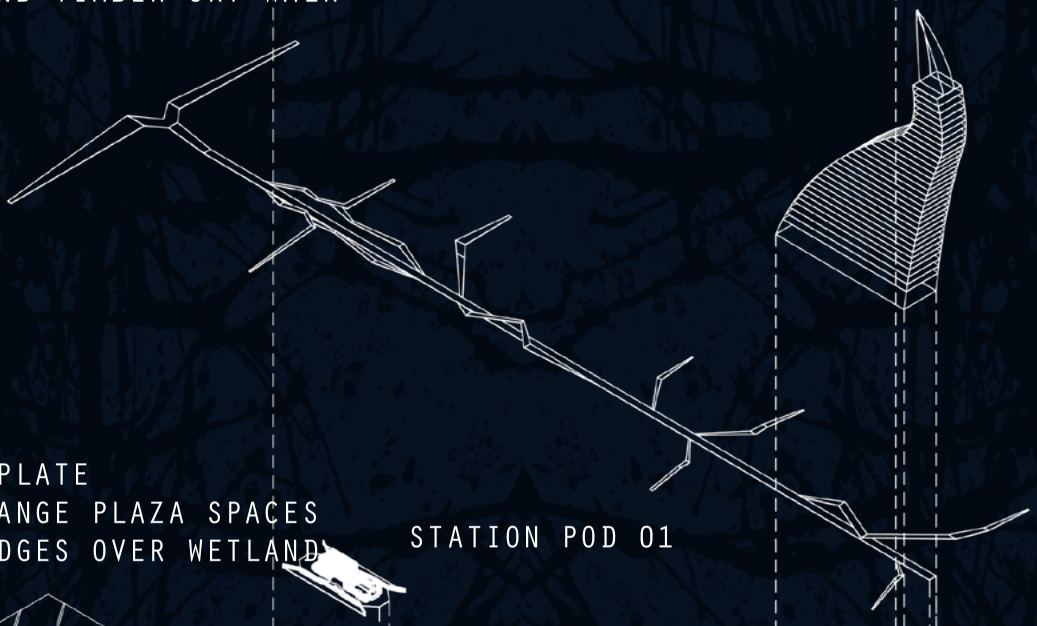
SOLAR HARVEST MECHANICAL
MESH SKIN

STEEL TENSION CABLE

CONCRETE AND COPPER
PLATED STRUCTURAL STEEL
RIBS

HOTEL

COPPER PLATED STRUCTURAL
STEEL AND TIMBER SKY-WALK

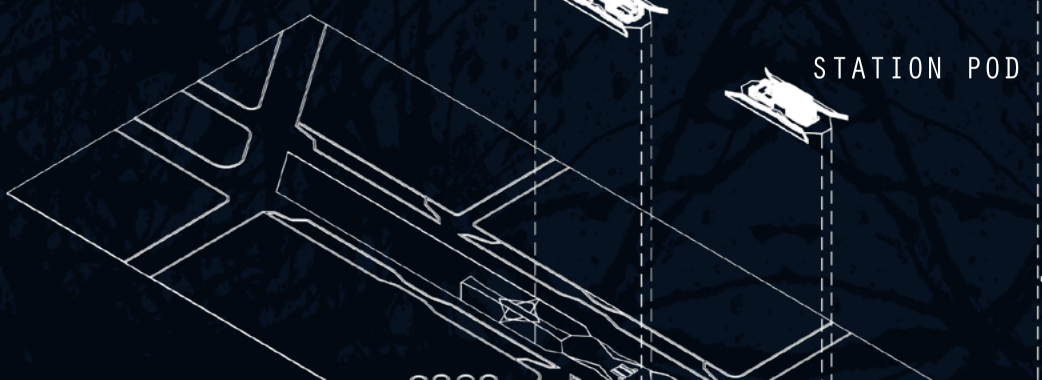


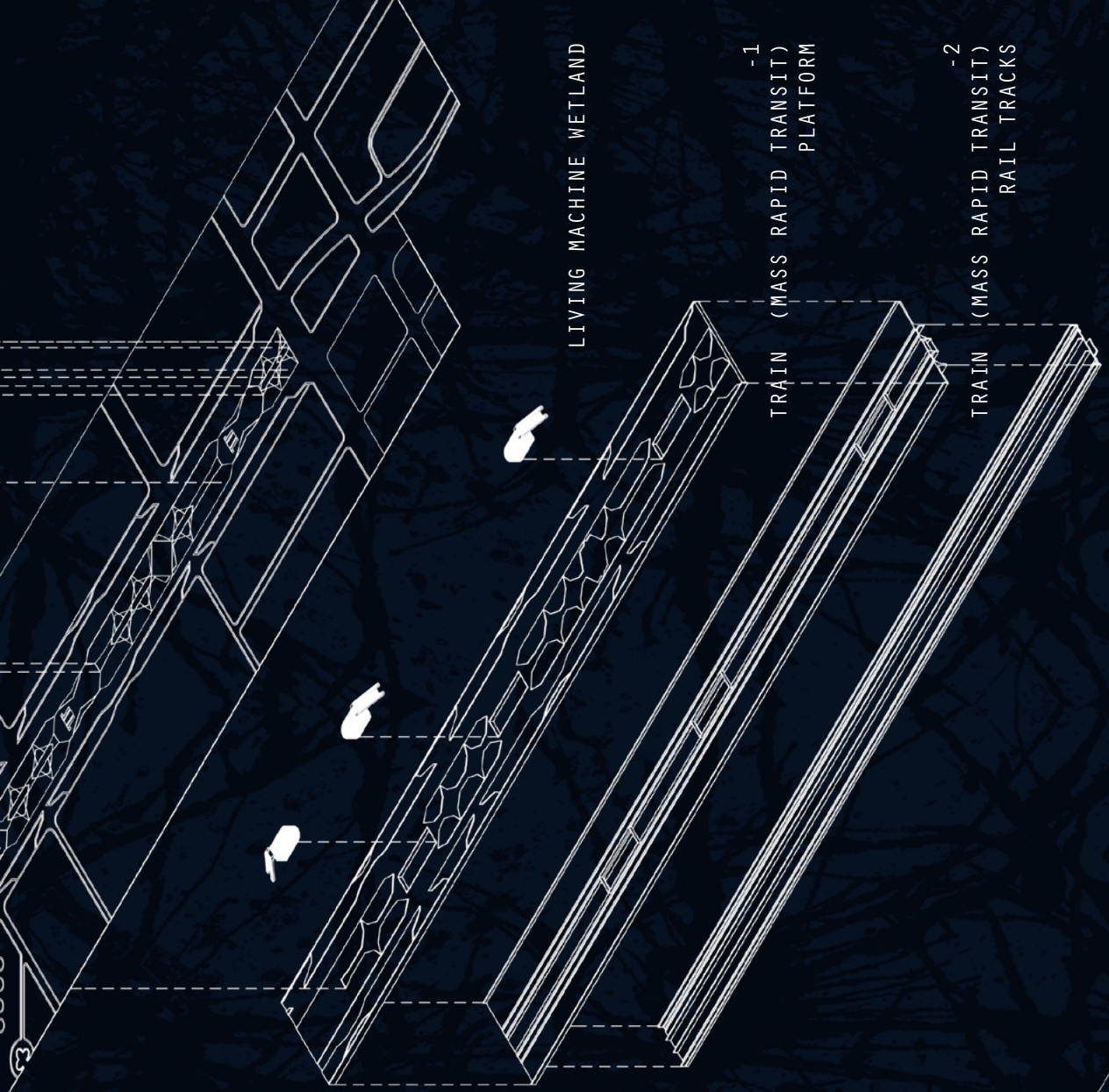
GROUND PLATE
INTERCHANGE PLAZA SPACES
AND BRIDGES OVER WETLAND

STATION POD 01

STATION POD 02

STATION POD 03
AND HOTEL





EXPLODED AXON

MACHINARIA - THE INTERCHANGE AT MULTIPLE LEVELS
3 STATION PODS AND HOTEL SERVICING DIRECTLY - THE
NEIGHBOURING CIVIC, EXHIBITION AND CONFERENCE PRECINCTS

MODELED IN AUTODESK REVIT RENDERED IN ADOBE PHOTOSHOP

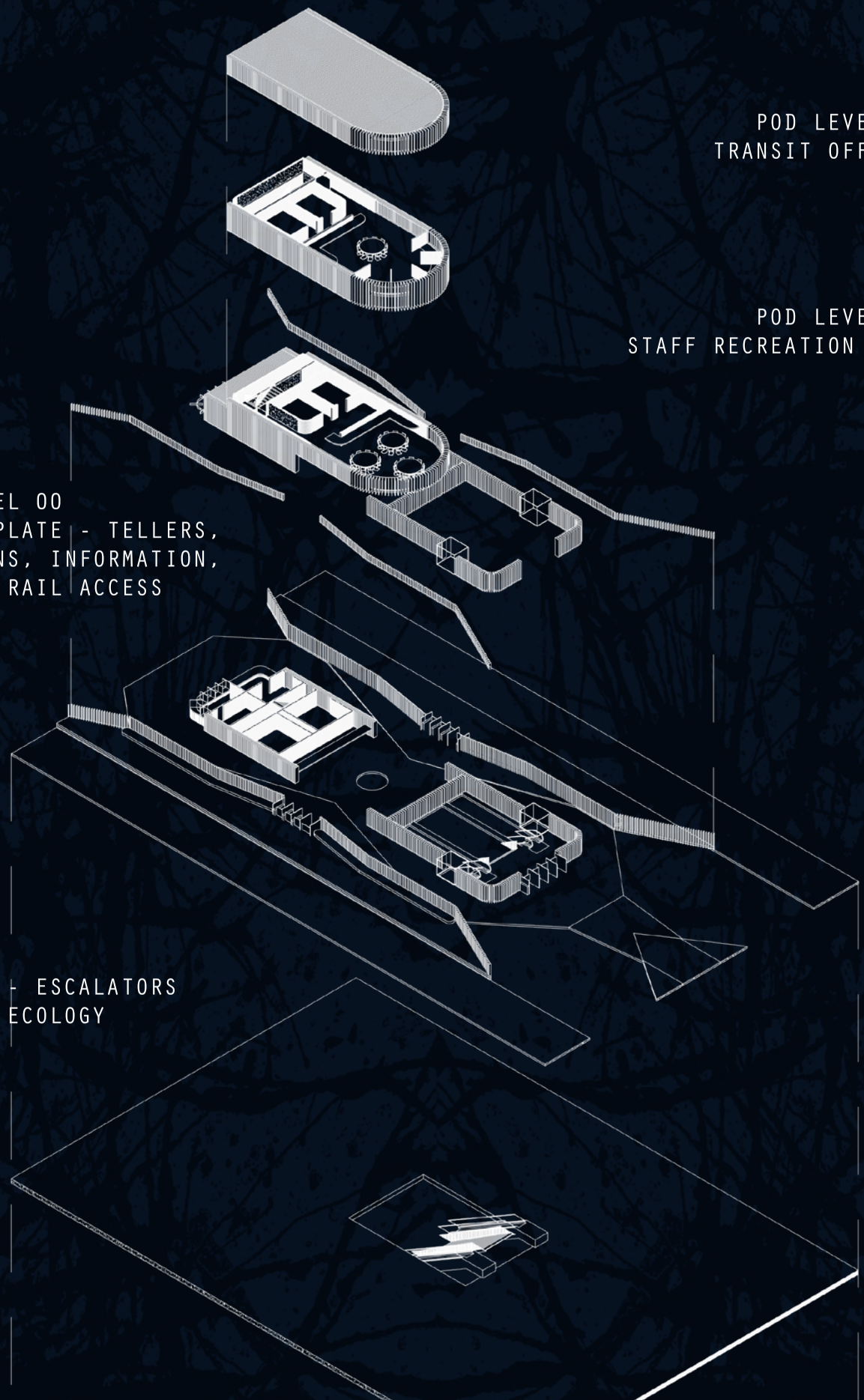
ORGANIC FIN FORMED TIMBER
POD CLADDING

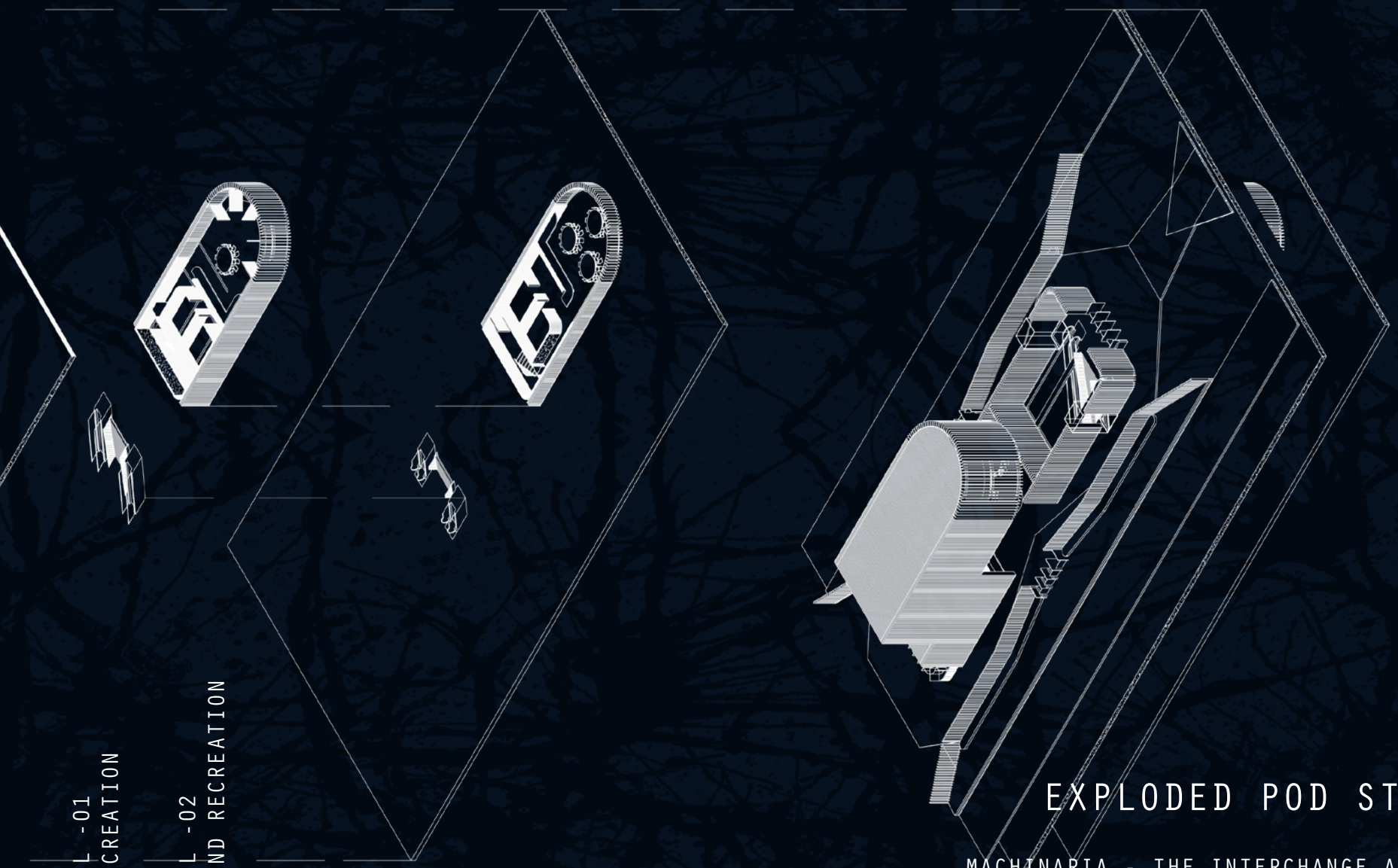
POD LEVEL 02
TRANSIT OFFICES

POD LEVEL 01
STAFF RECREATION AREA

POD LEVEL 00
GROUND PLATE - TELLERS,
ABLUTIONS, INFORMATION,
BUS AND RAIL ACCESS
CONTROL

WETLAND - ESCALATORS
WETLAND ECOLOGY





POD LEVEL -01
STAFF RECREATION

POD LEVEL -02
OFFICE AND RECREATION

EXPLODED POD STATION AXON

MACHINARIA - THE INTERCHANGE AT MULTIPLE LEVELS

3 STATION PODS. FACILITATING STAFF, DRIVERS AND ACCESS CONTROL FOR THE BUS RAPID TRANSIT (GO!DURBAN) AND MASS RAPID TRANSIT (PRASA)

MACHINARIA -

INTER-MODAL TRANSPORT INTERCHANGE

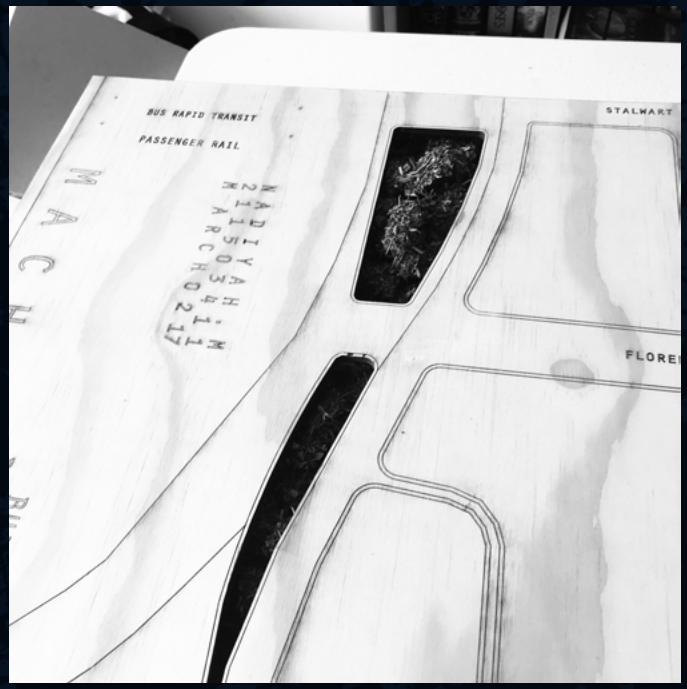
FINAL CONCEPTUAL MODEL

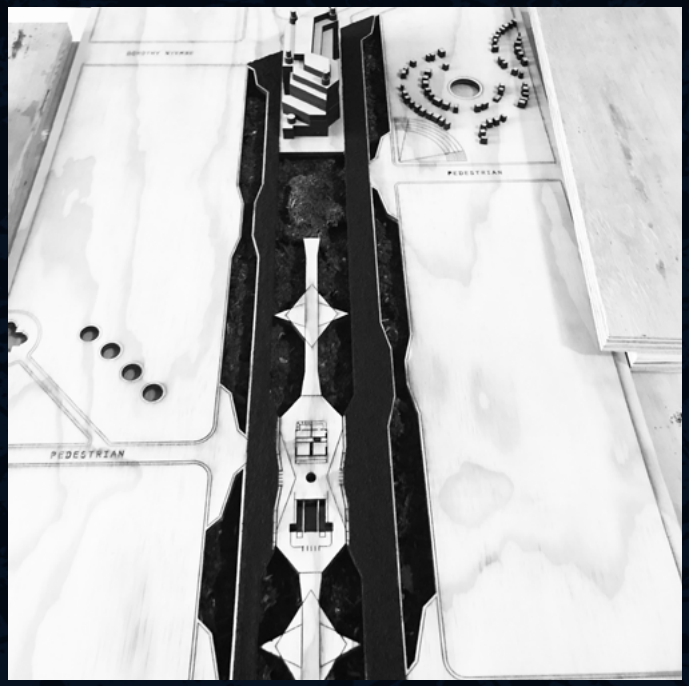
MATERIAL (FROM BASE UPWARD) - PLYWOOD, RESIN, LIQUID GLASS, MDF CONTEXT, PERSPEX FOR FINAL RIBBED FORM

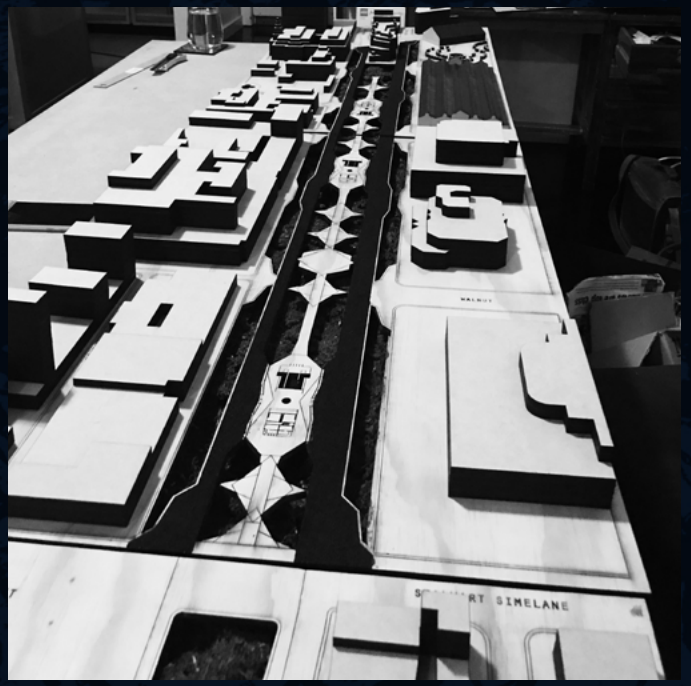
MAIN BUILDING MODEL

1|500

PROCESS MODEL BUILDING AND ASSEMBLY







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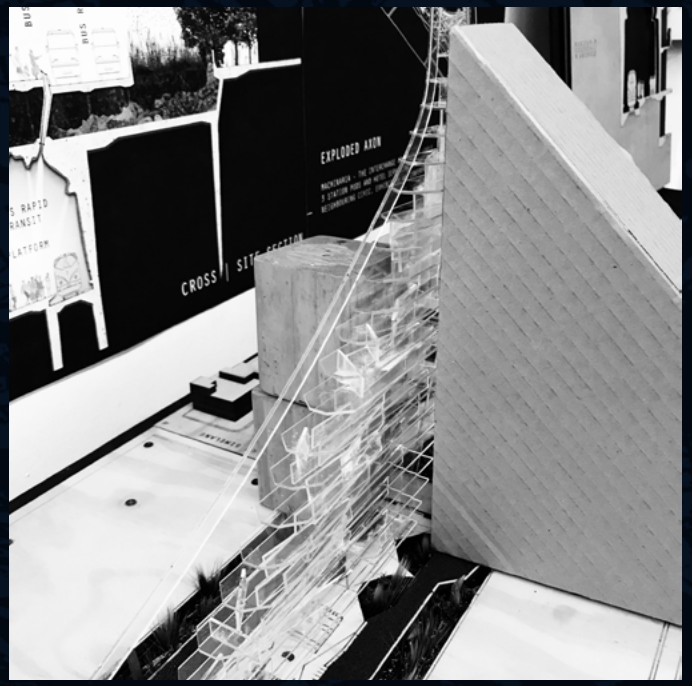

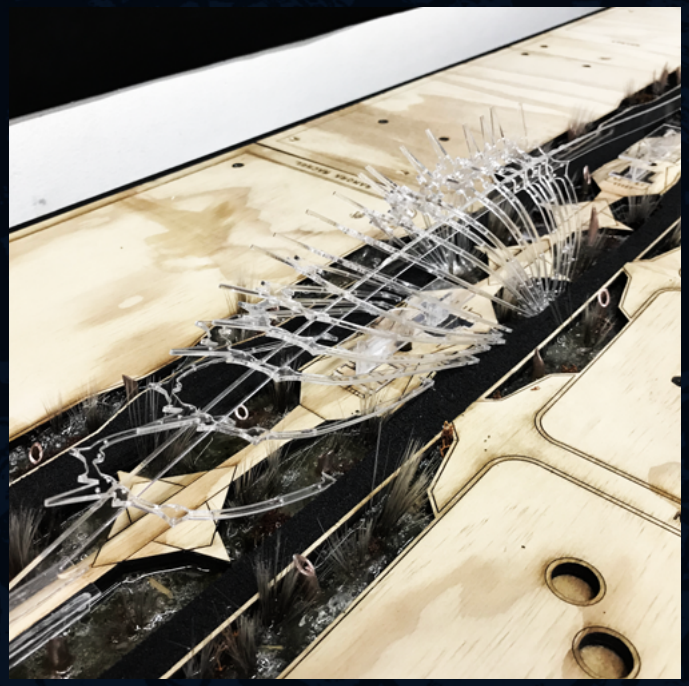

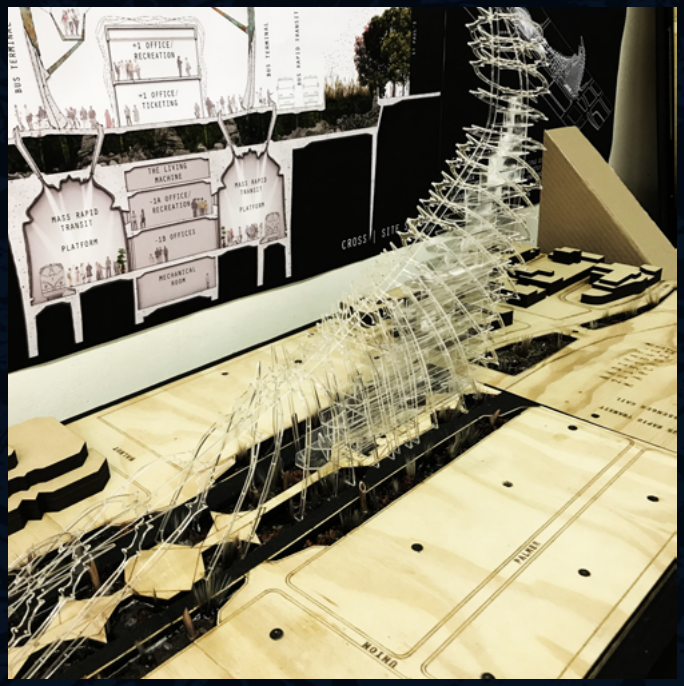

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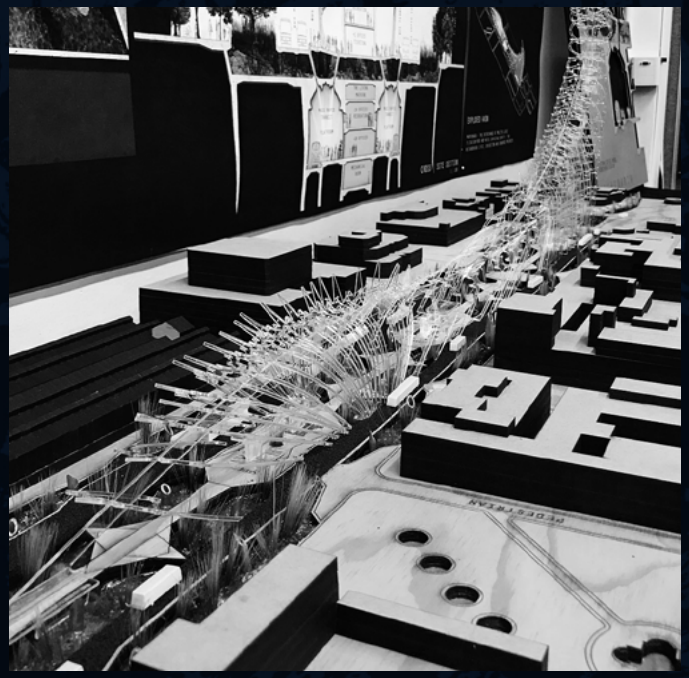

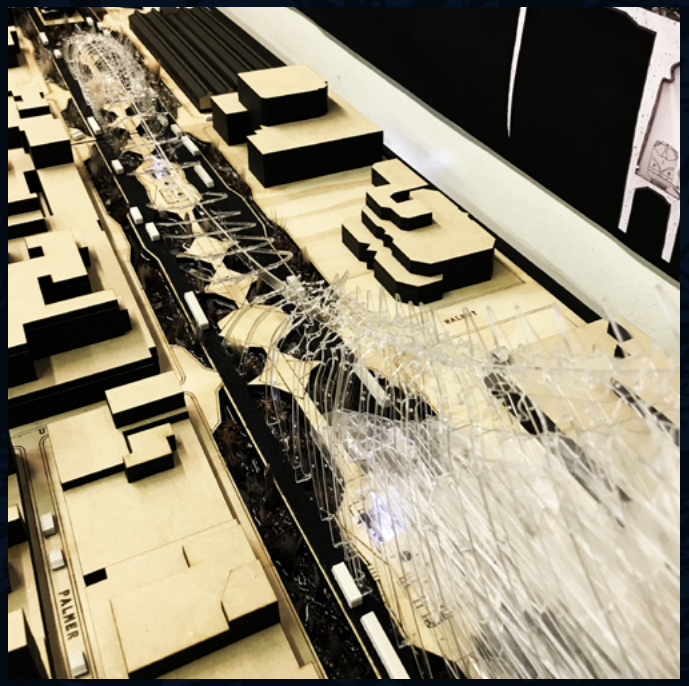


GROUND SITE PLAN
1 | 500


UXHALL CROSS
INTERCHANGE
-UK
l relationships, linear form and
site planning, iconic form
PHYSICAL FEATURES
and organic - mechanical form, portal frame structure
with light skin
ZONING
civic - transport - service to the public
TYPOLOGY
inter-modal transport interchange
TRAIN - BUS - TAXI
ACCOMMODATION
COMMON AREA: GROUND FLOOR
Central Information Centre
DA'AN PARK TAIPEI
INTERCHANGE
-TAIWAN
architectural ecology, iconic form,
relationship to nature
Waiting Areas
Ablutions
Ticketing Offices
BUS COMPONENT
BRT - Go Shelter
People Mover
Ticketing Kiosk
BRT Management Offices
Rest rooms for drivers
Security Offices
BICYCLE FACILITIES
Bicycle storage
Bicycle hire
THE LIVING MACHINE
enhancing architectural design and
detailing through the ecological
mechanics found in nature - filtration,
purification and sustainability
Admin Offices
Maintenance
LOWER LEVEL TRAIN PLATFORM
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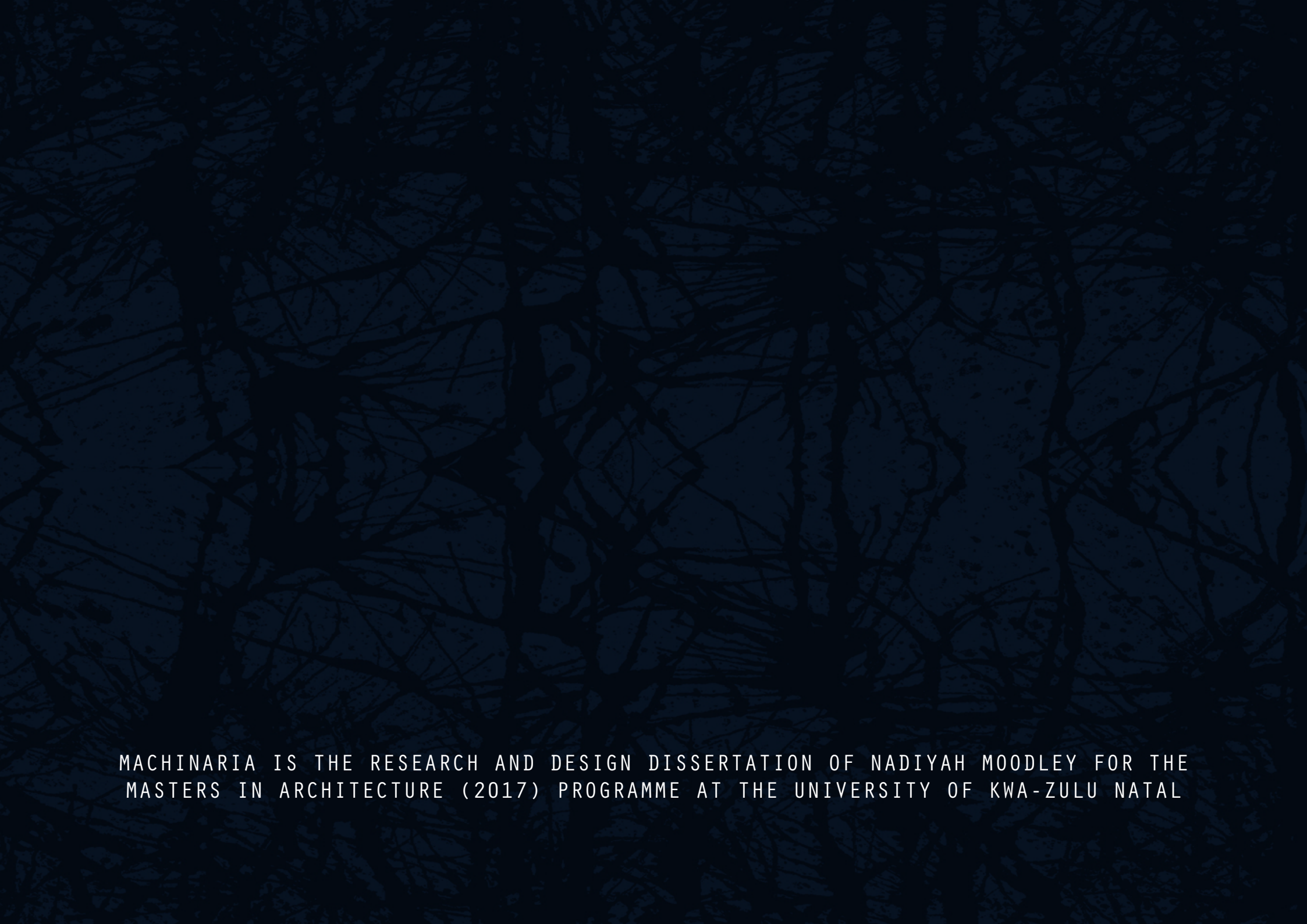
GROUND SITE PLAN
1 | 500

URBAN 1|2 000

SECTIONAL MODEL



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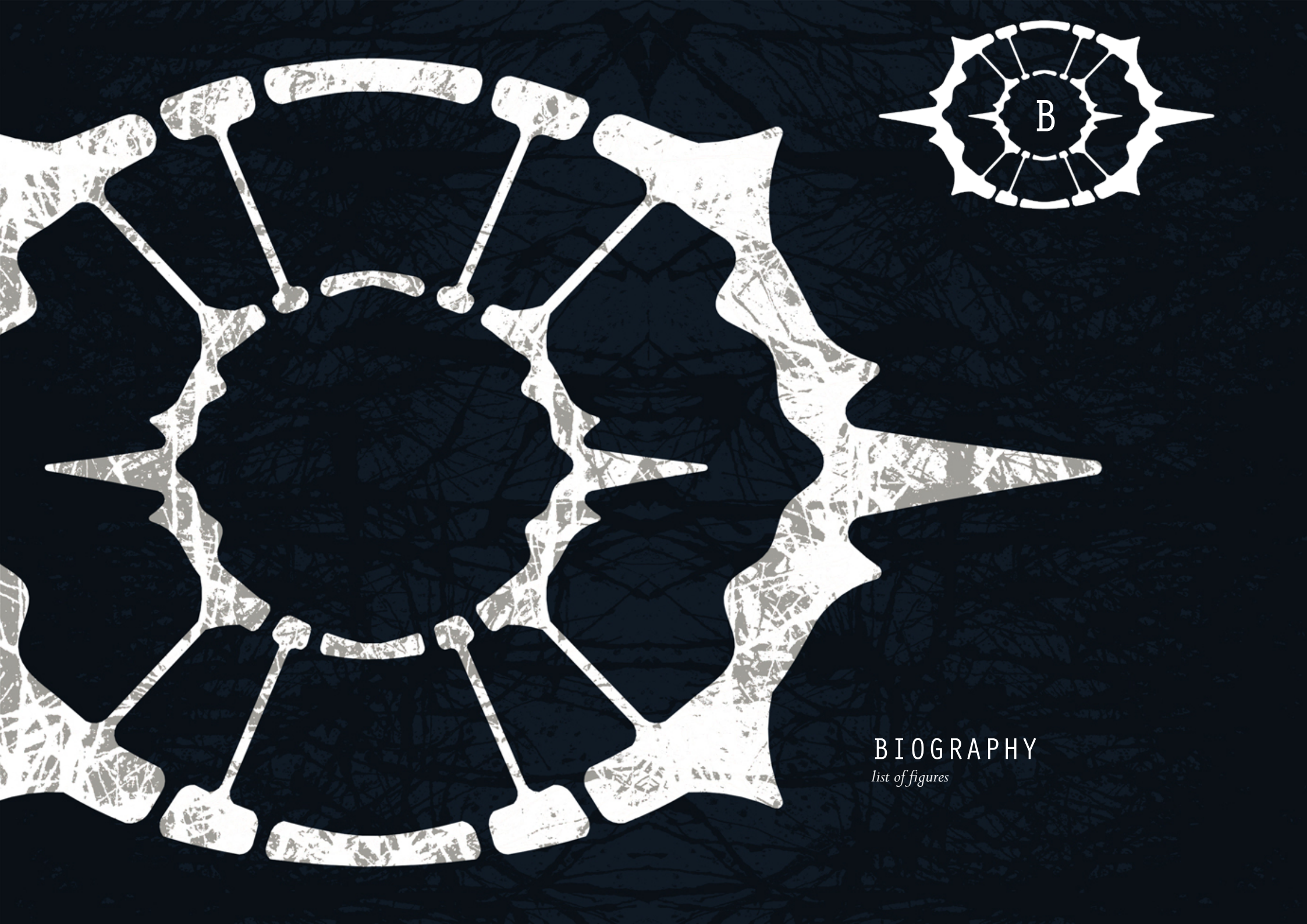

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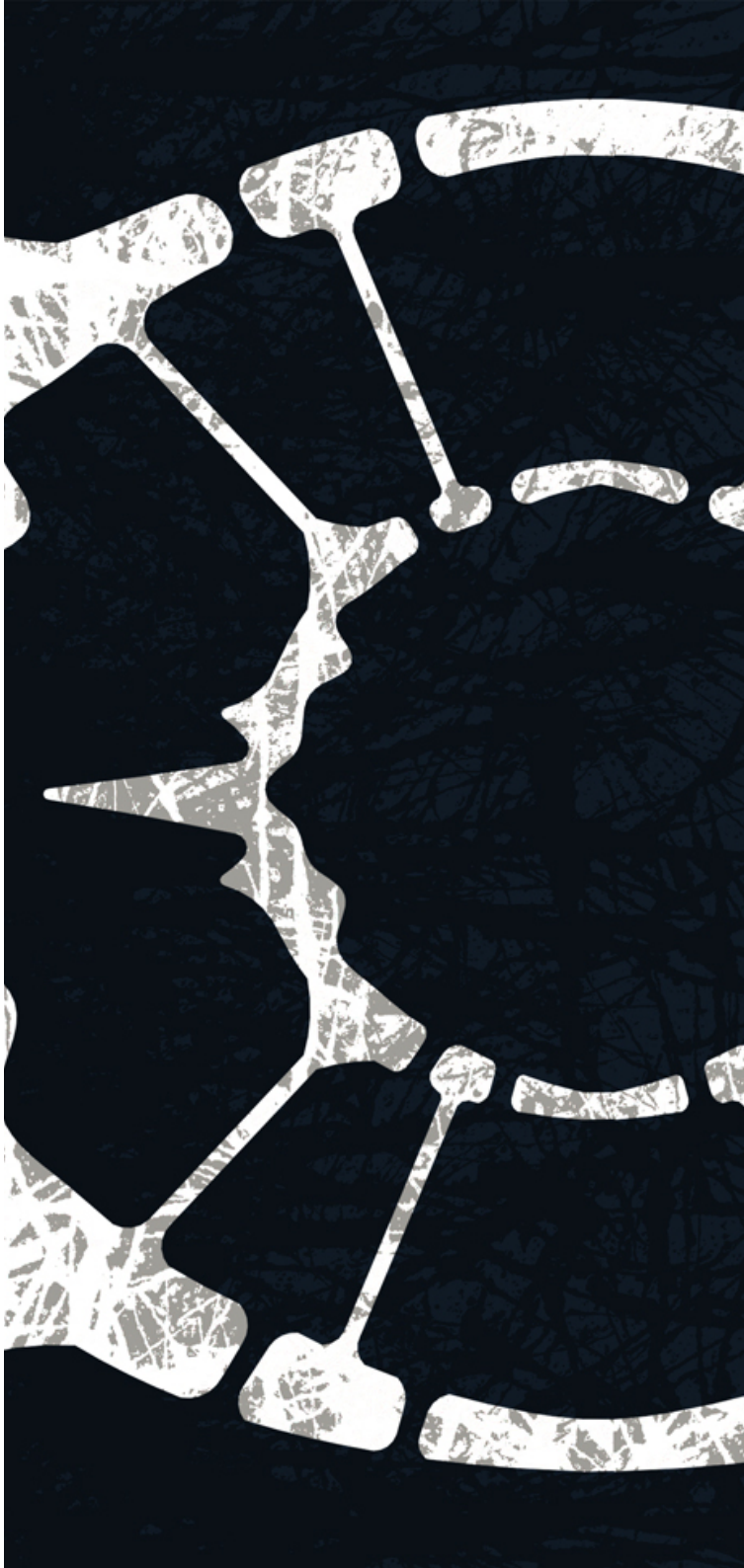

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3.44 – landscape, light and darkness. [Image Online] Available at: https://i.pinimg.com/736x/7f/4b/87/7f4b87778409723a03709d29c2653995--shadow-photography-contrast-photography.jpg [Accessed: March 2017]

3.45 –Tactility through texture - in the image of man. (Author's Graphic, 2017)

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4.07 – The Apartheid City - Drawing by Author

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4.17 – Expressive artwork hung up at the constitutional court, Johannesburg, South Africa.(Artist Unknown. Author's Graphic, 2017)

4.18 – Expressive artwork hung up at the constitutional court, Johannesburg, South Africa. (Artist Unknown. Author's Graphic, 2017)

4.19 – Expressive artwork hung up at the constitutional court, Johannesburg, South Africa. (Artist Unknown. Author's Graphic, 2017)

4.20 – Expressive artwork hung up at the constitutional court, Johannesburg, South Africa. (Artist Unknown. Author's Graphic, 2017)

4.21 – Expressive artwork hung up at the constitutional court, Johannesburg, South Africa. (Artist Unknown. Author's Graphic, 2017)

4.22 – Expressive artwork hung up at the constitutional court, Johannesburg, South Africa. (Artist Unknown. Author's Graphic, 2017)

4.23 – Expressive artwork hung up at the constitutional court, Johannesburg, South Africa. Various Artists

4.24 – Expressive artwork hung up at the constitutional court, Johannesburg, South Africa. (Artist Unknown. Author's Graphic, 2017)

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6.25 - Wan Chai District, Hong Kong. Showing densities in Urban Hond Kong. [Image Online] Available at: http://www.archdaily.co.zawanchaidistricthongkong.jpg [Accessed: July 2017]

6.27 - Urban road connection plan of the Durban inner city, showing the site location - Centrum. (Author's Photo, 2017)

6.28 - Centrum Road Connections. Source: Urban Solutions, 2016. [Online] Available from: http://www.durban.gov.za/City_Services/development_planning_management/Documents/Inner%20City%20LAP%20Nov%202016.pdf [Accessed: July 2017]

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6.33 - Urban plan of the inner city of Durban with proposed Machinaria - Interchange. (Author's Graphic, 2017)

7.02 - The dark and dangerous platforms of the Berea Station. Poor light quality and little security. (Author's Photo, 2017)

7.03 - The Rail yards of the Berea Station was designed primarily as a barrier between Warwick and the Durban Central Business District. (Author's Photo, 2017)

7.04 - The pedestrian Bridge designed by Design Workshop, adjacent to the Berea Station, connects the Music Bridge and the Muthi Market in Warwick Junction. (Author's Photo, 2017)

7.05 - Commuters, traders and passers-by pause to watch a religious sermon or tradition music video on the concourse of the Station. Traders now occupy the Station, providing amenities for those passing by. (Author's Photo, 2017)

7.06 - South end of the Berea Station showing the rustic and robust concrete facade, giving the feeling of heaviness and isolation. (Author's Photo, 2017)

7.07 - The colourful displays of the traders' goods add to the vibrancy of the space inside. However, the heaviness and lack of natural light gives the space a negative and uncomfortable quality. (Author's Photo, 2017)

7.08 - Empty and underutilised turnstiles to the train platforms below. (Author's Photo, 2017)

7.09 - Brooke Street Taxi Rank provides public transport services and brings in consumers, traders and occupants of the Warwick Junction Precinct. This taxi rank is known to home violent, gang related and fatal crimes. (Author's Photo, 2017)

7.10 - The underutilised platforms of the Durban Central Station is well lit due to light wells that let in natural lighting. (Author's Photo, 2017)

7.11 - Entrance of the Durban Central Station with exposed and broken service motors of the escalators, unmaintained and very isolated. (Author's Photo, 2017)

7.12 - Entrance lobby of the Durban Central Station. As seen, vacant yet grand in scale and volume. (Author's Photo, 2017)

7.13 - One of the vast, underutilised concourses of the Durban Central Station. Little or no amenities and a low volume gives the space a sense of isolation. (Author's Photo, 2017)

7.14 - Platform level with metro train. Broken or missing doors and windows of the train make it unsafe for commuters to travel. (Author's Photo, 2017)

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8.2 - Urban Curitiba - image depicting the natural systems integrated into the landscape of the city to facilitate issues of flooding whilst beautifying the city and creating green relief spaces for public interaction. [Image Online] Available at: https://www.theguardian.com/cities/2016/may/06/story-of-cities-37-mayor-jaime-lerner-curitiba-brazil-green-capital-global-icon#img-4 [Accessed: July 2017]

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8.4 - BRT system with dedicated feeder bus lanes and tubular bus stops. [Image Online] Available at: http://www.c40.org/blog_posts/curitiba-a-leader-in-transport-innovation [Accessed: July 2017]

8.5 - Ticketing systems similar to that of train systems. Transaction of tickets are done prior to boarding the bus, allowing a smoother transition flow between commuter and bus. [Image Online] Available at: https://www.theguardian.com/cities/2016/may/06/story-of-cities-37-mayor-jaime-lerner-curitiba-brazil-green-capital-global-icon#img-4 [Accessed: July 2017]

8.6 - Image of Curitba's BRT system, tubular bus stops and public spaces designed by Architect and Mayor Jaime Lerner. [Image Online] Available at: https://www.theguardian.com/cities/2016/may/06/story-of-cities-37-mayor-jaime-lerner-curitiba-brazil-green-capital-global-icon#img-4 [Accessed: July 2017]

8.7 - Bus Station act as docking stations for bicycles, promoting inter-modality. [Image Online] Available at: https://www.theguardian.com/cities/2016/may/06/story-of-cities-37-mayor-jaime-lerner-curitiba-brazil-green-capital-global-icon#img-4 [Accessed: July 2017]

8.8 - Tubular Bus stations. [Image Online] Available at: https://www.theguardian.com/cities/2016/may/06/story-of-cities-37-mayor-jaime-lerner-curitiba-brazil-green-capital-global-icon#img-4 [Accessed: July 2017]

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8.11 - Sculptural form of the Vauxhall Cross Interchange was designed pragmatically, indicating stops for double decker buses and regular buses. [Image Online] Available at: http://www.arupassociates.com/en/projects/vauxhall-cross/ [Accessed: July 2017]

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8.14 - Off-street entrance to the station with glass curtain wall allows air to flow through the space. [Image Online] Available at: http://archinect.com/scfc/project/daan-forest-park-mrt-station [Accessed: July 2017]

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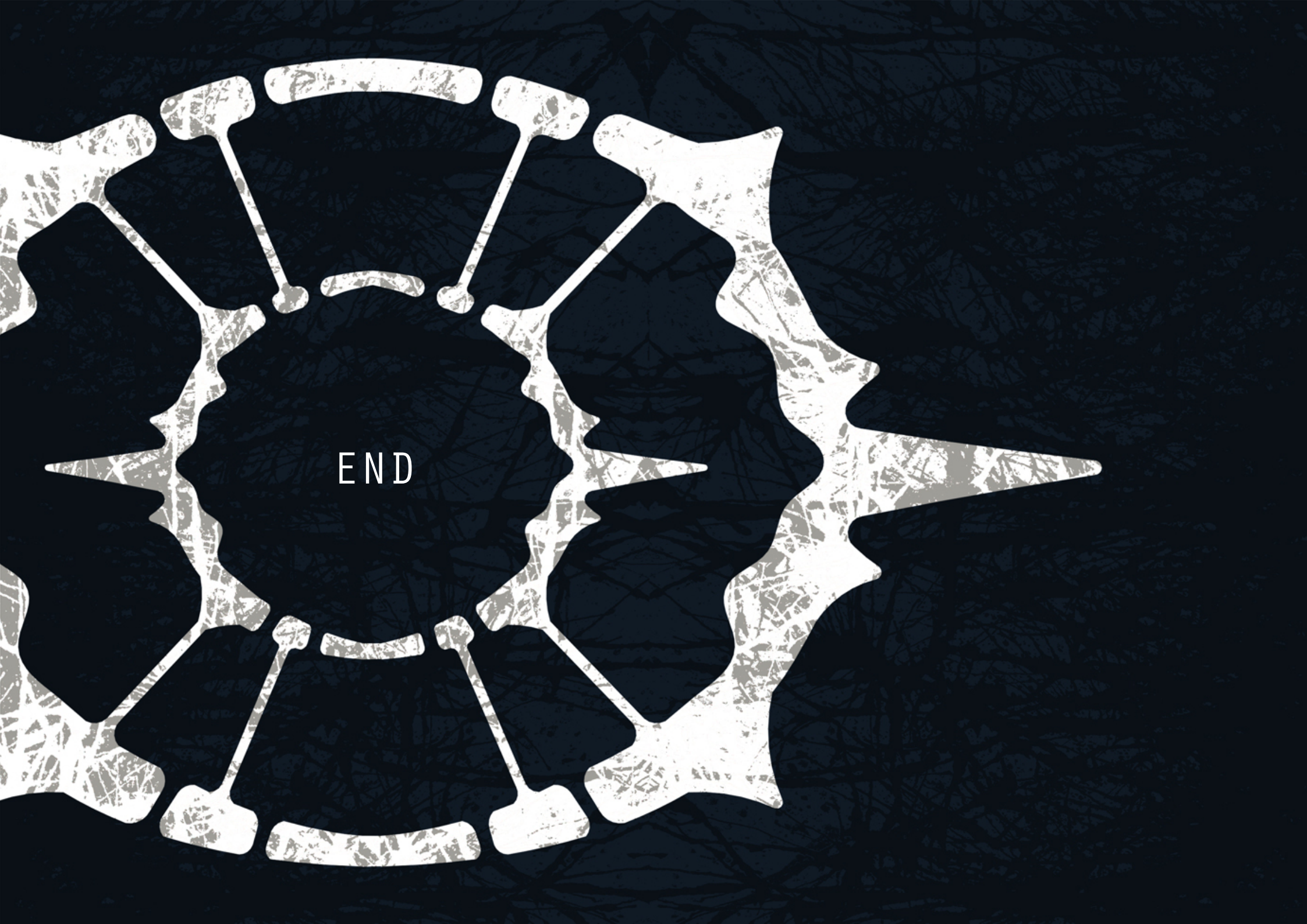
Images from Chapters 9 and 10 are Author's Graphics/Photographs

9 10


EAST BOUND (POINT/BEACH FRONT)
DR A B XUMA
FRONTAL VIEW
EXPLODED VIEW
EXPLODED POD


END

INVESTIGATING TRANSPORT ARCHITECTURE AS A KEY DRIVER FOR DURBAN PROGRESSING AD AN ECOLOGICAL CITY

TOWARDS THE DESIGN OF AN INTER-MODAL TRANSPORT INTERCHANGE

NADIYAH MOODLEY
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