Stimulating urban renewal; through forging connection between architecture + public infrastructure towards an integral urbanism.

Design Research Project APG 5058S

Submitted in partial fulfilment of the requirements for the degree

Master of Architecture [Professional]

by

Clive Warren Truter

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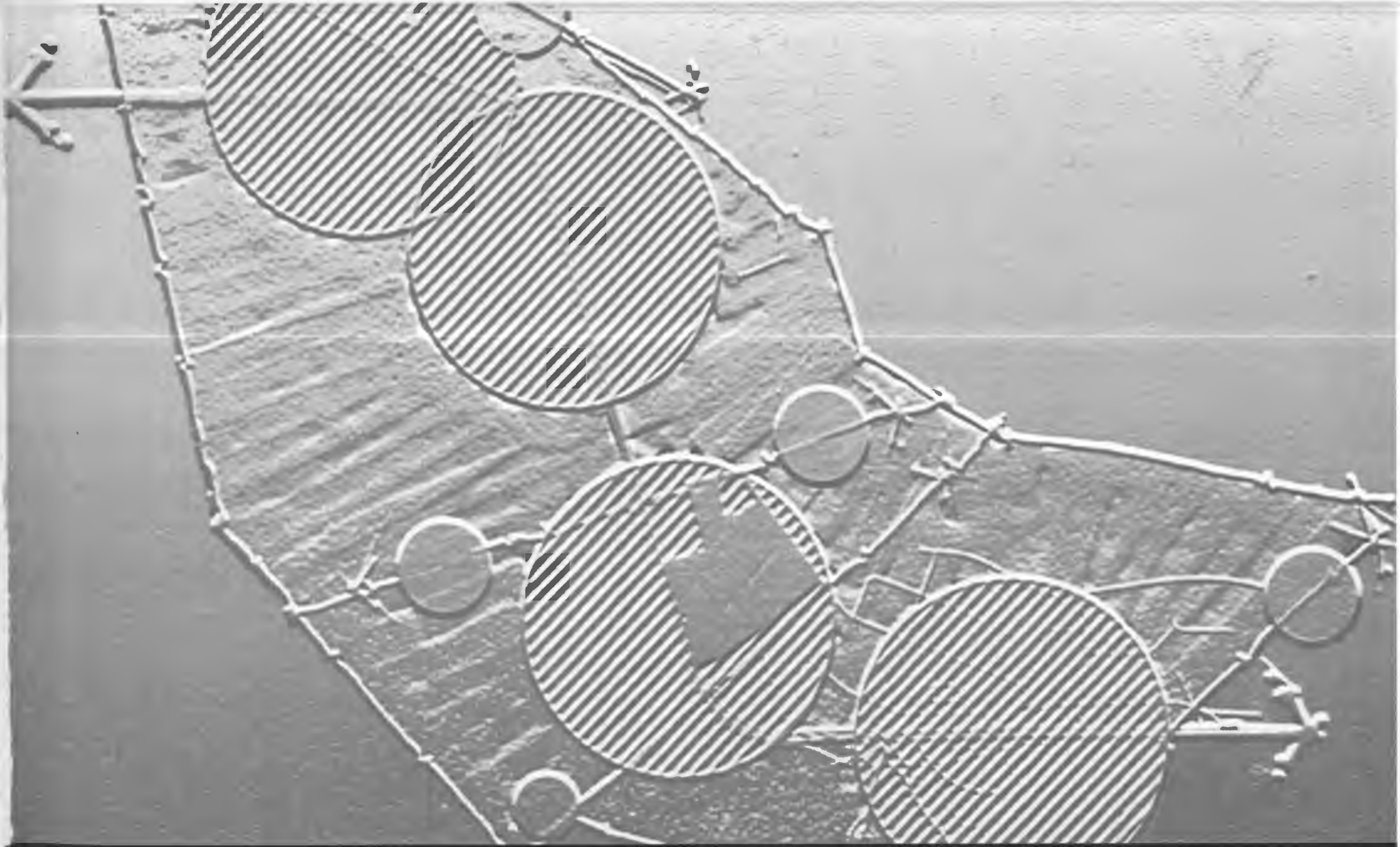

Khayelitsha Station precinct

UCT School of Architecture + Planning

TRTCLI 001

Thesis dissertation

Proposition: Stimulating urban renewal; through forging connection between architecture and public infrastructure towards an integral urbanism.

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A special dedication to my family and partner for your support throughout my studies, and finally to the commuters and youth of the Cape Flats.

chapter 1

Theory research dissertation

Proposition: Stimulating urban renewal; through forging connection between architecture and public infrastructure towards an integral urbanism.

Infrastructure + field conditions - framing a strategy for stations as stimulus of urban form and growth

Introduction

I am inspired to write this dissertation as a designer seeking new strategic means to interact and act upon the city. I have been a commuter from a very young age [since primary school], this informed my first understanding of the urban environment, through the use of public transport. In this dissertation my aim is to investigate this understanding of urban possibilities from a bottom up level. And in this process gain a strategic means for architecture to participate in activating stations. As a commuter and designer I am fascinated by the potential of stations.

Through vacation work experience at Jonker & Barnes architects, I participated in the redevelopment proposals of 3 stations on the Cape Flats from November 2007 to February 2008. This opportunity granted me with a basis of enquiry. What became evident through my research is that a fragmented understanding and development approaches at stations lead to disjointed urban solutions. My proposition calls for an integrated approach to realize urban possibilities of form and growth.

In this dissertation I discuss the significance of field conditions [1] to offer architecture a strategic dimension to evaluate process and enable public infrastructure with the potential to become catalytic towards an integral urbanism[2] . Inscribed in this idea:

- is a recognition that conventional architectural and planning practices are deficient to anticipate new alternatives in isolation;
- is that these traditional approaches are unsuccessful in negotiating mass mobility, interrelationships and perceptions in the contemporary city.

Objectives

The first objective is to transcend beyond traditional perceptions of infrastructure and develop an understanding of what infrastructure could be, through reconfiguring how it functions holistically in the urban landscape.Secondly, the aim is to formulate a comprehension of field conditions, through siting its significance for architecture as a strategic process-driven medium, to decode [or notate] latent and progressive urban scenarios.The third objective is located in the proposition, which explicitly notates a shift from the conventional notion of urban renewal, as we have come to understand it locally towards an integral urbanism. This aim of this is to investigate strategies in which the station can be the generator of urban form and growth.

Methodology

The process of this enquiry starts with a versatile set of parameters of what infrastructure could be through the siting of Stan Allen's propositions. This will enable me to draw tentative differentiation to appropriately discern between notions of 'landscape'[3] and 'urbanism'[4] . This distinction will provide a framework or means for a discourse into field conditions. From this foundation I intend to reconcile the concepts of landscape and urbanism through the sentiments of James Corner 'landscape urbanism'[5] . I will then, through a case study review , unpack strategies, to take out of this dissertation as a means to reconcile disjunctions in my design process. From here I will discuss the process which I have followed up till now from propositional notion to the most recent conceptual advances.

In conclusion, I will discuss the shift from urban renewal to integral urbanism. This exploration will involve briefly underpinning concepts by Roelof Uytenbogaardt and Dave Dewar; critique existing development practices and offer alternatives through the principles of integral urbanism.

1 Stan Allen; Points + Lines; Diagrams for the city; Princeton Architectural Press; 1999; NY
2 Nan Ellin; Integral Urbanism; Routledge-publishing; New York; 2006
3 Landscape Urbanism; A manual for the Machinic Landscape; AA-publication; Spain; 2006
4 Landscape Urbanism; A manual for the Machinic Landscape; AA-publication; Spain; 2006
5 Clare Lyster ; The Landscape Urbanism Reader; Princeton Architectural Press; NY; 2000
6 Stan Allen; Points + Lines; Diagrams for the city; Princeton Architectural Press; 1999; NY

The experience of the contemporary city has become incrementally inclined to flow, generated by mass mobility of people, goods and information. Re-imagining how infrastructure produces; performs and is distributed; provides a means of accepting an urban landscape that change over time. The following propositions through investigations by Stan Allen [6] aim to facilitate this process.

Propositions on Infrastructure

Infrastructure instils speculative preconditions through 'stage setting'[7] , in anticipation to prospective future contingencies and buildings (fig.1). The practical dimension here is topography[8] and underpins:

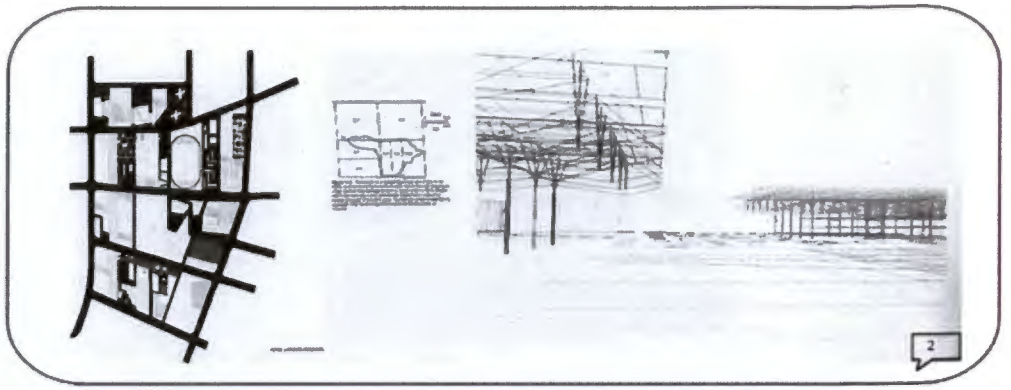
- surface provision, distribution and construction;
- service allocation, to enable future eventualities; and
- organization of mobility networks, communication and exchange.

Infrastructure is versatile; it anticipates[9] change and develops within a loose set of parameters(fig.2). It creates a matrix of constants and variables which can be simultaneously specific and indefinite; to acclimatise to changing conditions. This marks a progression from the pre-programmed 'master-plan' to a choreography [drawing; representation and notation[10]] which goes beyond the production of space to the 'performance of space'[11].

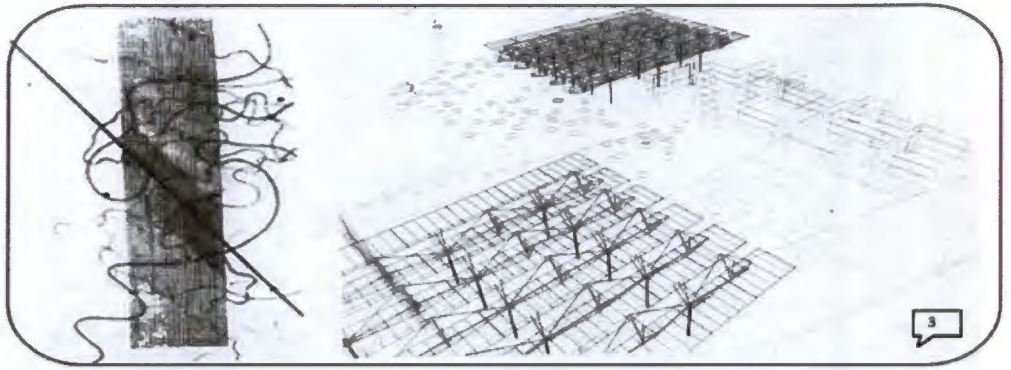
Infrastructure requires the participation of multiple authors, to design eventualities through a 'bottom up'[12] process rather that a 'top down'[13] imposition. It entails the significance of field work and delineates the scope of intervention, through a strategic process-driven dimension(fig.3).

Infrastructure adjusts to local conditions whilst preserving general 'continuity'. Its absolute state is consistency and deviations in the terrain are negotiated through tactical, site specific responses to suit a particular condition(fig.4).

infrastructure instils speculative preconditions through 'stage setting'



it anticipates change and develops within a loose set of parameters



infrastructure requires the participation of multiple authors

adjusts to local conditions whilst preserving general 'continuity'

7 Stan Allen; Points + Lines; Diagrams for the city; Princeton Architectural Press; 1999; NY
8 Stan Allen; Points + Lines; Diagrams for the city; Princeton Architectural Press; 1999; NY
9 Stan Allen; Points + Lines; Diagrams for the city; Princeton Architectural Press; 1999; NY
10 Stan Allen; Points + Lines; Diagrams for the city; Princeton Architectural Press; 1999; NY
11 Stan Allen; Points + Lines; Diagrams for the city; Princeton Architectural Press; 1999; NY
12 Stan Allen; Points + Lines; Diagrams for the city; Princeton Architectural Press; 1999; NY
13 Stan Allen; Points + Lines; Diagrams for the city; Princeton Architectural Press; 1999; NY

Infrastructure is static, but regulates the flow and exchange[fig.5]. This dimension produces field conditions, a pragmatic medium through which access control and specific requirements over time can be reconciled.

Infrastructural organizations operate like artificial environments[fig.6], through directing the flow of 'energy and resources' to a site which governs 'density and distribution'[14] across a terrain. This sets preconditions for gradual adjustments in response to:

- 'resource availability'; and
- terrain occupation as a result of fluctuating environmental conditions.

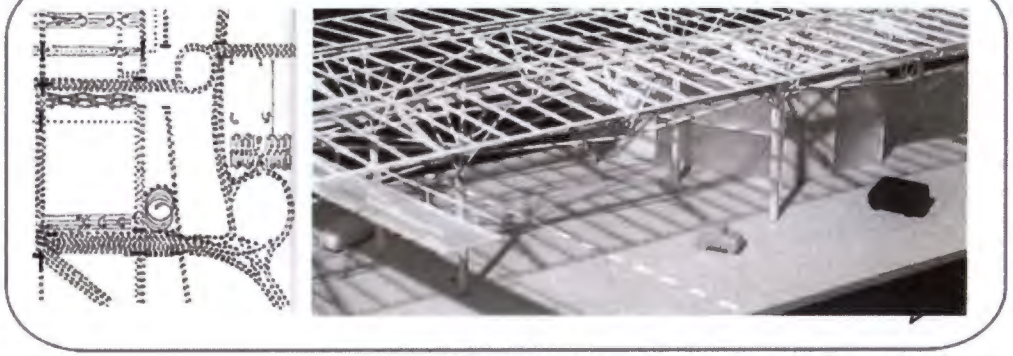
Infrastructure provides the means for 'detailed design'[15] of distinctive elements and composite sequences[fig.7]. It facilitates an architectural discourse into urbanism, which emphasises the performative aspects of infrastructure and transcends conventional scales of planning and typologies.

The propositions on infrastructure differentiate between landscape and urbanism. With that said, I draw assumption that 'landscape' is a metaphor for contemporary conditions, illustrated through Stan Allen + James Corners' field conditions. Latent connections between the different concepts can be realized through field conditions.

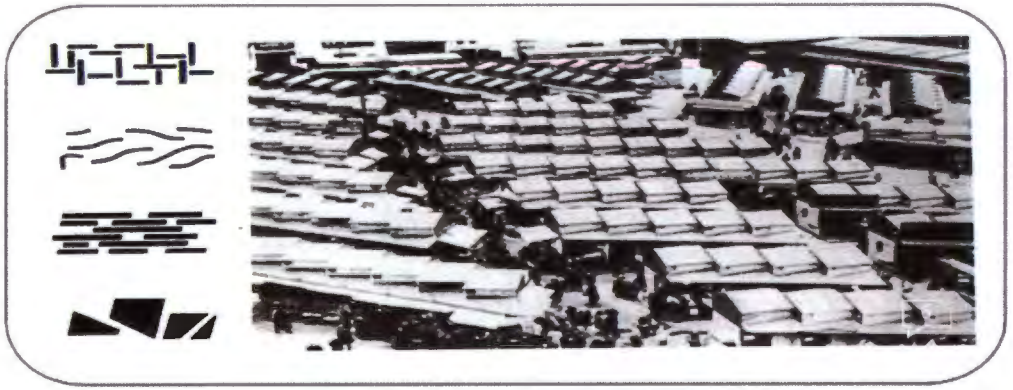
Field conditions

A field condition is a generic depiction of the theatre of operation and is particularly evident in mathematical field theory and 'generative rules of flock behaviour'[16] . It underpins the relationship between object and field, through anticipating change, through a loose set of parameters. In the urban environment, this concept is evident in the connection of open-ended infrastructural networks. In architecture, an enquiry into this concept would have to include a tactile speculation on:

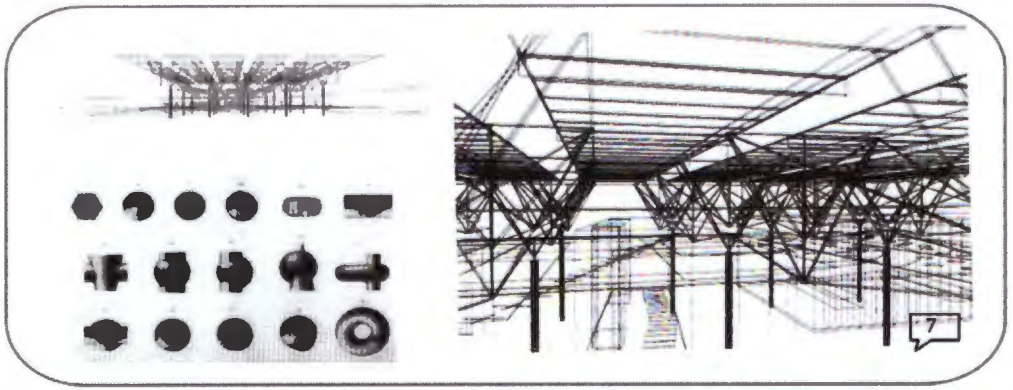
- the dynamics performance of use;
- new scripting of programme and space; and
- the versatility of schematic networks which merge different element, whilst recognizing individuality.



Infrastructure is static, but regulates the flow and exchange



Infrastructural organizations operate like artificial environments



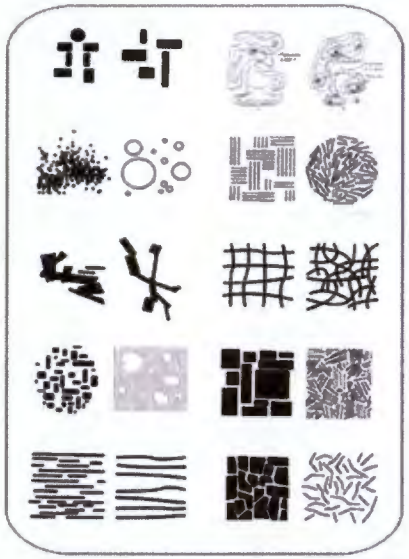
Infrastructure provides the means for 'detailed design'

14 Stan Allen; Points + Lines; Diagrams for the city; Princeton Architectural Press; 1999; NY
15 Stan Allen; Points + Lines; Diagrams for the city; Princeton Architectural Press; 1999; NY
16 Stan Allen; Points + Lines; Diagrams for the city; Princeton Architectural Press; 1999; NY

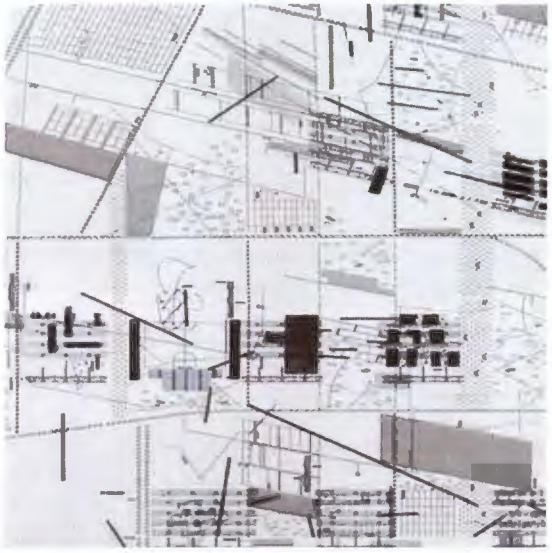
This subject however, does not proclaim to be the absolute process-theory to reproduce architectural form. The focus here is not distribution defined as arbitrary or methodical, but rather as a 'sequence of events'[17] .The opportunities that field conditions present to designers are to reconsider:

- conventional associations between figure and ground ;and
- representational notions[fig.9] between form and abstraction.

The idea is to provide conditions, from which an effect emerges which brings to call systems of organization which enable intensity out of [singular] entities. In order to explain how this procedure takes place, I draw on 'moiré-effects'[fig.8][18] , which is generated by superimposing consistent fields to evaluate concealed tensions. This produces an emerging 2 dimensional figure which merges different fields, endorsing the practice of this concept in architecture through the possibility of continuous 'surfaces'[19] . As the term suggests, the merging of fields occur primarily in the horizontal dimension and suggests 'thickening and intensification'[20] of activity in sequence to the expansive field of the city. Ultimately, field conditions entail for architecture to acknowledge change and spontaneity, through accommodating the 'uncertainty of the real'[21] rather than a complete dedication of certainty.



Moire- conditions illustrated 8



montage notations of speculation 9

Landscape Urbanism

'Landscape urbanism'[22] , as suggested through the ideas of James Corner, aim to collapse and reconcile traditional views of landscape and urbanism. The propositions on infrastructure and the operation of field conditions, as discussed earlier have close correlation to the notion of landscape urbanism. According to Corner, the contemporary metropolis has no visible sense of order and organization, but in this state lays its true potential. Essentially, landscape urbanisms consider the emerging contemporary city, as a dense, inhabitable mat, composed of accumulated surfaces and sequences, with people as governing body. However, in response to the failure of conventional planning strategies, landscape urbanism does not offer absolute treatments or rapid repairs, but unpacks opportunities to engage with the city critically. It operates through these fundamental underpinnings:

- Horizontality, which amplifies opportunity to 'interrelate, move and assemble', whilst allowing differences to coexist and proliferate.
- Surface strategies providing consistent fields and versatile sequences of organization;
- Propagates the potential of the 'infrastructural catalyst'[23] to produce and perform, to liberate future eventualities.

Urban geographer, David Harvey remarked that the quest for new alternatives to organize cities ought to develop from the 'utopia of processes'[24] rather than the 'utopia of form' . This signifies a shift from what things look like to how their operation could be enhance. In order to strengthen my strategy, I draw on through three case study projects and my own design process.

17 Stan Allen; Points + Lines; Diagrams for the city; Princeton Architectural Press; 1999; NY
18 Stan Allen; Points + Lines; Diagrams for the city; Princeton Architectural Press; 1999; NY
19 Stan Allen; Points + Lines; Diagrams for the city; Princeton Architectural Press; 1999; NY
20 Landscape Urbanism; A manual for the Machinic Landscape; AA-publication; Spain; 2006
21 Landscape Urbanism; A manual for the Machinic Landscape; AA-publication; Spain; 2006
22 Landscape Urbanism; A manual for the Machinic Landscape; AA-publication; Spain; 2006
23 Stan Allen; Points + Lines; Diagrams for the city; Princeton Architectural Press; 1999; NY
24 Landscape Urbanism; A manual for the Machinic Landscape; AA-publication; Spain; 2006

Julian Varas – Inhabiting the artificial ground

In this scheme, sequences of pedestrian trajectories were overlaid to construct a spine. The spine[fig.10] connects places of interest at regular intervals. This is then overlaid onto a field of existing infrastructural conduits which generates trajectories that are responsive and informative.

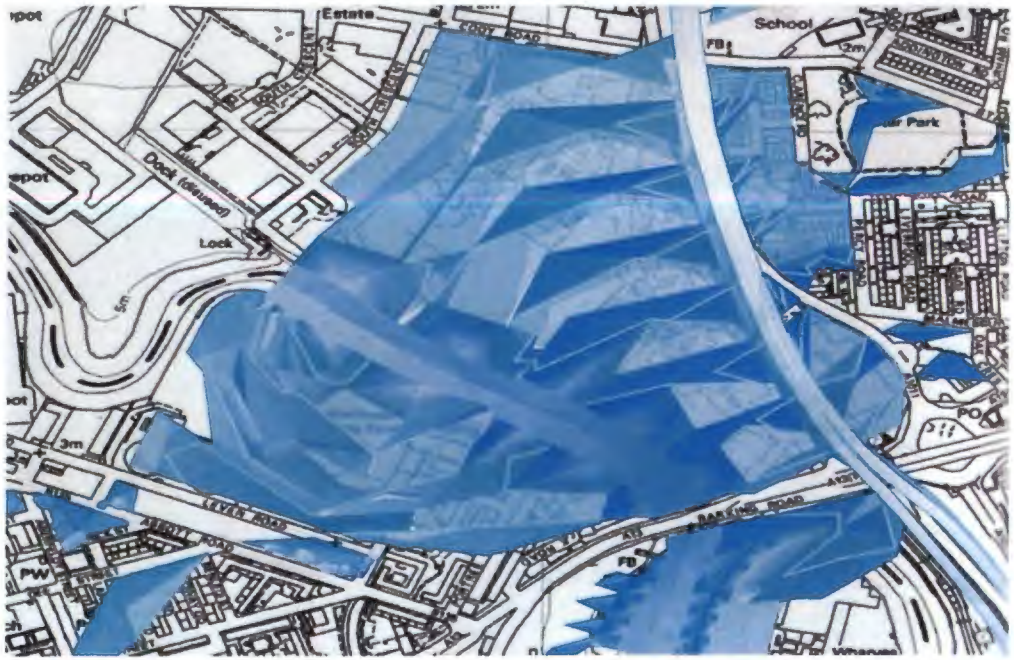
From this, a network of nodes is created. These nodes are then scanned[fig.12] to indicate their visual permeability to the field. This process aims to break repetitive nodal linearity by creating a hierarchy of nodes based on their connections and scale to the broader public landscape.

Public surfaces is then 'texturised and diversified' through a triangulation process, which indicates proposed built areas and integrates formal attributes of the artificial field. This surface fragmentation[fig.11] crystallises development potential and can operate quantitatively and spatially.

This project in my opinion, illustrates an integrated approach from linear sequence to surface and formal attributes. The nodal scanning is a strategy which I will employ in my process to construct a more dynamic vertical argument. In my most recent concept proposal I lacked a solid underpinning of a hierarchy of nodes, height and density differentiation. I wish to insert the idea of a modulated surface plane across the new terrain which has emerged through artificial field relations.

The station catalyst, located centrally in my project will radiate a continuous 3D surface and the notion of folding will be employed to reveal new possibilities. This has the potential, to provide a more ground foundation for engaging with the urban fabric beyond the station catalyst. This process also has the potential of setting a programmatic stage which can better inform formal translation, across the site.

sequences of pedestrian trajectories were overlaid to construct a spine 10



surfaces is then 'texturised and diversified' through a triangulation process 11

nodal scanning strategy 12

24 Landscape Urbanism; A manual for the Machinic Landscape; AA-publication; Spain; 2006
25 Landscape Urbanism; A manual for the Machinic Landscape; AA-publication; Spain; 2006

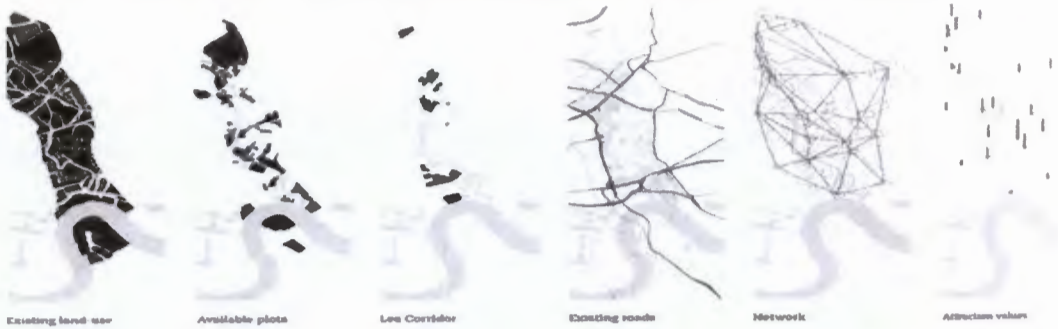
Fabian Heckler – Emerging public space

In this scheme, straight object to field linearity was disrupted through expanding sections of diversity[fig.13]. A movement system based on desire lines constructs a network based on primary and tertiary links of broader connectivity. Fragmentation, availability, 'use and land value'[26] are obstructions in the permeation of the urban fabric. However, as these routes expand over time, traditional linear amenities erode until maximum permeation[fig.14] is reached.

I site this project particularly because maximum permeation is delineated. My field conditions process followed similar principles. This project, however engages much more rigorously with the emerging terrain. Here, the terrain is fragmented along corridors which intensify gradually. In my scenario study, which will be explained later, I preserved some obstructions, which led to a movement order which was still governed by existing impositions.

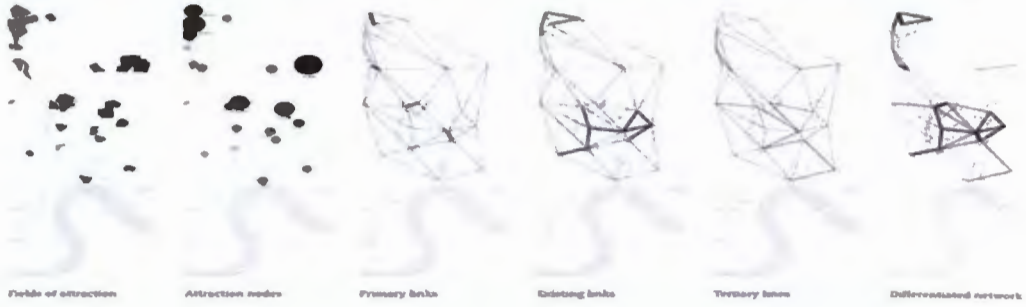
Flow is achieved here through a hierarchy of routes[fig.15]. The primary routes are intensified and spatially articulated to suggest a pilot phase of development and distribution. From these thickened edges, primary links inspire connections to secondary links; and subsequently tertiary links.

My site however has a more radiating quality, but the principles employed in this project illustrate a strategy of shaping a more organic, pedestrian friendly urban form. To improve on my most recent conceptual proposal I will investigate maximum permeability, by shaping a hierarchy of movement routes and remove all flow obstructions. This also indicates a much deeper comprehension of customs and practices of the area are required, which could entail me spending some time in Khayelitsha among the residence of the area.



straight object to field linearity disruption 13

maximum permeation 14



hierarchy of routes 15

Roxanne Scorcelli – Urban Excess[27]

This project locates itself at a river edge, where preconditions generated artificial determinants[fig.16] to drive variation in the scheme. These determinants are quantified, then utilized to organize movement conduits, in association too each other and by varying parameters of the emerging geometry. From here trajectories is dissected to reveal nodes, field relations and edges.

This allows for the evaluation of the system and indicates the extent of density distribution across the new proposed urban fabric. Expressive merger occur between structure and movement, by introducing spaces of relief, shared facilities and vertical connections. These elements operate as thresholds at intersecting moments to guide orientation and movement in the scheme. Movement conduits are then thickened paired in bundles and organized in sequences[fig.18]. The aim is through this is to anticipate growth in the formal attributes of proposed system.

This project in my opinion, firstly encompasses the idea of creating more than what is currently required, to invest in the fact that conditions will change over time. Secondly, the notion of excess, through my deductions suggests that a balance ought to be struck between what is appropriate and what is too much. I am particularly seduced by the rich organic quality achieved in plan[fig.17] through merging expression.

The notion of folding is noted through the manner in which movement conduits flow and seamlessly overlap. Ribbon sequences of movement opportunities, spill into the fabric, to not only speculate its own growth potential, but also reveal the reactions of the urban fabric to the catalyst. I will take into my design process, the manner in which this project integrates with broader infrastructural networks across the site. This could stimulate the attraction value between the station catalyst in my project and other means of interchange.

preconditions generated artificial determinants 16

rich organic quality achieved in plan 17

ribbon sequences of movement opportunities 18

27 Landscape Urbanism; A manual for the Machinic Landscape; AA-publication; Spain; 2006

chapter 2

Technology Research dissertation

Technology research dissertation

Chapter2

Proposition: Stimulating urban renewal; through forging connection between architecture and public infrastructure towards an integral urbanism.

Merging expressions - Infrastructure as integrated structure; its relationship with movement and the opportunities it offers architecture.

Introduction

[Forging connections + integrated approach]

Reconciling objectives of theoretical design dissertation

Static + motion - [visualizing trajectories] - optimization

Methodology

Station = infrastructural catalyst
Movement + peaks :foot counts
[Live loads + capacity] :depth & width
Integrated structural systems & optimizing movement

Case Study Review

Global = Napoli station : deductions + technical strategies Norpark
Local = AHL stations : quantitative + spatial + structure + integrated systems
Global vs. Local = design strategy

Unpacking design strategies + illustration through design concept

Introduction

Merging expression between architecture and engineering has the ability to generate richer stations, both visually and experientially. The merging of expression notion manifest itself in the proposition as ' forging connections' and entails an integrated approach of design practices and technology to aspire to a built environment that is completely interconnected. This notion has various scales of spatial intervention and technological implications.

Reconciling objectives of theoretical design dissertation

In my theoretical design dissertation I emphasised the significance of field conditions in architecture as a strategic medium to activate stations as a generator of urban growth. The objectives are to:

- Firstly; transcend traditional perceptions of infrastructure and develop an understanding of what infrastructure could be, through reconfiguring how it functions holistically in the urban landscape.
- Secondly; to translate latent and progressive urban conditions ;through this
- To expose the potential of infrastructure as generator of integrated urban growth.

I wish to advance this argument in this investigation, to analyse how movement systems fuse with concourse plane and roof and how structure translate the static and motionary. By implication, this suggests that my focus is on integrated systems of expression and how it relates to movement. Architecture, infrastructure and structure to the naked eye are static constructs, but within its different components it seeks an equilibrium which negotiates forces in tension and compression.

Engineers are able to visualize these force trajectories and make it visible through structural optimization to enhance performance as illustrated in structural typologies. For architects this offers analytical parameters to understand and generate form that performs. From this discussion I intend to adopt and develop a design approach which aspires to integrate structural components to optimize the experience of movement at stations.

Methodology

What makes a station an infrastructural catalyst? This enquiry is vital in establishing a basis for this discussion. A station to me is public infrastructure, in which the optimization of movement should be the most critical aspect. Movement occurs through the mechanical operation of the trains and the manner in which commuters are deposited onto the platforms. Then how commuters are elevated onto concourse level, where choice is offered and commuters are absorbed into movement trajectories. These trajectories aim to reconcile with pedestrian desire lines to points of attraction, intermodal interchange and safe routes home.

At a station, movement peaks fluctuate between mornings [5-8am; going to work and school]; afternoons [1-3pm], coming from school and evenings [4- 6pm]. The primary demographics of the commuters are people going to work and school. Fridays and Mondays the higher traffic is expected. These are known fluctuations in the contemporary cities and agencies [formal and informal] take full advantage of this potential.

In structural engineering terms, this means foot counts and fluctuation of live loads. This implies the provision of structural attributes such as strength, stiffness and stability to facilitate or regulate flow. This can be illustrated through the lateral movement of the commuter from street- to-street across the railway tracks and from platform to concourse level. The concourse level, aims to be an assembly plane of intersections, which is spatially articulated by geometry, generated through structural optimization. Live loads are fluctuated mass movement of commuters which is distributed from the centre of critical mass across a grid of supports.

This translates into distances or spans, which in accommodating mass, generates depth. Width is generated spatially, by assigning appropriate values by anticipating places of high traffic. The greater the span the more its structural depth and similarly, the more people traffic, the wider the space ought to be. These values, both width and depth can be manipulated through the choice of structural system, but more importantly it provides an analytical reference to integrate structural components to allow for ease of movement.

To achieve and illustrate the intentions mentioned above, I draw on a global and local comparative case study review to unpack structural attributes and design strategies. I draw on the work of Zaha Hadid through a descriptive siting the Napoli station. This project influenced my thinking, however since it has been recently proposed, not much technical information is available at present. I will however make deductions based on insight and locate technical strategies through siting the built Norpark alpine stations.

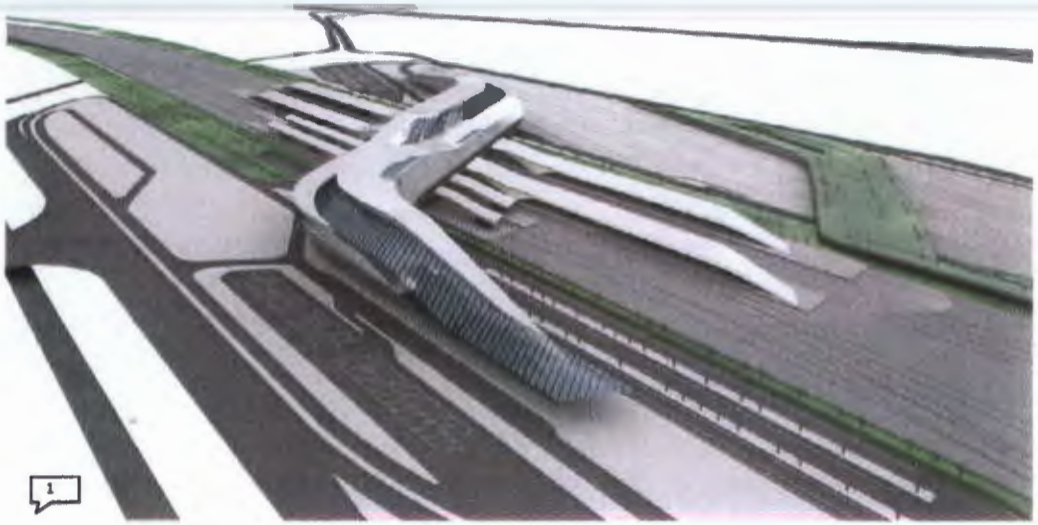
A shift occurs here from railway to funicular stations; they differ in scale but the same design principles are present. Through this I wish to create a global comparison through the design process of Hadid from design concept to construction.

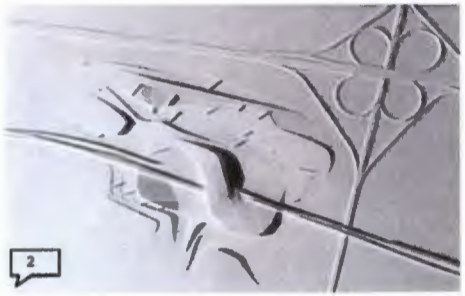
From here, I site local comparison through the work of Jonker + Barnes architects, in the redevelopment of Athlone, Heideveld and Langa station. The reason why I have selected these particular local projects is because it creates a dialogue of expression for conditions on the Cape Flats. I have identified Khayelitsha station as site of intervention. The selected local projects share quantitative, spatial and structural similarities with Khayelitsha station and I intend to draw out strategies to generate a dialogue of expression to enhance my design approach.

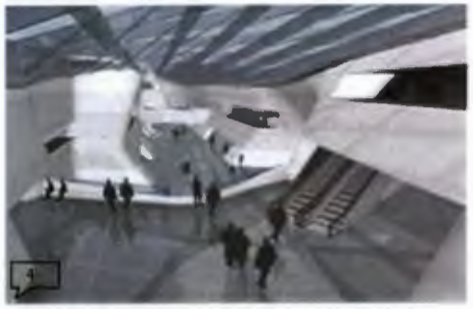
Napoli station - Zaha Hadid

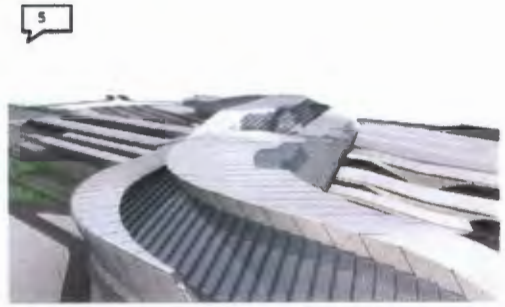
The concept for this station relates to the trajectories of commuter from street-to-street and the broadening of the concourse above. Desire lines are translated into lucid ribbons which fold and unfold to present an idea of skin that unwraps to form the interior [fig.4] of the concourse, which creates logic for continuous surfacing influenced by movement and light. The concourse volume is dedicated and column-free, with a glass roof overhead. The structural system employed seem largely concealed[fig.1], however the plastic attributes of the building is achieved through forging connections between structural components and movement. The warping roof plane[fig.5] fuses into placid walls, which in turn merges into the concourse plane to suggest ideas of an integrated system. Where intervals occur in the flowing surface, dynamic voids appear which carves out sections and overlaps which is expressed internally and externally.

My deductions are that structurally, force trajectories are made visible to achieve the overall form. Two sets of platforms are visible[fig.6], which possibly distinct between high-speed and regular train traffic. The main vertical supports are located on the forecourts [fig.3] at either sides of the railway line and at the centre of the 4 platforms. The lateral movement logic dictates that the span across the 6 points of vertical support occur through a S-shaped plan[fig.2]. From the forecourt approach, its is visually anchored into the ground and ascends gradually to the concourse plane. Slab and beam depths are manipulated to support cantilevers through, thickening and by means of ring beam support which culminates into the concourse plane.









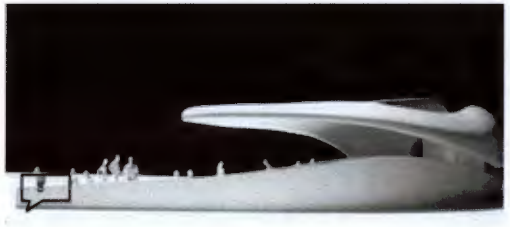
The insertion of a dedicated movement spine [fig.6] splits the concourse into 2 regions. In order to achieve the plastic attributes of these regions materially, my opinion is that reinforced concrete will be used for its moulding capacity. The glass roof insertion [fig.5] overhead, sits supported between the regions, to allow for natural light to animate the space as it falls onto the curvaceous interior walls. This project, in my opinion, captures the notion of rolling and bundled surfaces and the material possibilities of obtaining plasticity through integrating movement, plane, walls and roof systems.

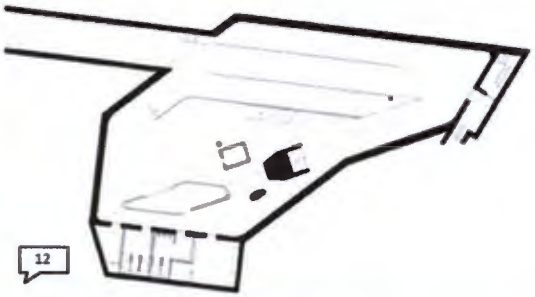
Hungerburg funicular stations – Innsbruck

It is my opinion that similar design principles are present in railway stations and funicular station. Railway stations operate mainly horizontally, whilst funicular railways are found at mountain inclines pulled by moving cables which counterbalance ascending and descending shuttles. Thus, the operational mechanisms differ somewhat, the building typologies operates very similarly. The comparison between the typologies also serves to enrich my design process through extracting complementing features[fig.7]. This draws my attention to the recently completed Hungerburg Alpine funicular railway line, which stretches 1700 meters over 4 stations, at an incline of up to 46%. I site these stations to extract the technical strategies inherent to Hadid's work, in sequel to the ideas presented through the Napoli station.

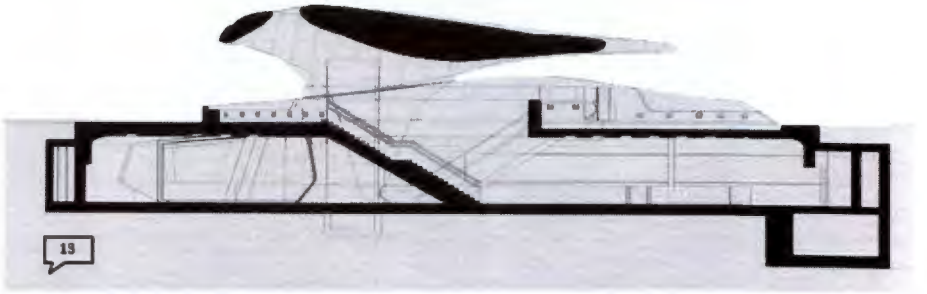
Congress station

The first of the four stations is located at a narrow traffic bend, where pedestrian and cycling paths overlap, at an altitude of 568 meters at the foot of the Norkette mountain range. An escalator and reinforced concrete staircase draws in pedestrians from either side [fig.10 + 11] to form a rolling plinth of solid concrete. A double-curving, glass membrane canopy arches over the concrete plinth. An opening in the canopy brings in natural light to the underground platform level. The lift[fig.11] sits in this volume in a steel and glass shaft. The different movement systems, mechanical and fixed sits embedded in the concrete shell[fig.12]. There is no obstruction of movement and the movement system operate both independently and collectively to animate the rolling surface. The building is quite heavy in mass, but structural components are integrated to optimize movement. In the overarching canopy[fig.8+ 9], depth is manipulated sculpturally to achieve its curvaceous character and structurally[fig.13] to channel forces of compression onto the concrete plinth without using columns.





underground platform level plan



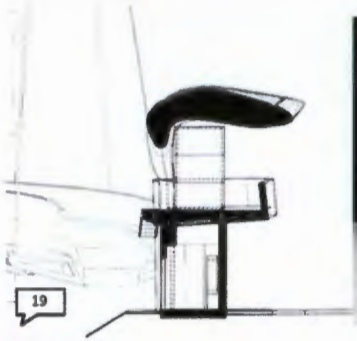
longitudinal section

Löwenhaus station

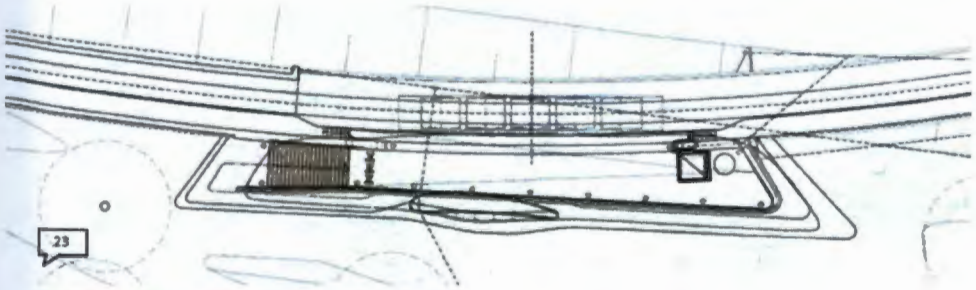
At the second station interval, the station building is located at an altitude of 574 meters. A concrete plinth ascends 4 meters to platform level[fig.19]. The platform level is supported by an angled reinforced concrete stairway on the one end, and by wedged concrete wall configuration next to the lift shaft on the other end. In between these fixed structural points, a slanted wall and beam configuration, assists in distributing live loads across an estimated 20 meter span[fig.24].

The wall and beam configuration follows the silhouette slanted staircase, platform and lift to form an arch-like opening on ground floor. This configuration[fig.20], in my opinion, act as an optimized shear wall for lateral stability which is generated by off-setting various depths from the main structural components and a thickening of knuckles at intersecting points. The double-curved roof element [fig.21+22], spans curvaceously over 2 storeys with large cantilevers over the staircase and lift shaft with 2 fixed structural points, one on the lip of the concrete plinth and the other anchored in the ground.

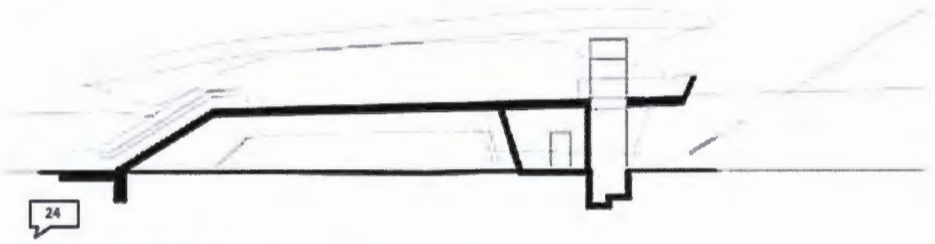
Out of this project I wish to take into my design process, the manner in which the structural components merge with movement mechanisms to optimize visual expression. The stairway and lift facilitate the 2 approaches to the station, and operates collectively to activate and support the platform plane through structural elaboration.



cross section



platform level plan



longitudinal section

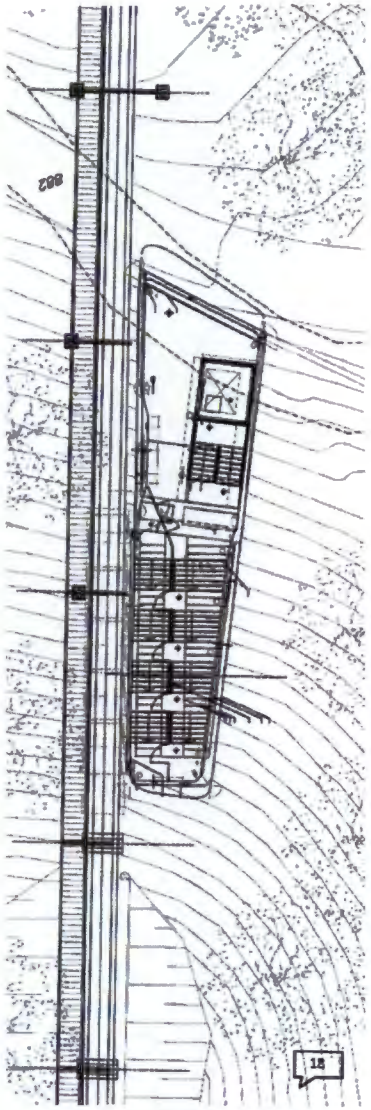
Alpenzoo station

The third station, Alpenzoo station is located at an altitude of 667 meters on a narrow forest clearing strip with an incline of 46%. The structure sits in an excavated piece of land, and comprises of a 24 meter high reinforced concrete embankment[fig.15] which rises up to a horizontal platform. The embankment acts like a load-bearing cavity wall, retaining the excavated earth and distributing live loads vertically to the ground[fig.14].

Beam members connect the two regions and cavity conditions exist. The cavity optimizes the depth and width of the structure and allows it to swell and shrink under extreme climatic conditions. The embankment houses a steel and glass lift shaft and external staircase in front of the structure[fig.16 + 17]. The horizontal concrete viewing platform cantilevers of the central support of the embankment and rises up to a stepped platform, which follows the trajectory of the railway course. The stepped platform is supported by a series of beams at fixed intervals and an additional slab member at an incline which act as an external skin. The sloped slab[fig.14] distributes the live loads from the beams onto a wedged concrete column, which anchors the stepped platform to the ground.

The double-curving glass roof[fig.17] uses a similar geometric and structural language as the aforementioned stations, and arches over the concrete embankment and stepped platform. This project in my opinion illustrates, in my opinion how depth and width ratios can be modified through a sandwich configuration. These configurations exemplify the optimization of structure, by reducing the material mass and creating cavities to help the building react to extreme climatic conditions.The project also depicts how vertical expression can be achieved at narrow site conditions[fig.13]. The building offers strategic suggestions of orientation and viewing. The movement sequence up the embankment seems very strenuous if not by lift, but is a direct result of the extravagant slope. To apply this model in my design process, further consideration would need to be given to ease and reconcile vertical movement by staircase for conditions suited to my site, Khayelitsa station.

14 cross section



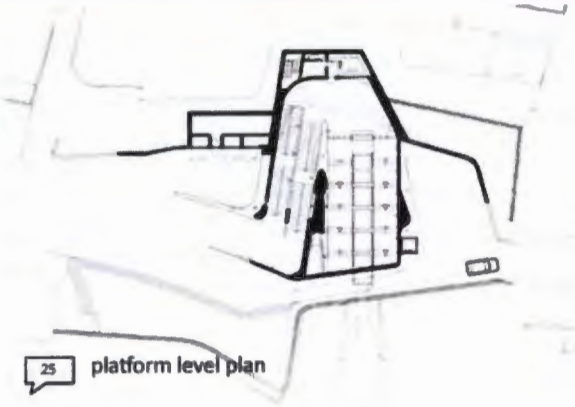
platform level plan

Hungerburg station

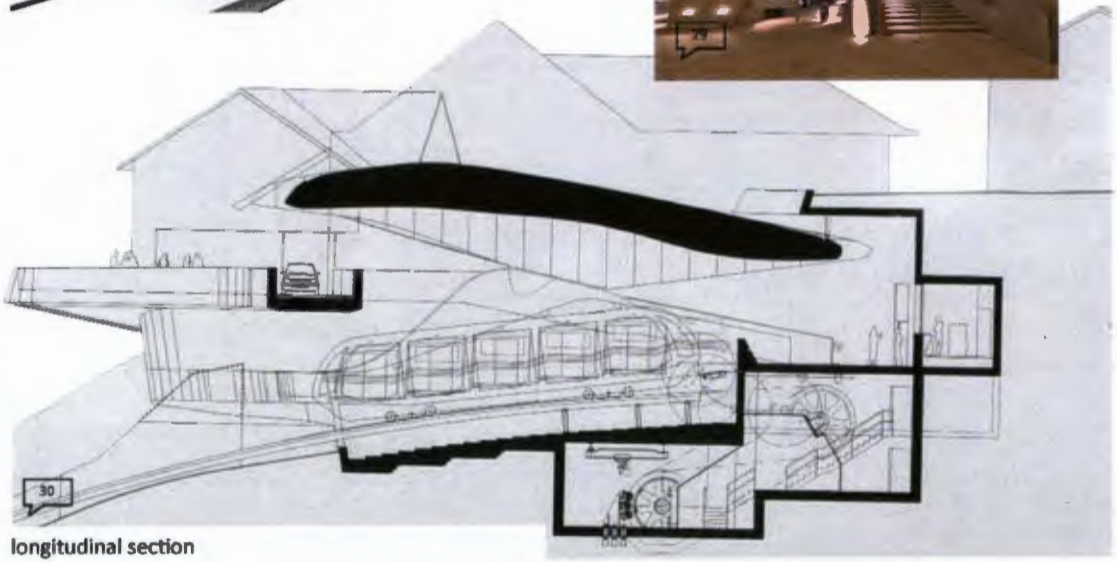
Hungerburg station is the final destination on the railway course and sits in an excavated concrete shell at an altitude of 857 meters, the highest station in a railway course and facilitates an foot count of 1200 people every hour. This station seeks to blend in with the natural contours of the Norkette Mountain. The structural components comprise of a system of concrete retaining walls which carves out a horizontal plane[fig.25]. The basement floor houses the cable operating system[fig.30]. From the horizontal concrete plinth, movement toward the station platform occur in a whirlpool – like manner. The robust, solid concrete plinth gives rise to sloping [low] concrete walls which follow the trajectory of the stepped surface[fig.26].

The movement sequence starts of with 2 offset staircases split by a low wall[fig.28+29]. This leads one to a bend and an access control threshold and station platforms which are 2 sequences of stepped planes. A glass lift is located at the outermost edge of the platforms. The double-curving glass canopy follows a similar structural language as the other station. Only here, it is much more structurally expressive and create a double arch which butterflies of the platforms and stairways[fig.27]. The roof canopy[fig.30] is vertically supported at 3 points to transfer dead loads to the ground. An additional tensile steel member is evident in section and my opinion is that it provides additional suspension – support to the back edge of the geometry.

The geometries of the roof canopies at the 4 funicular stations were formed using car and boat software modelling technology. Working models at a scale of 1: 50 were used to test surface continuity, to achieve the 'shell and shadow' concept. Thermo- formed glass were put through rigorous test for stability and durability and the individual stations comprise of an estimate 2000 different glass pieces. The glass thickness varies between 10 and 12 centimetres because of varnish and coating variations. Each glass panel is different, and its measurement and curve had to fit perfectly to form the roof shell. The canopy geometry was generated to fit each particular concrete plinth conditions. Glass element was inserted into a high temperature mould in accordance with the designer's 3D parameters. After this, a float glass film is attached to the glass pieces to the distinct colour. The glass pieces are then bonded onto metal brackets on the outside of a steel rib cage. The steel support system comprise of longitudinal and transverse elements with diagonal bracing. The external surface of the glass canopy is flush and rainwater is collected through concealed gutters.



25 platform level plan



longitudinal section

Langa Station

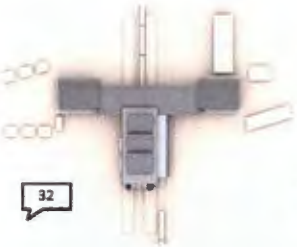
Langa station is located between Langa and Epping Industria, in the northern suburbs of the Cape flats. In 2007, Jonker & Barnes architects was mandated to advance the buildings capacity, along with Heideveld and Athlone stations. The principle agent, Jeffares & Greene and clients, SARCC main objective was to redevelop the stations from the existing subway model to a concourse station. According to Census 2002 , at Langa station the morning peak [6 – 8: 30am] generates a foot count of 30280 people in both directions and the evening peak [5 – 6pm] generates a foot count of 14570 people, served by 25 trains.

Spatially, this was translated a concourse box [fig.32] elevated 6500 mm above ground. This connects to a 50 metre long walk, winged by 2 circulation boxes, comprising of interrelated ramps[fig.33] and stairs. The circulation boxes[fig.31], located at the forecourts aim to direct density and structure dedicated routes to the station. The 1 :15 ramp[fig.36] gradient, comprised of a 7500mm length to a 500mm height ratio, with intervals on 1500mm landings rising up to the first 3000mm. From there the ration adjusted to a 5000mm length to 330mm height ration, with intervals. The ramps rising up to the first 3000mm was supported by load-bearing brick walls and hardcore infill, the remaining ramps were supported by steel I-section columns on concrete plinths at the landing intervals. The ramps support forms the periphery of the circulation box building envelope.

All the station administration and operation occur at the concourse[fig.37]. To filter in natural light a saw tooth roof was proposed, with triangulated steel truss members[fig.34]. My opinion is that this project[fig.35] illustrates straight forwardly what the main spatial components are and spatially division and integration should occur in sequence from forecourt to platforms.

35 longitudinal section

31



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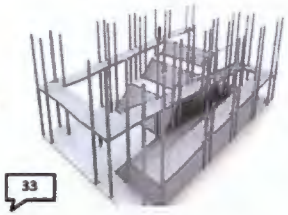

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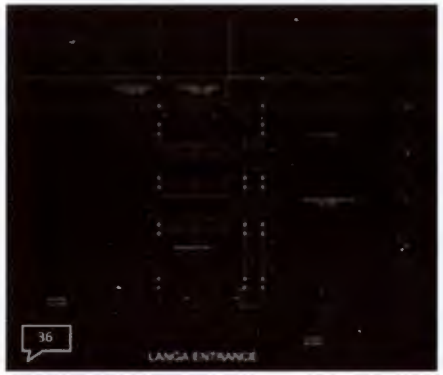

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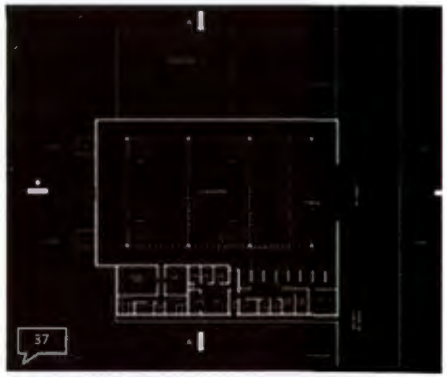
circulation box plan



37

concourse plan

Heideveld station

Heideveld station is located between Heideveld and Gugulethu, and generates a morning peak of 15307 commuters and an evening peak of 8502 commuters, served by 25 trains, according to Census 2002 estimation . These values were inputted into a spatial parameter analysis compiled by Jeffares & Greene engineers to extract a design value from which a design concept in collaboration with Jonker & Barnes architects was conceived. The Gugelethu forecourt has already been incorporated into a urban design scheme by ARG architects comprising of ablution facilities, informal trading sheds, vegetation and paved surfaces. It was thus important to participate in existing design gestures and create similar conditions on the Heideveld forecourt. On both forecourts, very narrow site conditions exist, making the integration of movement systems quite complex[fig.39].

Two linear movement systems comprising of 130 meter long ramps and a 10 meter wide staircase, fuse into a dedicated sky bridge for street to street access[fig.42]. The pedestrian bridge is then layered with station programme to enforce access control through 2 openings to the station concourse[fig.44] which leads commuters to the platforms. A canopy and tree- like steel column ecology[fig.40] was proposed as the driving idea to fuse the pedestrian bridge and concourse under an expansive canopy. The canopy and concourse level slab are supported by a family of 9 [comprising of 4 columns each] tree like steel columns, located on the platforms, distributing gravitational load onto piled foundations. The concourse slab[fig.41] is a Bondek construction, comprising of steel plate girders spaced at 5000mm centres with Bobcrete infill panels; a structural concrete topping and wire mesh on top of slab. The concourse to platform staircases and lifts are located in the column family composites to maximize compression load distribution.


38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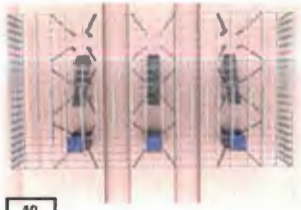
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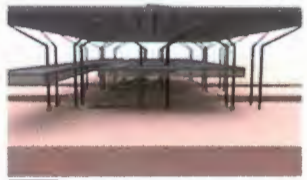
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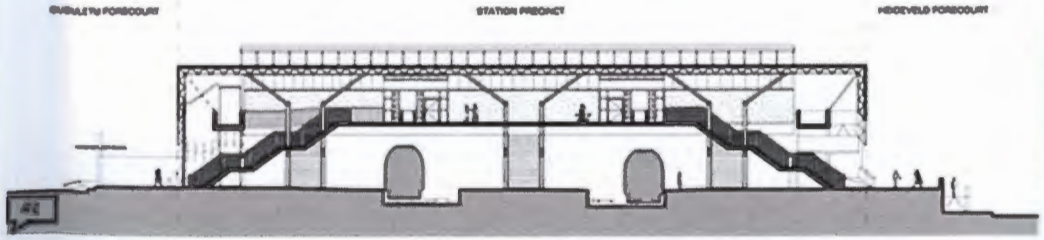
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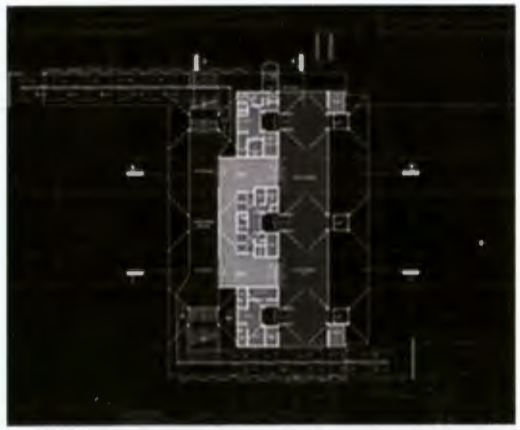
longitudinal section


43

heideveld forecourt plan


44

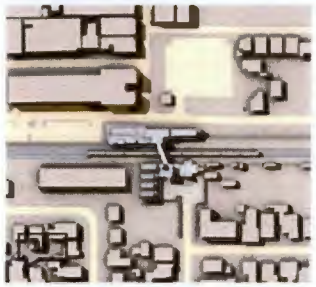
concourse plan

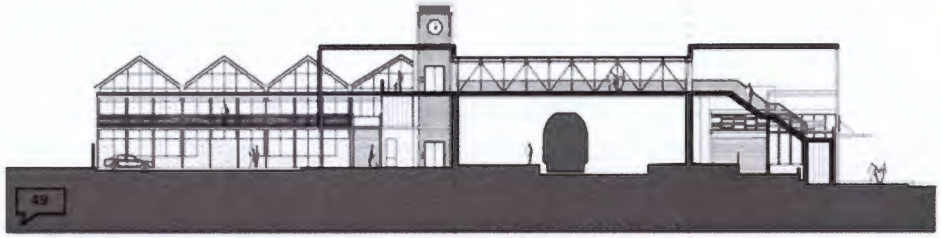
The canopy proposed, is to be constructed out of a 500mm deep spaces frame. The ramp system[fig.43] complies with the configuration outlined at Langa station. This project illustrates, in my opinion, the layering of programme [bridge- admin-concourse] to generate effective access control. The expansive canopy seeks to unite the different programmatic and movement entities through structural articulation.

Athlone station

Athlone station sits in between a dense Athlone CBD and the Sybrand Park suburb. Unlike Langa and Heideveld stations, limited land is available for development and the existing historical station had to be preserved. This station generates a morning peak of 3822 commuter and an evening peak of 804 commuters. The design concept[fig.46] deviated from the concourse station, with a new administrative station building proposed on the eastern forecourt with a narrow system of ramps rising up 6,5 meters onto a pedestrian bridge. The pedestrian bridge spans about 28 meters diagonally[fig.45] over the railway tracks and platforms and ends in a crush space where a lift shaft/ clock tower is located.

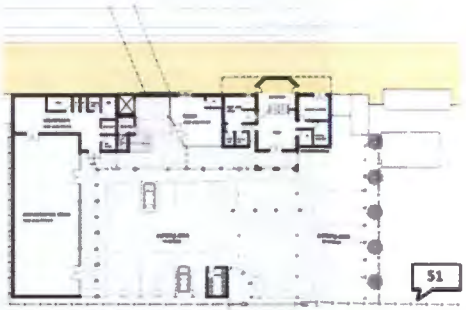
The reason for this, is Intersite [the property management agent of the SARCC] had limited land available on the western forecourt[fig.48 + 51]. A system of ramps could not be realized without taking up most of the space and collaboration with a private developer secured a lift mechanism in the proposal for street- to street access. Unlike the other station, the integrated land-use and development provided a better means of vertical circulation. The maintenance and capital of the lift is completely mandated to the private developer, which in turn is able to take full advantage of the foot count the station generates. The existing station building was to be refurbished with new internal spatial planning and link to the circulation tower. On the eastern forecourt[fig.47 + 50] the station building was to be constructed of concrete and masonry, with multi-storey window openings onto the street, a 2 meter wide Kliplock and steel roof overhang and distinct horizontal mesh fins. A light Kliplock roof on C-channel purlins floats over the ramps, pedestrian bridge and western forecourt tower, supported on vertical I-section steel members and cross bracing. The clock tower consists of a steel and glass lift shaft with an external wire mesh skin.





longitudinal section

eastern forecourt plan



western forecourt plan

The envelope of the circulation tower has the same language as the horizontal wire mesh fins of the new station building. A new retail proposal, comprise of a series of steel portal frames[fig.49] in a concrete and masonry shell. A timber deck supported by vertical I-section member and a 2 meter wide roof overhang connects the retail sheds to the circulation tower.

chapter 3

Bibliography

- Modern Trains and Splendid stations: Architecture, design and rail travel for the 21st century; Merrell Publication; The Art institute of Chicago; London; 2001
- The Modern station; Brain Edwards; New approaches to railway architecture; E&FN Spon-publication; London; 1997
- Architecture of Rail; Marcus Binney; The way ahead; Academy Editions; London; 1995
- Interfaces / Intrafaces; Marcosandmarjan; Cons2quence: book series on fresh architecture; Institute for cultural policy; SpringerWienNewYork- publishing; Austria; 2005
- Landscapes in Motion; Digital Hadid; Patrick Schumacher; Birkhauser-publishing; Pg 74; Switzerland; 2004
- Liquid Spaces; Zaha Hadid; Projects documentation; Thames & Hudson-publishing; Pg 23; 108; London; 2004
- Mark #1: Another architecture; Published by Frame; December 2007/ January 2008, Pg 173 -181
- The State of Architecture at the Beginning of the 21st Century- Tschumi + Cheng Monacelli Press- Columbia Books of Architecture-Pg 14 Winy Maas, towards an urbanistic architecture + Gregg Pasquarelli, Architecture beyond form
- ROAM- Reader on the Aesthetics of Mobility; Ed. Anthony Hoete; Black Dog Publishing;2003; NY + London
- Five Minutes City; Architecture and [IM] mobility; Winy Maas; Rotterdam 2003; MVRDV; Episode Publishers
- Urban Review Report: Upgrade of Athlone, Heideveld and Langa train stations; Jonker & Barnes architects in association with Jackie James, Intersite & SARCC + Metrorail; 2007

Image reference

1-6 Liquid Spaces;Zaha Hadid; Projects documentation; Thames & Hudson-publishing; Pg 23; 108; London; 2004

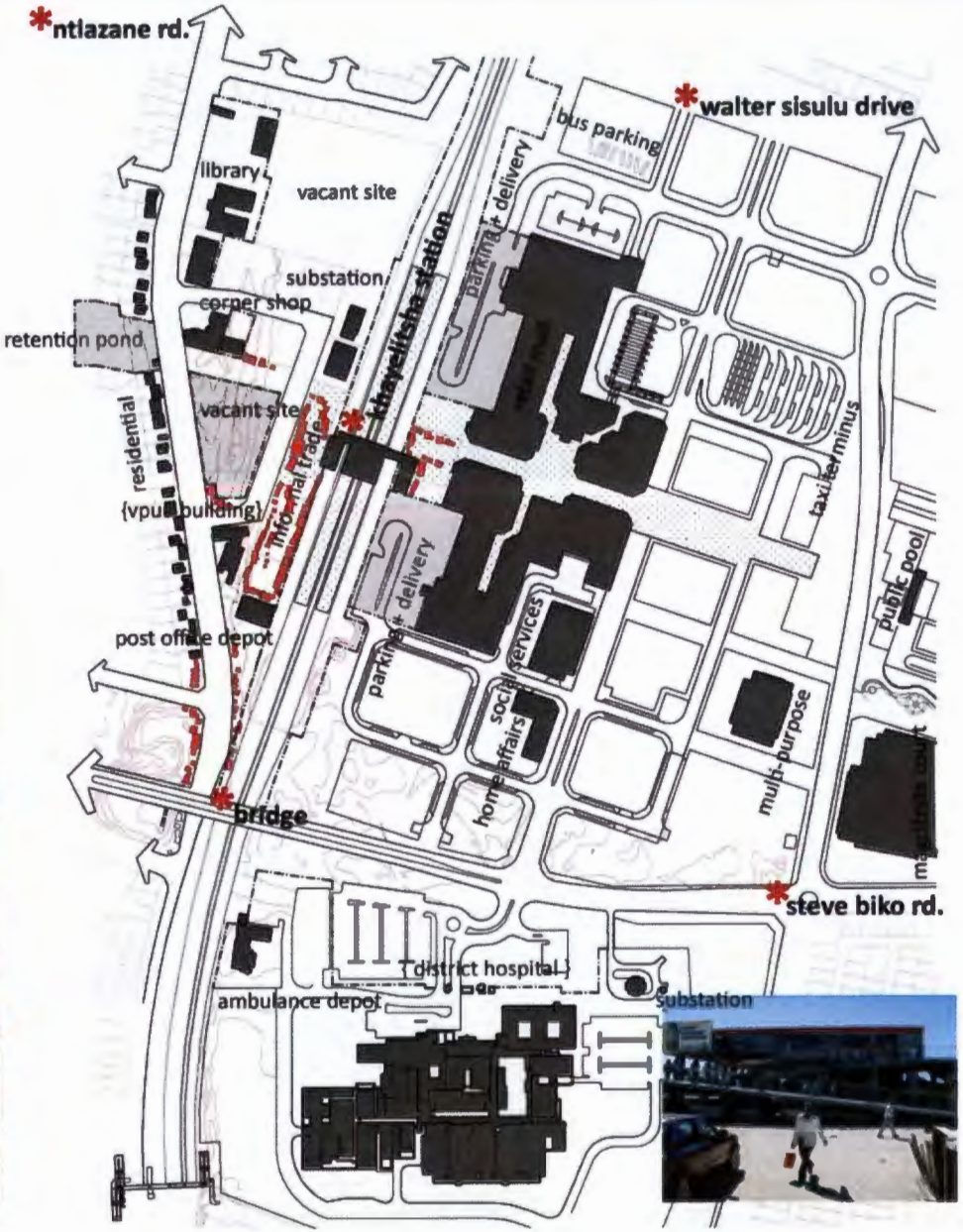
7 – 30 Mark #1: Another architecture; Published by Frame; December 2007/ January 2008, Pg 173 -181

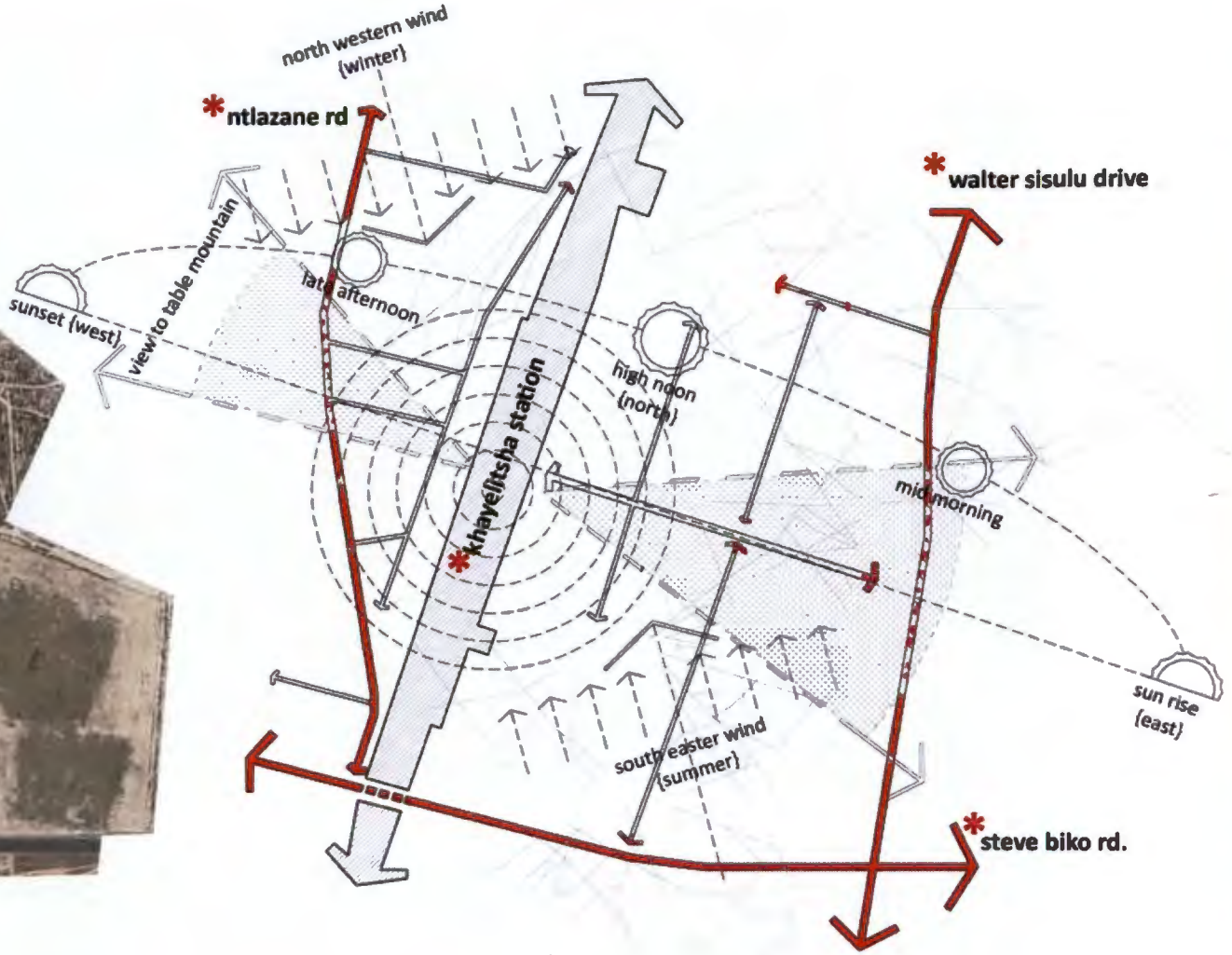
31 – 51 Urban Review Report: Upgrade of Athlone, Heideveld and Langa train stations; Jonker & Barnes architects in association with Jackie James, Intersite & SARCC + Metrorail; 2007

51 – 71 Own design process images

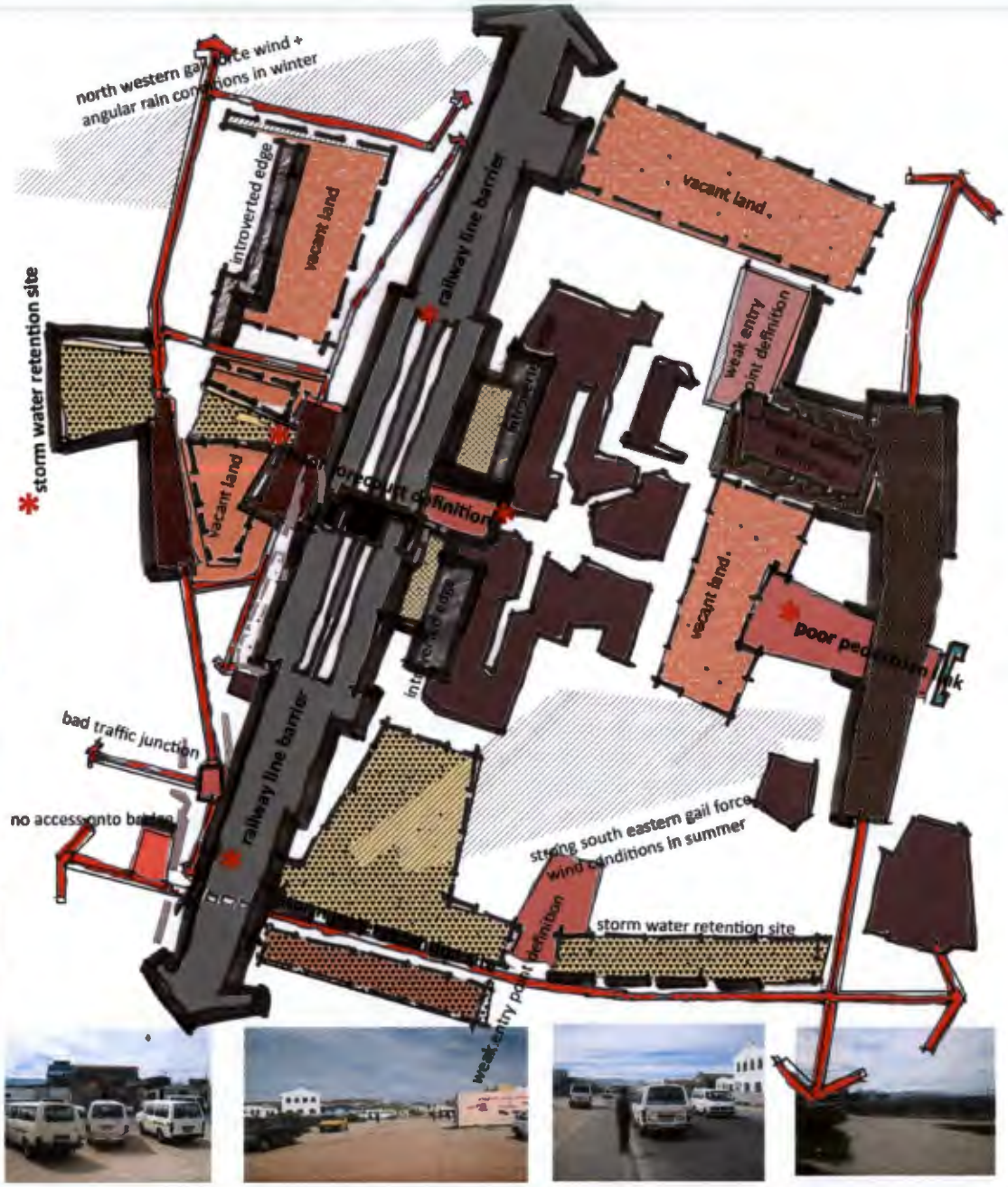
53 Five Minutes City; Architecture and [IM] mobility; Winy Maas; Rotterdam 2003; MVRDV; Episode Publishers

The urban condition at Khayelitsha station, is a general depiction of affairs of stations on the Cape Flats. The station is located at the point of critical mass in the Khayelitsha CBD and recognized as an urban renewal nodel in the greater Cape metropole. The site boasts with recently completed multi-purpose centre, magistrate court and retail mall. A VPUU building and district hospital is currently under construction. The spatial experience of the site is characterised by under developed land,however a rich and affluent informal trade cluster on the forecourts prompted my to follow the direction of the footcount in order to intervene rationally




north western wind
(winter)
ntlazane rd
walter sisulu drive
view to table mountain
late afternoon
sunset (west)
high noon
(north)
khayelitsha station
mid morning
sun rise
(east)
south easter wind
(summer)
steve biko rd.

Issues	Khayelitsha Station Precinct
Access	→ There is poor access to the station on both sides of the railway line. → There is no independent pedestrian crossing over the railway line. → Existing concourse over railway line insufficient to force connections with forecourts- an interrupted station precinct exists.
Vacant land	A large amount of the land around the station is undeveloped and therefore provides very limited natural surveillance.
Poorly defined forecourts	No definitive spatial definitions, where commuters transfer onto forecourts.
Special needs passengers	The ramps, the primary means of special needs facilities access, is compromised in function, due to negotiation in use occur between able commuters and informal traders.
Safety	→ Commuters are very susceptible to crime, particularly on: → Occurs walking to, from and between transport facilities; → Waiting at boarding points and facilities; → Travelling on board a mode of transport. (En-route). → No 24-hour surveillance exist, which is aggravated by inadequate lighting and unsafe routes
Signage	Station signage is inadequate; consequently passengers wait on the station concourse until they see the train arrive.
Barriers and poor connections	The station precinct is separated from the shopping facilities on the eastern forecourt, signified by a backyard-delivery attitude towards the station threshold.
Orientation	Buildings and activities are isolated events in space, public spaces and routes on east-west axis are interrupted. Taxi-rank, bus-stop and long-distance bus service facilities occur sporadic and there exist no connections to suggest an intermodal interchange.



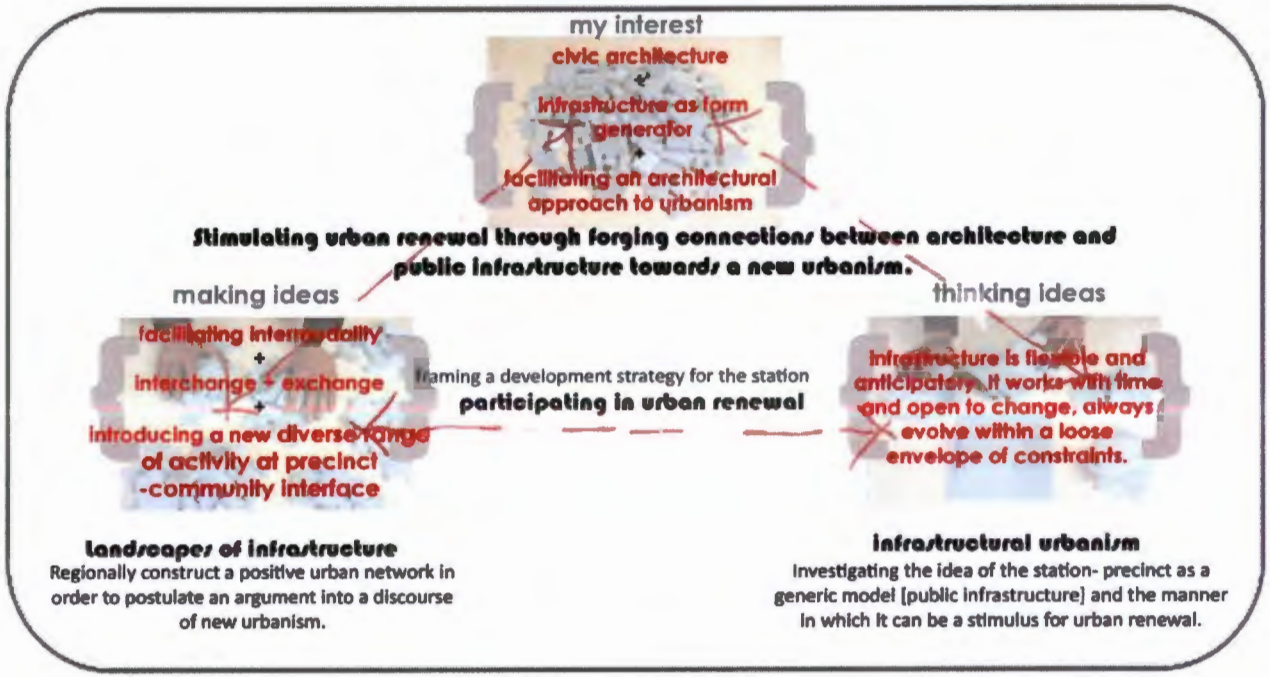
Opportunities	Khayelitsha Station Precinct
Integrated station precinct	The undeveloped lands on both sides of the station provide an ideal opportunity for an integrated station precinct development .It provides the opportunity to strengthen the connection to Khayelitsha CBD.
Informal trading connections	The informal traders provide a necessary service on both sides of the station and should be part of the proposed station development.
Bridge Access	The opportunity exists to provide a road-to-road pedestrian bridge complimentary to the Station development, possibly in partnership with CoCT
Interfaces with forecourts +existing activities	The parking area opposite station on the west provides opportunity for integrated development with the station. The parking areas and minibus taxi holding area on the distribution road provides opportunities for multi-purpose development complimentary to the station precinct. This would strengthen the connection with the CBD and improve the overall safety of the area.
Additional rail lines	Additional railway lines is under investigation to introduce a freight line, this would facilitate a distribution component to the station and CBD.
Clustering activities	Investigate the opportunity of forging connections among the forecourts, court + home affairs, retail, multipurpose centre, library and post office.
Inter-modal interchange	Existing long-distance bus service exists on vacant land on the north east side of the station. The bus and minibus taxi stops on the distributor road on the west forecourt provide the opportunity to strengthen an inter-modal interchange with the station.
Proposed new buildings	Bus + taxi terminus Criminal investigation building Phase 2+3 of multi-purpose centre Service station New Regional hospital VPUU light box building

The design process which I followed was initiated with a propositional notion. In formulating the proposition ,through an architectural discourse I made distinction between my interests, making and thinking ideas. The proposition [Stimulating urban renewal, through forging connections between public infrastructure and architecture towards a new urbanism] was shaped through merging initial themes of interest. From this basis, I postulated an argument which led me to research to investigate compatible design approaches.

I was conscious that the proposition which I tabled was very broad with various scales of interpretation. In scoping an architectural mandate, I was inspired by Parc de la Villette, by Bernard Tschumi and locallyby the VPUU [Violence Prevention through urban upgrade] – light boxes in Khayelitsha by Jonker & Barnes architects. These projects share similar design approaches and spatial attributes which outlined to me, an architectural approach to urbanism through a dialogue of infrastructure.

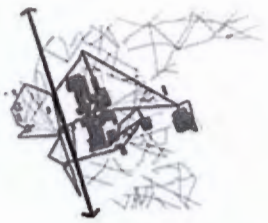
Through following this inclinationI I discovered a conceptual diagram by Winy Maas from MVRDV which roughly encapsulated my line of thinking. My deduction from this concept diagram was that of a sequence of gradual urban growth and phasing to achieve formal and spatial attributes of the precinct precinct .

The diagram suggests an elasticity or versatility, through which connections can be forged with other structuring entities to initiate a new urban order and growth speculations. This aided me in setting preconditions, in search for a site for intervention. Khayelitsha station,an urban renewal node within the greater Cape Town metropole complied with the parameters for a study site.



formulating the proposition

conceptual diagram by Winy Maas



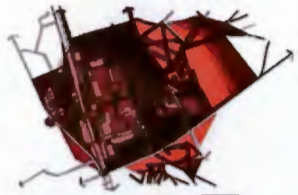
commuter trajectories and movement patterns [1]

forging artificial field of relations [2]

formal + informal movement systems [3]

sequence of nodes [4]

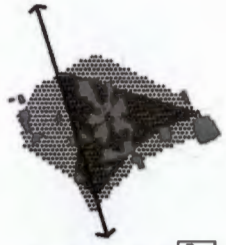
a new terrain emerges [5]



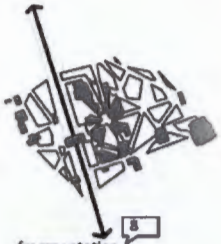
flow is obstructed by current impositions [6]

Buildings and desire lines data was generated through tracing the aerial picture. I then overlaid places of attractions[1], formal and informal, with commuter desire lines, revealing commuter trajectories and movement patterns. This prompted me to elaborate on the movement trajectories[2] to form points by forging artificial field of relations. What became clear through this was that a more organic movement sequence occurs than what the formal movement infrastructure facilitates[3].

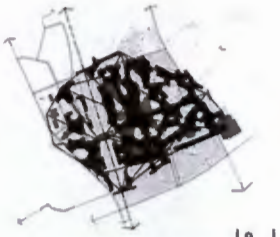
And that at intersection points a higher movement and attraction value exists. I employed this to produce a sequence of nodes[4]. In the nodal sequence, the station is a central point, out of which other nodes radiate, to create secondary nodes. I then took the perimeter loop of the artificial attraction field and the outer loop of the nodal sequence to construct a new terrain[5] which radiate from points of critical mass. When I overlaid the new terrain and its field relations with a diagram of the existing urban order, it became evident that flow is obstructed[6] by current impositions.



surface and graphic texture definitions [7]



fragmentation [8]

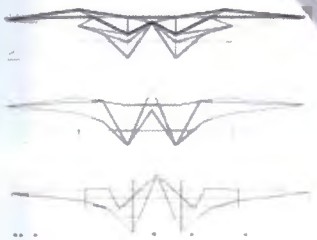


speculation on density and distribution [9]

This prompted me to shape surface and graphic texture definitions which cuts[7] through obstructions to optimise flow. This was then fragmented to examine development potential. The fragmentation[8] method employed was through cutting the terrain along existing major pedestrian corridors. The buildings [retail and station] closest to the core would have to be dissected beyond operation, but its here which site for intervention lie, at the core of speculating growth.

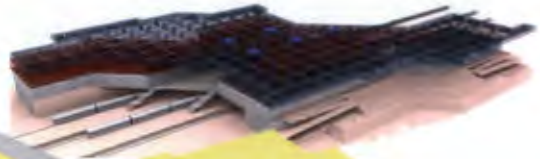
I then thickened lines[9] along main movement routes, abstracted the diagram and generated a speculation on density and distribution. The notion of field conditions as advocated through the work of Stan Allen deeply influenced the development of this narrative .Furthermore, note the shift from new urbanism to integral urbanism. The reason for this shift was because conventional meaning and association implied by the term 'new urbanism' failed to reconcile with the agenda of this specific enquiry.

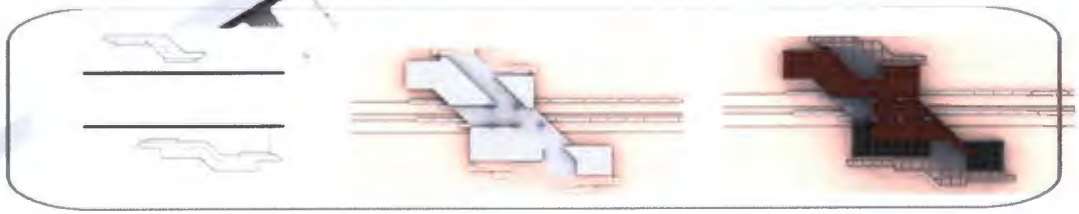
conceptual model of the station catalyst



The field condition narrative equipped me to venture into a scenario study[fig.70]. I initiated this process by speculating that only partial reconstruction occurs. I then proposed the idea of a station catalyst in conjunction with some existing buildings [indicated in white]. I then extruded new additions [indicated in light grey] to be proposed. Through this process of interpreting figure and ground a hierarchy of public spaces was created at intersections of fields. This prompted me to build a conceptual model[fig.69] of the station catalyst, through extruding layers of card to explore horizontal surfacing and dedicated movement possibilities.

I further explored this idea through a scenario study[fig.71], with the aim to investigate the idea of a continuous movement plane integrating oncourse, platforms and forecourts. In the model I suggested an initial movement sequence, spatial organization and the location of primary structure.



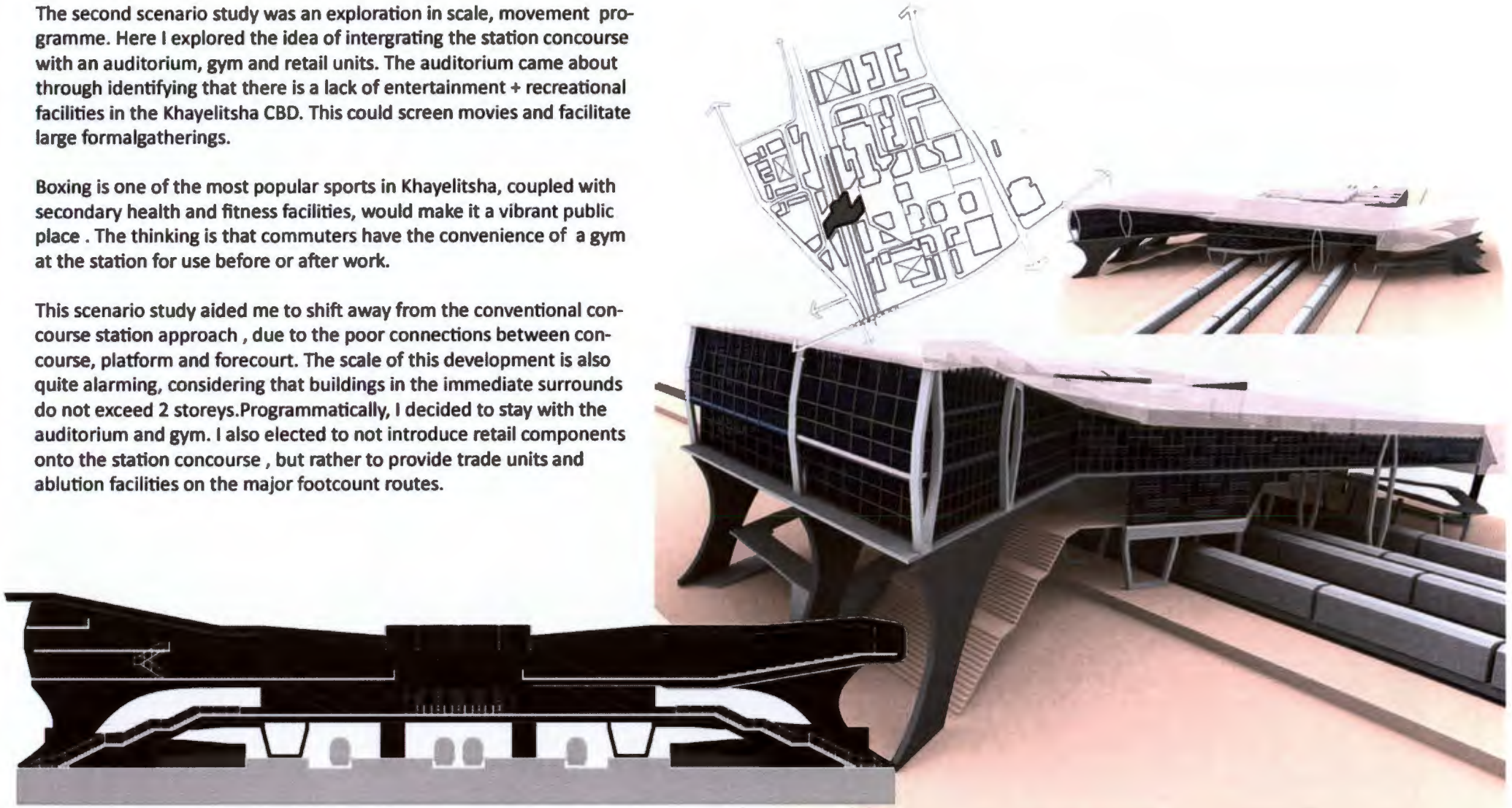


speculating that only partial reconstruction occurs

The second scenario study was an exploration in scale, movement programme. Here I explored the idea of intergrating the station concourse with an auditorium, gym and retail units. The auditorium came about through identifying that there is a lack of entertainment + recreational facilities in the Khayelitsha CBD. This could screen movies and facilitate large formalgatherings.

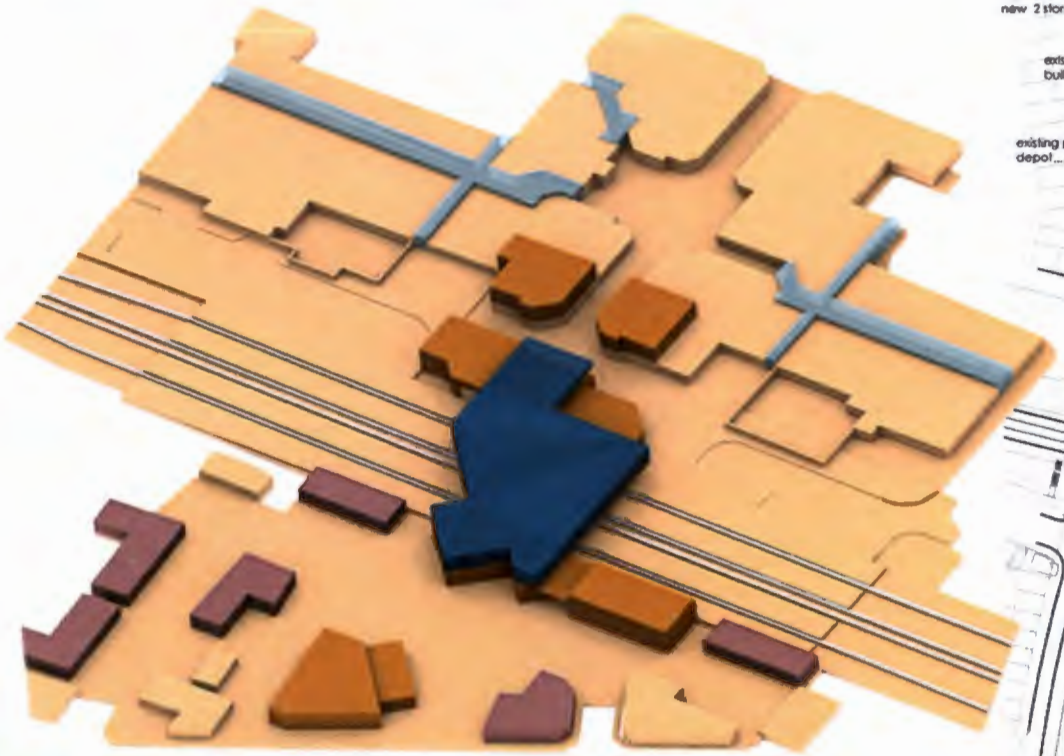
Boxing is one of the most popular sports in Khayelitsha, coupled with secondary health and fitness facilities, would make it a vibrant public place . The thinking is that commuters have the convenience of a gym at the station for use before or after work.

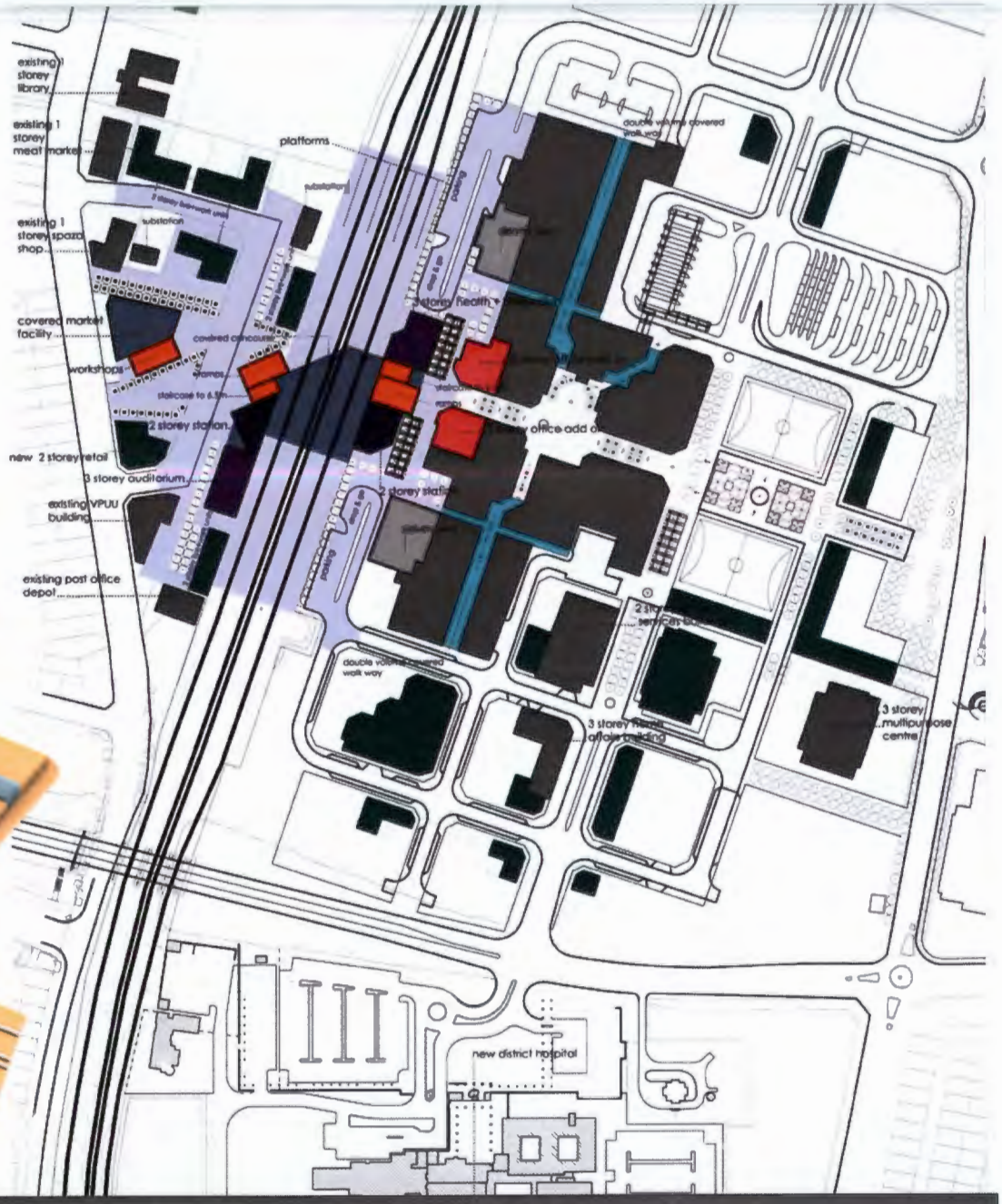
This scenario study aided me to shift away from the conventional concourse station approach , due to the poor connections between concourse, platform and forecourt. The scale of this development is also quite alarming, considering that buildings in the immediate surrounds do not exceed 2 storeys.Programmatically, I decided to stay with the auditorium and gym. I also elected to not introduce retail components onto the station concourse , but rather to provide trade units and ablution facilities on the major footcount routes.



The urban agenda as depicted in the site development diagram is to reinforce the idea of the station as place of critical mass. the thinking from here is by optimizing the station and forecourts; growth and formal attributes would be generated.

Futhermore, the diagram indicates the dissection of the retail mall along the main desire lines to render the CBD more permeable and increase flow. I opted for a "book end" approach towards the forecourts to better define these edges. The green areas in the diagram indicates possible future edges or infill, radiating from the station in order to achieve the objective of an integrated station precinct. However to achieve this phasing rational has to be considered.

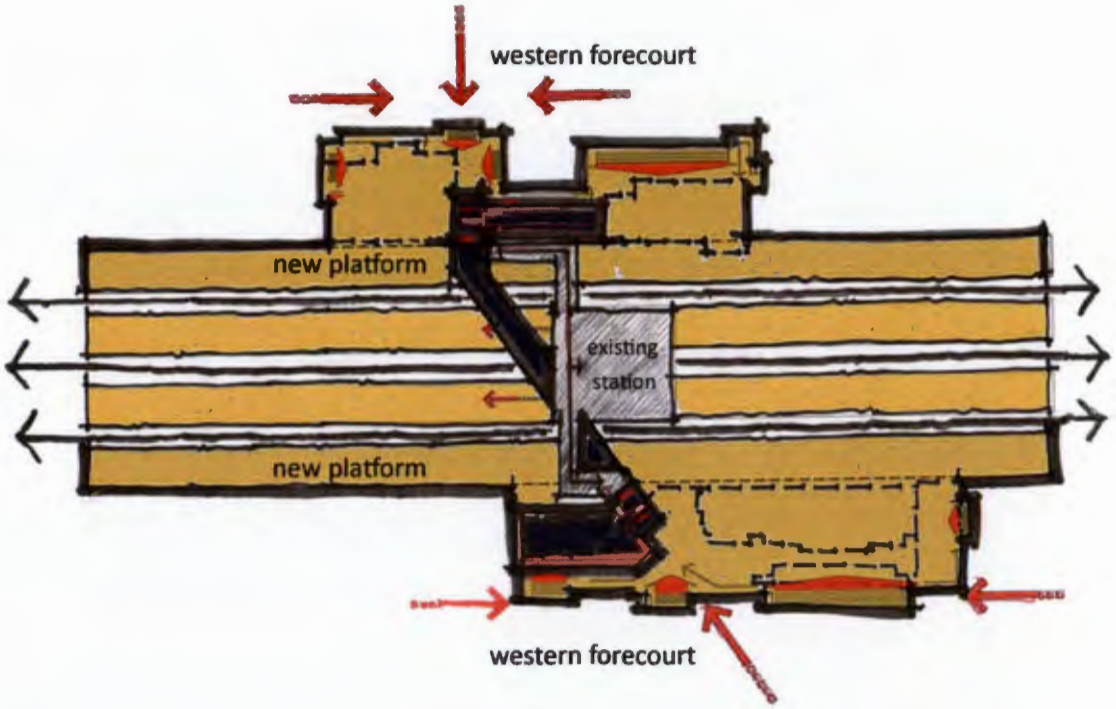


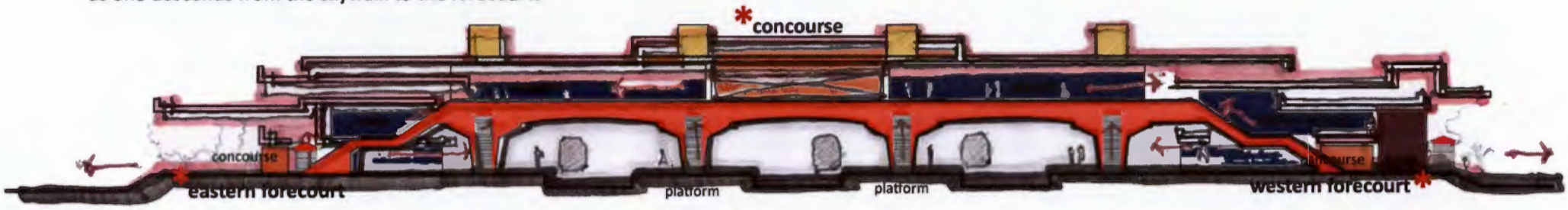


The first phase of development is sitemaking. Two new platforms is added which extends into the forecourts. This undulating plinth has a variety off access possibilities
capturing all major commuter trajectories. The ramps and stairs of the existing building whilst the new ramps , stairs and part of the skywalk is constructed.

The trajectory of the new circulation systems follow the main pedestrian axis of the CBD and is angled away from the retention pond of Ntlazane Road, to allow greater views of Table Mountain and offers direct connections to the new VPUU building currently under construction and the informal taxi drop + go on the western forecourt. At this stage the existing station concourse building is still in use.

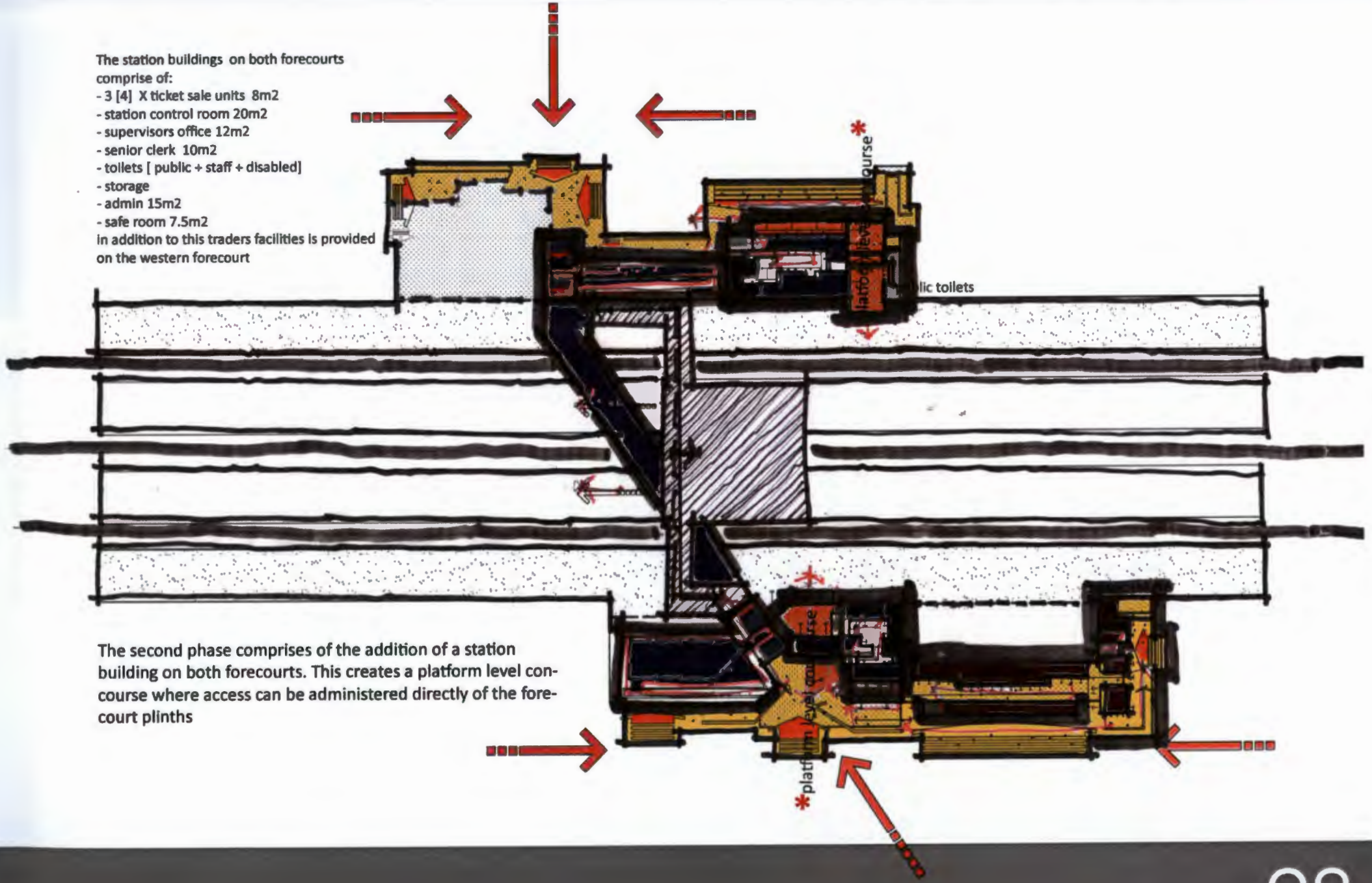
The diagram [phase 5] below indicates the movement strategy from eastern to western forecourt.The massing approach here seeks to fragment scale. From the platform one ascends up onto a double volume concourse 5 meters above ground. Once on the councourse the height drops gradually to a single storey skywalk, as one is filtered through the access control point. The height picks up again as one descends from the skywalk to the forecourts



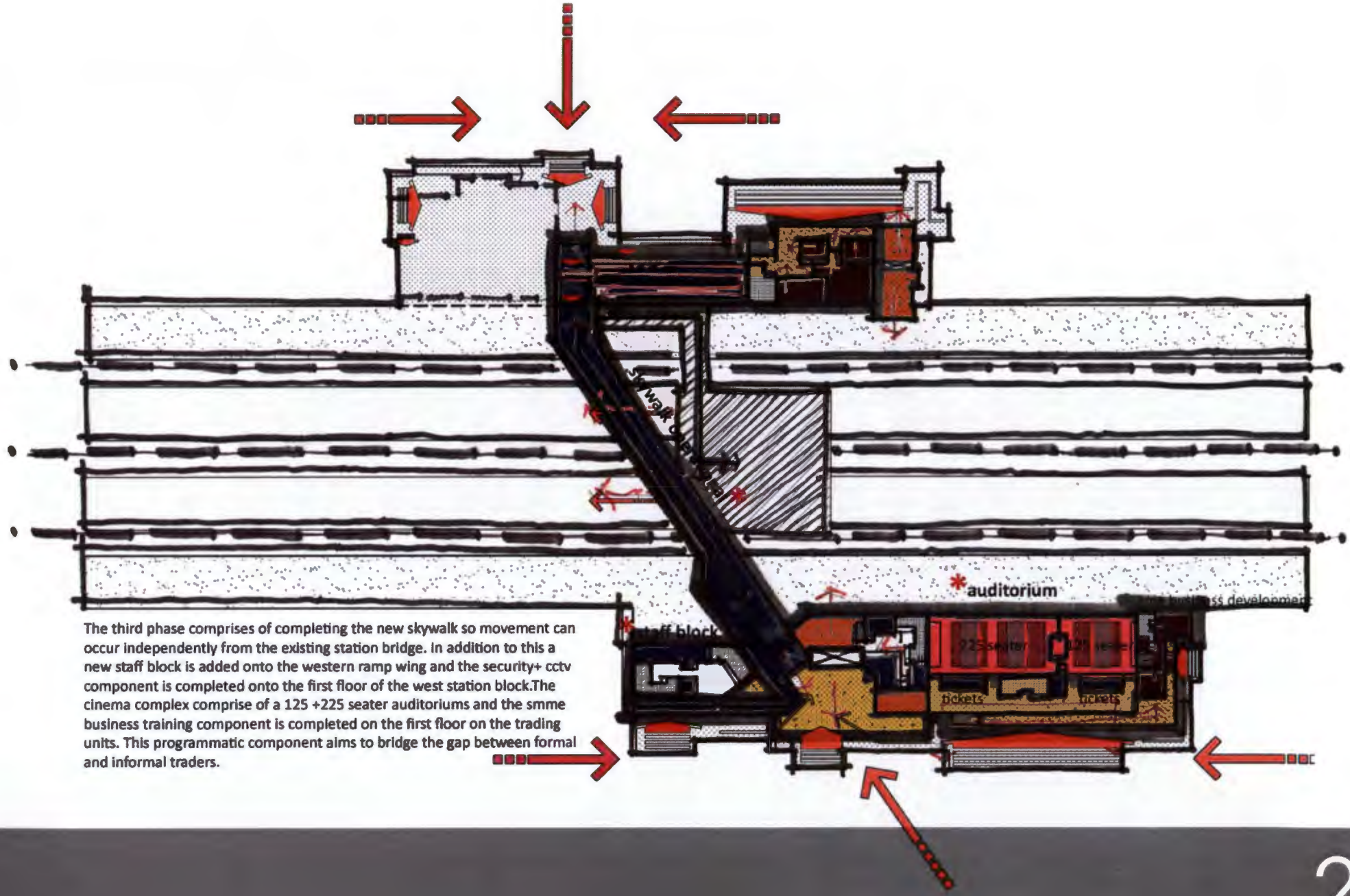


The station buildings on both forecourts comprise of:
- 3 [4] X ticket sale units 8m2
- station control room 20m2
- supervisors office 12m2
- senior clerk 10m2
- toilets [public + staff + disabled]
- storage
- admin 15m2
- safe room 7.5m2

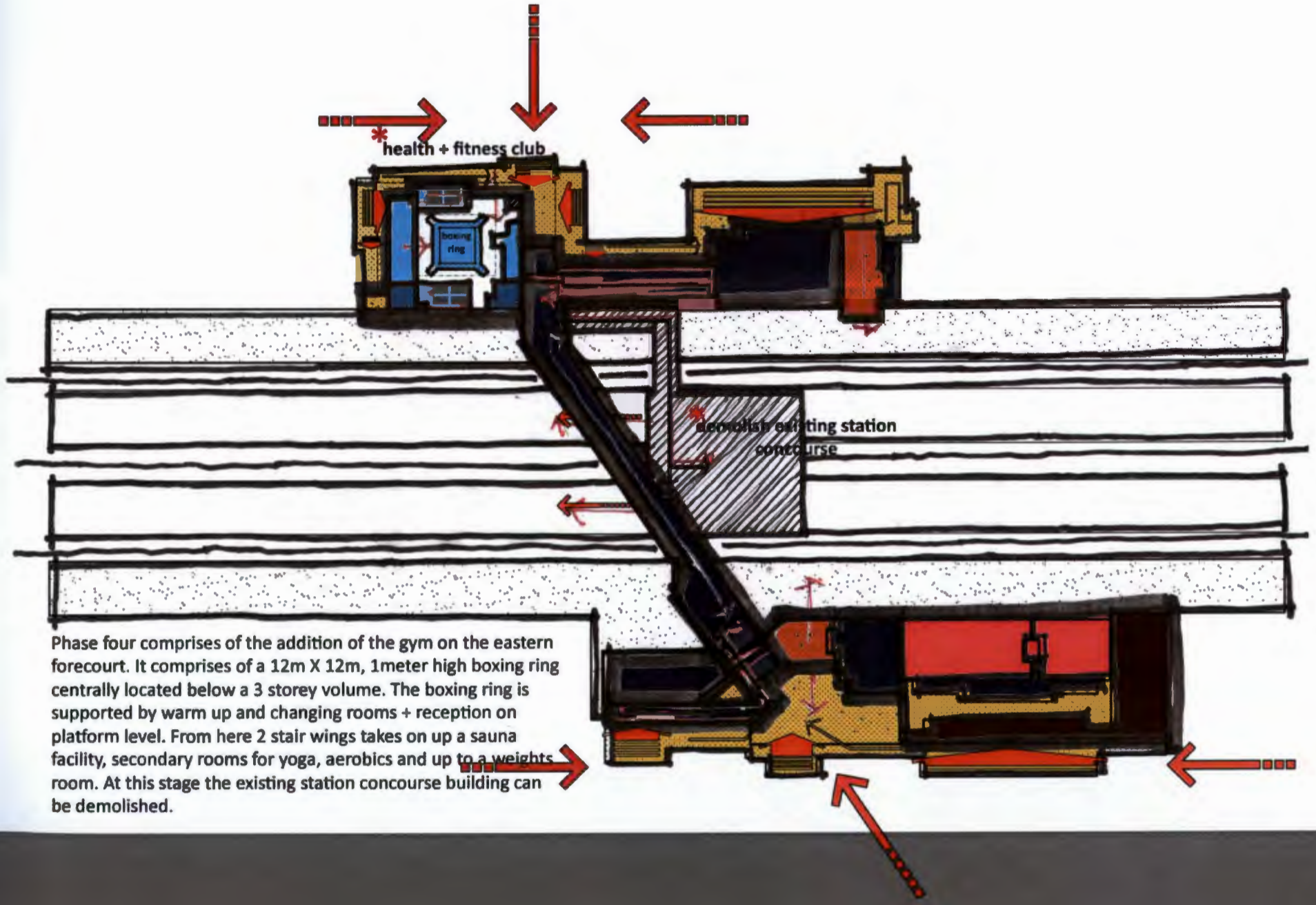
In addition to this traders facilities is provided on the western forecourt



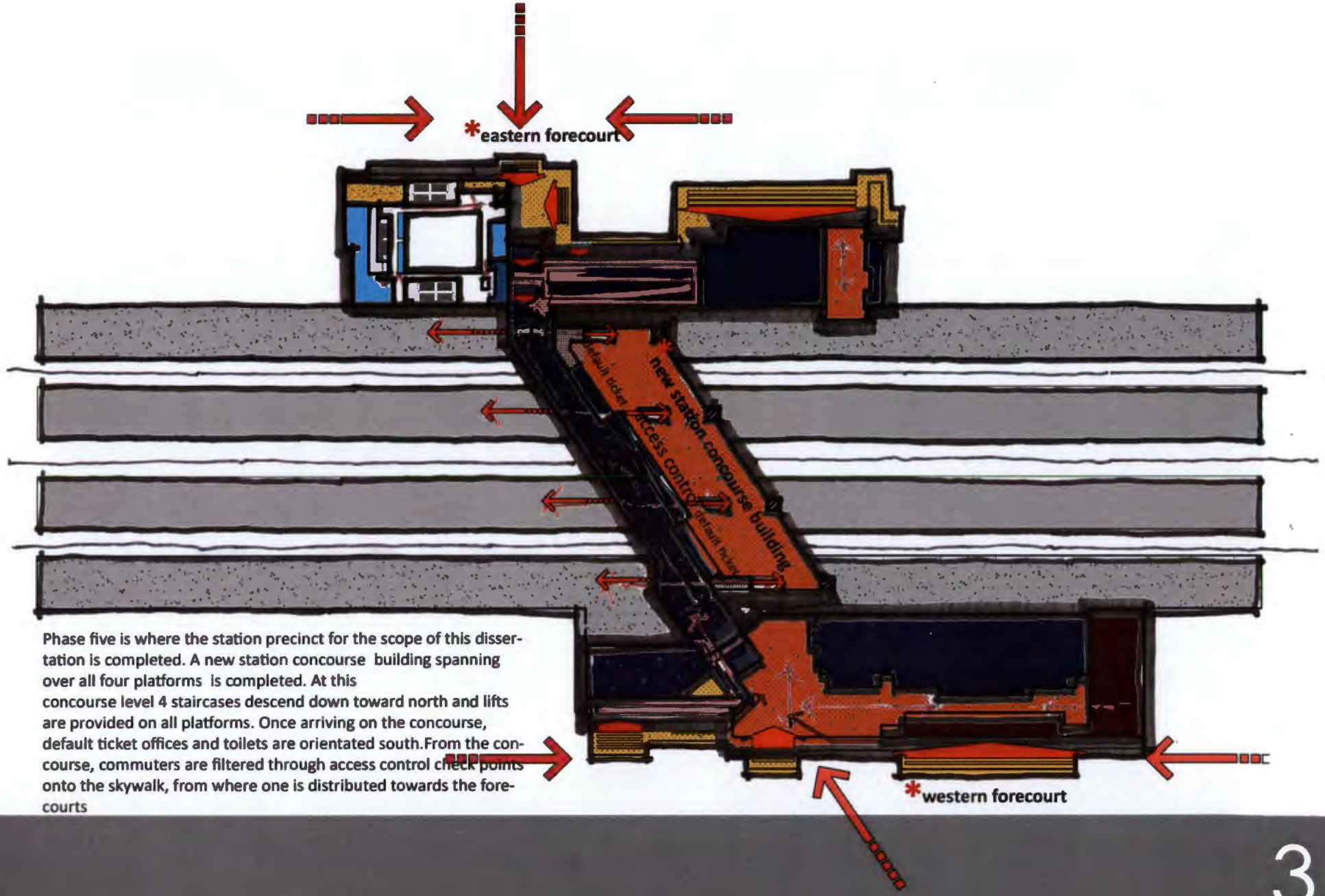
The second phase comprises of the addition of a station building on both forecourts. This creates a platform level concourse where access can be administered directly of the forecourt plinths



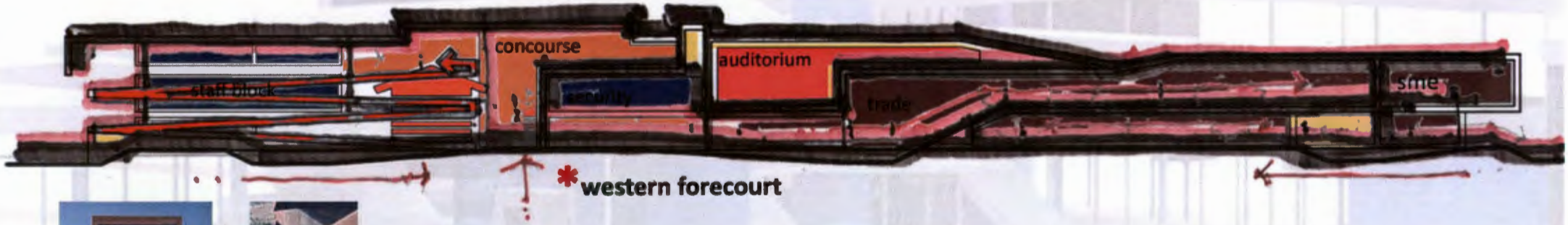
The third phase comprises of completing the new skywalk so movement can occur independently from the existing station bridge. In addition to this a new staff block is added onto the western ramp wing and the security+ cctv component is completed onto the first floor of the west station block.The cinema complex comprise of a 125 +225 seater auditoriums and the smme business training component is completed on the first floor on the trading units. This programmatic component aims to bridge the gap between formal and informal traders.



Phase four comprises of the addition of the gym on the eastern forecourt. It comprises of a 12m X 12m, 1meter high boxing ring centrally located below a 3 storey volume. The boxing ring is supported by warm up and changing rooms + reception on platform level. From here 2 stair wings takes on up a sauna facility, secondary rooms for yoga, aerobics and up to a weights room. At this stage the existing station concourse building can be demolished.



Phase five is where the station precinct for the scope of this dissertation is completed. A new station concourse building spanning over all four platforms is completed. At this concourse level 4 staircases descend down toward north and lifts are provided on all platforms. Once arriving on the concourse, default ticket offices and toilets are orientated south.From the concourse, commuters are filtered through access control check points onto the skywalk, from where one is distributed towards the forecourts



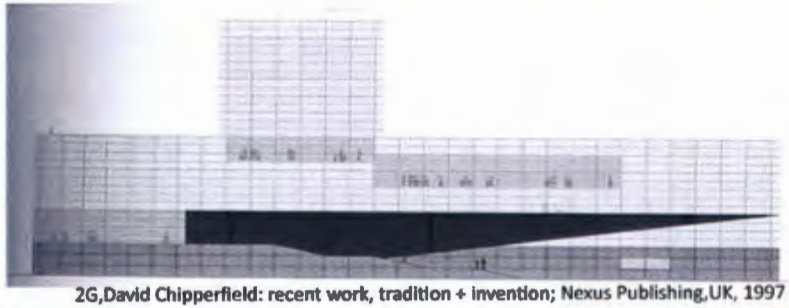
*western forecourt

Detail, Review of Stairs I Ramps; Issue 6_2009; Blackwell Publishing

Detail, Review of Facades, Issue 10_2008,Blackwell Publishing

2G,David Chipperfield: recent work, tradition + invention; Nexus Publishing,UK, 1997

Articulating an auditorium + structural sequence



2G,David Chipperfield: recent work, tradition + invention; Nexus Publishing,UK, 1997

Figge Centre

In concluding this narrative of form and spatial attributes in my design process, I draw on two projects by David Chipperfield. I have only very recently become aquinted by this architect, but at a glance, the manner in which the architect articulates his structural proportions and the play off in material distinction, give me clues of how my design could resolve itself structurally and materially. My opinion is that the design process was morphed by the main ideas investigated through the work sited by Zaha Hadid and Jonker + Barnes architects. However, by the fusion of these design approaches and the comprehension of field condition in the Khayelitsha station precinct the current state of the design was achieved. With that said, my deductions are that to progress the main idea of flow to more tactile elements like skin and the manipulation of solid and void, I will take cognisance of the material quality in these two projects towards my final design review.

2G,David Chipperfield: recent work, tradition + invention; Nexus Publishing,UK, 1997