

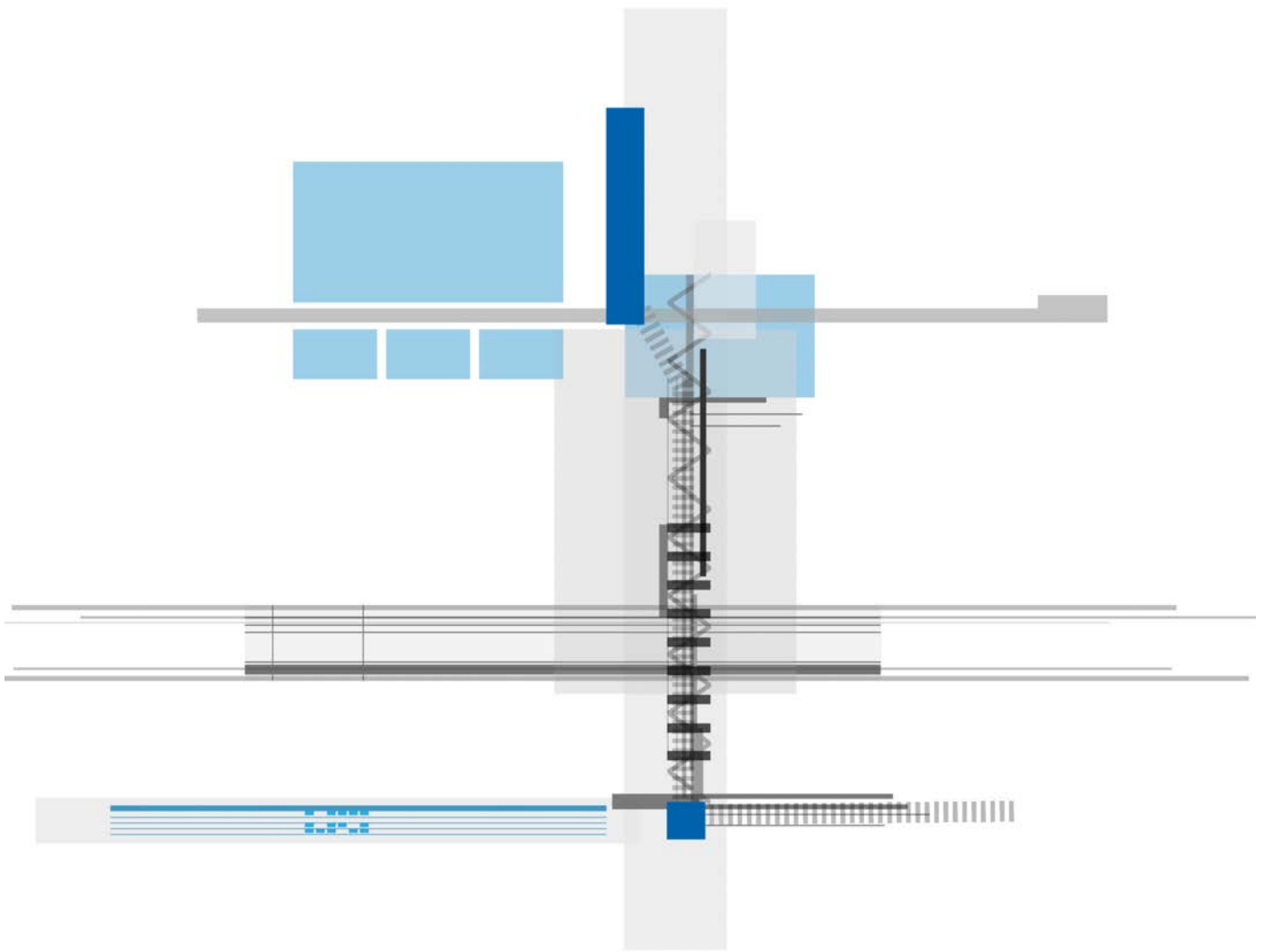
THE JUNCTION

TRANSCENDING SOCIOTECHNICAL DIVIDES
THROUGH YOUTH SPACE

RAHUL DOWLATH

The copyright of this thesis vests in the author. No quotation from it or information derived from it is to be published without full acknowledgement of the source. The thesis is to be used for private study or non-commercial research purposes only.

Published by the University of Cape Town (UCT) in terms of the non-exclusive license granted to UCT by the author.



THE JUNCTION

TRANSCENDING SOCIOTECHNICAL DIVIDES THROUGH YOUTH SPACE

RAHUL DOWLATH
DWLRAH001

SUPERVISOR: FRANCIS CARTER, for UCT
CO-SUPERVISOR: TESSA BRUNETTE, for ARUP CAPE TOWN

APG5079W DESIGN DISSERTATION

Design Dissertation report presented as part fulfilment of the degree of
Master of Architecture (Professional) in the School of Architecture Planning
and Geomatics, University of Cape Town.

DECEMBER 2017

ACKNOWLEDGMENTS

My sincerest gratitude goes to the following people who assisted me:

My design dissertation supervisor, Francis Carter, for his unwavering support and advice;

Tessa Brunette, my design dissertation co-supervisor, for providing technical support, expertise and facilitating access to Arup's technical resources;

The engineers at Arup: Matthew Lilley and Jaco Kemp, for their technical insight and guidance;

Dr. Cecil Madell, for insight into Heideveld and supporting my fieldwork research;

Mr. Tarzan Mbita, for his support in Gugulethu fieldwork and facilitating engagements with the community;

VPUU, for providing access to facilities and resources that aided the urban development work;

The Fields of Play Master's Studio 2017 for their support and collaboration during this year;

And finally, my parents, for their constant support and guidance throughout my architectural studies.

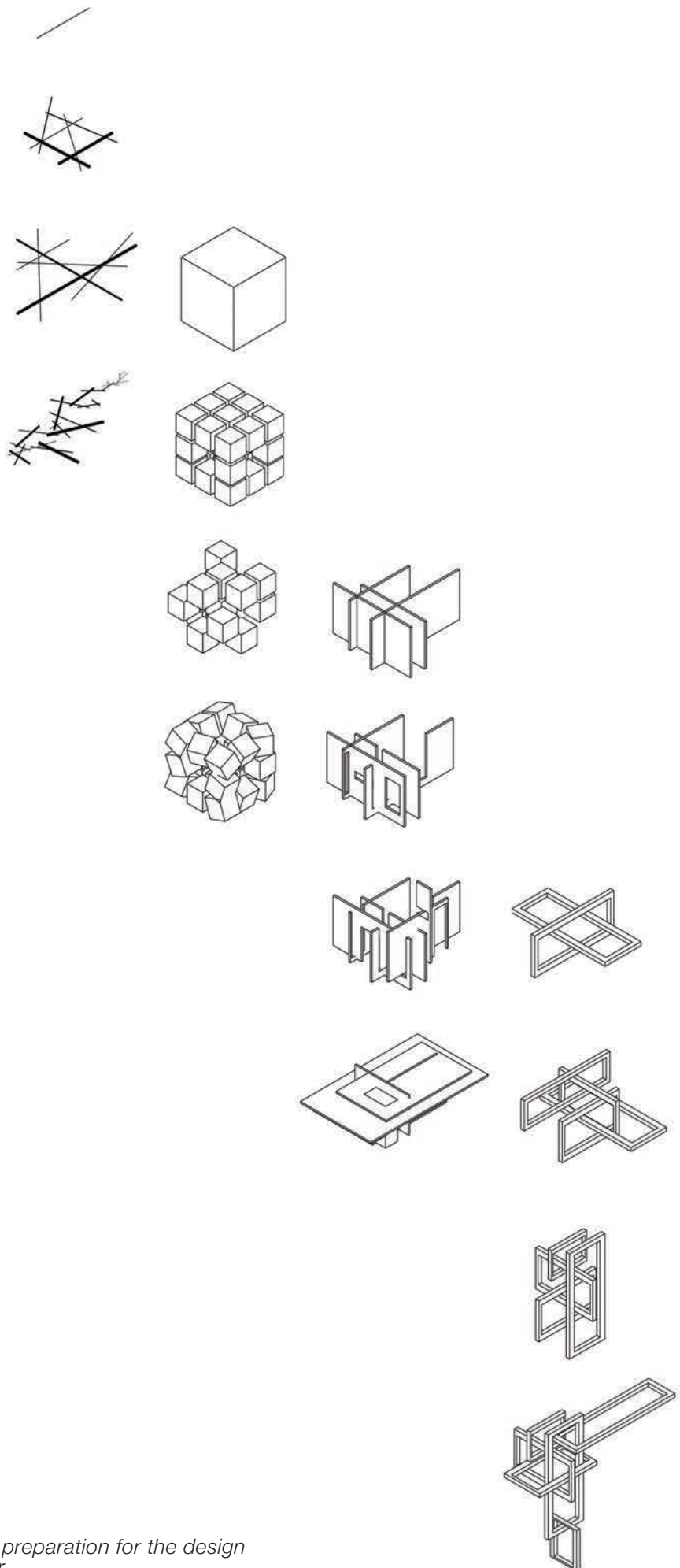


Fig.01 – Diagramming Experiments in preparation for the design dissertation, done in the first semester

abstract

Infrastructure continues to perpetuate the effects of splintering urbanism in South African cities. Where apartheid planning policies such as the group areas act used infrastructure as a mechanism of social organisation, this design dissertation proposes using architecture as social infrastructure to transcend these sociotechnical divides.

The concept of the sociotechnical denotes the synergy of a city's infrastructural systems and its social life. In this design dissertation this idea is explored at various scales: at the urban level, through a development strategy that spatialises unsafe public open land; at the architectural scale, through surface articulation and interfacing with urban infrastructure; and at the technical level, through building performance analysis and technical design development in support of architectural goals.

The project uses a distributed programme that stretches across communities in order to socialise the existing urban infrastructure of a pedestrian bridge. By leveraging the social significance of a local football club, the project proposes a social programme around the idea of a football clubhouse as a programmatic anchor. In reacting to urban infrastructure, the idea of imageability and presence are important considerations. These concepts enable youth to positively engage with the

architecture, and allows the building to convey its purpose and programmatic intent, thereby creating a strong social interface with its users.

Sociotechnical architecture is considered as an urban armature that socialises and spatialises urban infrastructure. The architecture therefore seeks the minimal amount of fixity to support a variety of flexible events surrounding sports and recreation activities. This is achieved through a selection of robust materials used in horizontal surfaces of social purpose, and the combination of structure, materiality and geometry to create a series of vertical surfaces of social presence and architectural imageability.

The result is a strategic arrangement of architectural interventions deployed across a large urban scheme. By distributing the architecture across urban infrastructure, the project connects two communities and presents an architectural response to splintering urbanism.

KEY WORDS

social infrastructure / sociotechnical / social programme / flexible event space / sports / education / schools / splintering urbanism

glossary

Architectural Imageability

A concept developed by Kevin Lynch denoting the visual quality of a built environment held in the mental image formed by its occupants. In this design dissertation, imageability extends this idea to how buildings convey their purpose and presence to their surroundings, particularly through structure, surface and facade.

Building Physics

A field of the built environment that studies environmental effects on space and structure. Using physics concepts and calculations, primarily through software modeling and analysis, a better understanding of the environmental performance of a building or specific space can be gained through such studies, and informed design decisions can be made. This design dissertation adapts some of these concepts within a limited means to understand how certain spaces and design ideas can potentially perform in relation to local weather data.

CFD

Computer Fluid Dynamics is a digital adaptation of applied mathematics, physics and computational software principles to visualise how liquids and gases flow through and around models, and how they affect these objects. In this project, basic CFD analysis was used to test design ideas using rationalised 3D geometry.

Existential Space Theory

Developed by Christian Norberg-Schulz, it explores how the built environment comprises 'organisational schemata', which contribute to how people identify themselves within a space. It forms the theoretical basis for understanding architectural presence and imageability, and was further explored in the Studies in Architectural Theory and Technology paper.

HPB

Acronym for the Heideveld Pedestrian Bridge, the main infrastructure which this project engages with.

Networked Infrastructure

Described in *Splintering Urbanism* by Stephen Graham and Simon Marvin, it denotes a standardisation of infrastructural systems that seek to create a sanitised and functional urban place. Within this design dissertation, the term is used

to describe infrastructural systems – particularly systems of transport – distributed across the urban landscape that seek to connect fragments of the city.

Sociotechnical

Denotes the interplay between the social forces of a city (its culture, social patterns of inhabitation, economy) and the technical forces (the pipes, ducts, cables, bridges, tunnels and other infrastructural systems, often as a hidden layer beneath the social surface) that supports this rich and dynamic social life. The social and the technical are perceived as being a symbiotic relationship, with both forces affecting, and affected by, each other on a daily basis. The concept is based on a sociological concept that seeks to overcome the social/technical dualism of modern society. Related to the concept of Actor-Network Theory, it further denotes how technological systems are another actor in the vast network of social and technical processes evident in the contemporary city.

Splintering Urbanism

Based on the eponymous book by Graham and Marvin, it denotes how infrastructure, including new technological systems and privatised provision of infrastructural systems such as highways and telecommunications systems, affects the socio-spatial experience of a city. Often, infrastructure creates a fragmentary experience that contributes to issues of spatial inequality. In this design dissertation, this concept is adapted to the socio-spatial issues evident in post-apartheid South Africa, juxtaposed with the planning strategies used during apartheid, where infrastructure was deployed a physical mechanism to organize communities based on race.

Surface Architecture

Based on the book by David Leatherbarrow and Mohsen Mostafavi, it denotes how surface effects can contribute towards ideas of architectural presencing. In this project, surfaces are used to extend and socialise the spaces created by infrastructure.

contents

INTRODUCTION.....	13
DESIGN RESEARCH QUESTIONS.....	15
METHODS.....	17
ETHICS.....	18
PART I: NARRATIVES	
THE JUNCTION: STORIES FROM SITE.....	21
<i>Site Selection</i>	23
<i>Heideveld: A Background</i>	25
<i>Infrastructure</i>	31
<i>The Football Club</i>	35
<i>Imageable Buildings</i>	37
THE SOCIOTECHNICAL: SPLINTERING URBANISM IN CAPE TOWN.....	41
PROGRAMME DEVELOPMENT.....	45
PART II: SYNTHESIS	
THE JUNCTION: TRANSCENDING SOCIOTECHNICAL DIVIDES.....	55
<i>Urban Development Plan</i>	57
<i>Social Infrastructure: Defining, Testing, Diagramming</i>	65
<i>Translating Programme: Spatial Arrangements & Adjacencies</i>	71
<i>Institutional Arrangements</i>	85
<i>Youth Space: Architectural Imageability through Surfaces</i>	87
DESIGN RESEARCH FINDINGS.....	
<i>Process</i>	94
<i>Programme</i>	98
<i>Theory to Structure</i>	105
<i>Public Sociotechnical Buildings</i>	113
CONCLUSION.....	116
REFERENCES.....	118
IMAGE CREDITS.....	119
<hr/>	
APPENDICES.....	
A: FACULTY ETHICS APPROVAL.....	120
B: PLAGIARISM DECLARATION.....	122
C: STRUCTURED INTERVIEW QUESTIONS.....	123
D: HEIDEVELD PEDESTRIAN BRIDGE ENGINEERING DRAWINGS.....	126
E: ENVIRONMENTAL+STRUCTURAL ANALYSIS.....	130

```

function transitionEnd() {
  var el = document.createElement('bootstrap')

  var transEndEventNames = {
    WebkitTransition: 'webkitTransitionEnd',
    msTransition: 'msTransitionEnd',
    OTransition: 'oTransitionEnd otransitionend',
    transition: 'transitionend'
  }

  for (var name in transEndEventNames) {
    if (el.style[name] !== undefined) {
      return { end: transEndEventNames[name] }
    }
  }

  return false // explicit for ie8 (..)

  // http://blog.alexmacca.com/2012/01/05/emulating-transition-end/
  // emulateTransitionEnd = function (duration) {
  //   var called = false
  //   set = this
  //   $(set).one('bsTransitionEnd', function () {
  //     var callback = function () { if (called) {} }
  //     setTimeout(callback, duration)
  //     return this
  //   })
  // }

  $(function () {
    $.support.transition = transitionEnd()

    if (!$.support.transition) return

    $.event.special.bsTransitionEnd = {
      bindType: $.support.transition.end,
      delegateType: $.support.transition.end,
      handle: function (e) {
        if ($(e.target).is(this)) return e.handleObj.handler.apply(this, arguments)
      }
    }
  })
})(jQuery);

Modal.prototype.hide = function (e) {
  if (e) e.preventDefault()

  e = $.Event('hide.bs.modal')
  this.trigger(e)

  if (!this.isShown || this.isLoading()) return

  this.escape()
  this.resize()

  $(document).off('focusin.bs.modal')

  $.removeData(this, 'bs.modal')
  this.$element.removeClass('in')
  this.$element.off('click.dismiss.bs.modal')
  this.$element.off('mouseup.dismiss.bs.modal')
  this.$dialog.off('mousedown.dismiss.bs.modal')

  $.support.transition && this.$element.hasClass('fade') ?
  this.$element
    .one('bsTransitionEnd', $.proxy(this.hideModal, this))
    .emulateTransitionEnd(Modal.TRANSITION_DURATION) :
  this.hideModal()
}

Modal.prototype.enforceFocus = function () {
  $(document)
    .off('focusin.bs.modal') // guard against infinite focus loop
    .one('focusin.bs.modal', $.proxy(function (e) {
      if (document !== e.target &&
        !this.$element[0].contains(e.target)) {
        this.$element.trigger('focus')
      }
    }), this)
}

Modal.prototype.escape = function () {
  if (this.isShown && this.options.keyboard) {
    this.$element.on('keydown.dismiss.bs.modal', $.proxy(function (e) {
      if (e.which == 27 && !this.isInput()) this.hide()
    }), this)
  }
}

```

Fig.02 – The Sociotechnical: The interplay between the social forces of city life and the technical systems that support this dynamic life.

“

When our analytical focus centres on how the wires, ducts, tunnels, conduits, streets, highways and technical networks that interlace and infuse cities are constructed and used, modern urbanism emerges as an extraordinarily complex and dynamic sociotechnical process.

(Graham & Marvin, 2001, p.8)

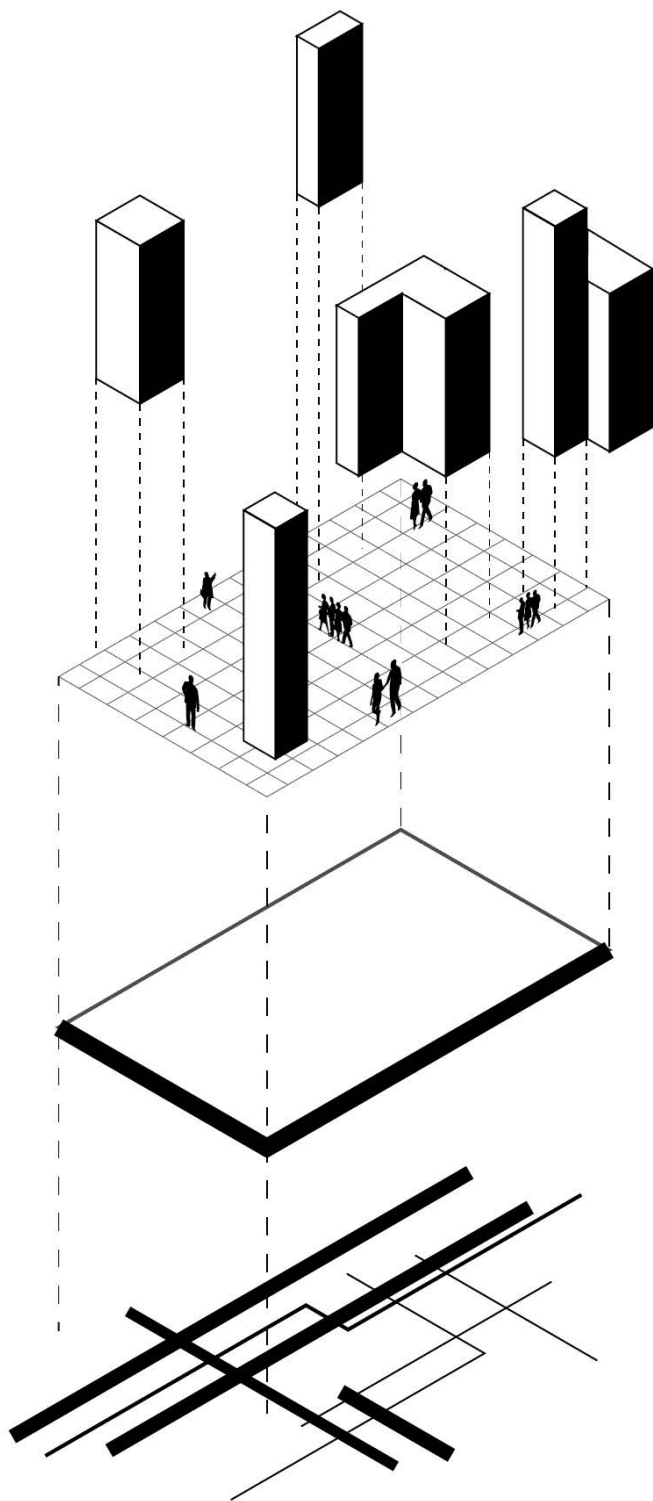


Fig.03 – Layers of the contemporary metropolis: the invisible technical layers that support the dynamic life above

introduction

The contemporary South African city faces a socio-spatial crisis where apartheid planning strategies continue to perpetuate fragmentation. The use of infrastructure to enact modernist planning techniques in the apartheid era continue to divide communities. The notion of the sociotechnical – where an urban experience is derived from the interplay between a city’s technical systems and its social life (Fig.03) – presents the possibility for interrogating this fundamental issue at the scale of architecture. This design dissertation proposes an architecture of social infrastructure as the means for transcending these sociotechnical divides.

Architecture as a form of social infrastructure comprises the synergy of social surfaces and social programme. Horizontal surfaces of social purpose and vertical surfaces of social presence combine to form an imageable, compact architecture that socially activates infrastructure across communities.

By investigating the issue of appropriate imageability and social programme, infrastructure that once divided communities can be re-activated through architectural intervention. As such, they can gain a new urban purpose in connecting once fragmented pieces of the city and consequently present new socio-spatial opportunities for citizens.

The design dissertation was derived from two main issues identified through fieldwork and work done in the 2016 BAS(Honours) design studio *Fields of Play*. Firstly, South Africa has a significantly young population; according to Statistics South Africa, approximately 49% of the population is younger

than 25 years old (Statistics South Africa, 2011). Secondly, vast pockets of under-utilised land, a relic of apartheid spatial planning practices, permeate settlements at the periphery of the contemporary South African city.

The issue of at-risk youth in under-serviced communities presents the possibility for developing a social programme that addresses the effects of splintering urbanism. If infrastructure is seen as the physical systems that supports the lives of cities, then can architecture be interpreted as a social infrastructure to support the development of youth? Capturing the youth demographic at the point where infrastructure has divided communities presents the testing ground for exploring the idea of sociotechnical architecture.

This concept has been explored at Nyanga Junction in southern Gugulethu. Violence Prevention through Urban Upgrading (VPUU) have been instrumental in developing an urban scheme that transcends the racial group areas division between the communities of Manenberg and Gugulethu (divided by the train station). A new community hall at Lotus Park, and the Oliver Kahn Safe Hub by Amandla EduFootball, have begun to activate the space around the train station with youth-centered activities. The Lotus Park community hall has become an informal hang-out space for youth due to its Wi-Fi hotspot, and the Safe Hub includes a youth café and soccer programmes designed to educate and develop youth through strategic programmes. Many children come from Manenberg, across the train line. VPUU's

work in this area represents a means of socialising the urban spaces around infrastructure. This idea is further explored at the northern region of Gugulethu through this design dissertation. Principles from VPUU's strategy and a study of the Oliver Kahn Safe Hub are explored as inspiration for engaging at the urban and architectural scales on the design dissertation's broader themes of confronting local forms of splintering urbanism.

This design dissertation is supported by Theory and Technology Studies undertaken in the first semester. In these studies, I explored the idea of architectural imageability and bioclimatic architecture. The findings informed the theoretical background to this design dissertation and set up the technical approach towards environmental performance design strategies.

This design dissertation report will document the process of exploring the idea of social infrastructure. It is divided into two sections: Part I introduces the site as seen through the lens of its residents. It presents the early development of the design project's social programme and introduces the primary theory supporting the thesis argument (*Splintering Urbanism* by Stephen Graham and Simon Marvin). Part II documents the design development, expanding the idea of architecture as social infrastructure by defining and testing this notion, and examining the design decisions that led to the final architectural outcome. Part II concludes with the design research findings from this design dissertation.

design research questions

The design research question centres around the issue of social infrastructure:

Can architecture, as a form of social infrastructure, be used to transcend sociotechnical divides?

Furthermore, what architectural means can be used to enact this social agenda? What is an architecture of social infrastructure, and how can architecture be used to engage with planning agendas that historically sought to divide communities?

This design dissertation seeks to address these key questions through an exploration of literature, site analysis and programmatic synthesis. In responding to the thesis of 'surface architecture' (Leatherbarrow & Mostafavi, 2002) as a form of social infrastructure, a foundation can be set for interrogating these ideas at an architectural scale.

Programmatically, both a large-scale urban strategy and a series of compact but strategic architectural interventions will be the driving forces for exploring these design research questions.

These design research questions will be further expanded in Part II when the architectural synthesis is unpacked.

methods

CREATIVE DESIGN METHODOLOGIES

Methodology used for this dissertation can be categorised into two aspects: creative and research methods. Creative methods drove much of the design exploration and the synthesis of fieldwork data. Primarily, the use of diagramming using analogue and digital methods aided in extracting key findings from fieldwork.

Two representational methods emerged from early exercises at the beginning of the design dissertation: diagramming and digital 3D modeling. As explored in the Theory and Technology Studies paper, diagramming is seen as a powerful method of 'scripting' (Eisenman, 1999) architecture, especially when understanding how issues of presence can be translated from the project's intent into an architectural design.

Diagramming aided in understanding the scope of the project, exploring issues of structure and programme, and illustrating site development ideas. Diagramming, as a means of scripting architectural intent, was used to storyboard the project's narrative. The diagram succinctly represents key ideas, and can be used to set the stage for the design dissertation's core arguments. Furthermore, diagramming allows retrospective; it can be used to illustrate the series of design considerations made through the project's development in order to support the final design outcomes.

3D digital modeling was used to build a comprehensive site model of Heideveld and Gugulethu. Engineering drawings of existing site infrastructure, including the Heideveld Pedestrian Bridge, was obtained from Mott MacDonald Consulting Engineers^[1]. This was used to build an accurate 3D model of the bridge within its context.

This design dissertation made use of BIM (Building Information Modeling) in order to co-ordinate technical data (bridge and related infrastructure information), and empower the creative process by allowing various methods to leverage a comprehensive 3D base model.

This 3D digital design model was used as the base to develop a further series of drawings across scales, from the urban precinct plan to technical detailing. Furthermore, the BIM model was used in a series of technical simulations to test building performance strategies.

Alongside these primary creative methods, freehand sketching and diagramming was used ad-hoc to explore and understand various design ideas.

¹ Mott MacDonald, an international engineering consulting firm, acquired PDNA in 2013. Design drawings for the HPB were therefore in possession of Mott MacDonald.

RESEARCH FOR DESIGN METHODS

Design research methods included fieldwork interviews, site orientation visits, literature review of the primary theory (Splintering Urbanism) and fieldwork collaboration with VPUU. Through this collaboration, VPUU's fieldwork methodology of baseline surveying was used to understand trade within the informal settlement of Lotus Park in southern Gugulethu. This fieldwork enabled first-hand understanding of the fundamental role infrastructure (and the lack of it) has in shaping the everyday urban experience. This data is collated in the group report *The Life of Streets* (Moodley, Dowlath & Van't Hof, 2017).

ETHICS

Ethics clearance for fieldwork research was obtained by the Faculty Ethics in Research Committee (Appendix A). The majority of fieldwork was ethnographic-based through interviews undertaken with various people in both the Heideveld and Gugulethu communities.

Precaution was taken to avoid interviewing or photographing children, and all interviews were conducted with informed signed consent from interviewees. Consent was requested before recording interviews which were later transcribed. Consent was also requested before photographing subjects for inclusion in the report. In certain cases, the rules of the institution being visited were respected in terms of their own rules regarding photography, as was the case at the Oliver Kahn Safe Hub.

Fieldwork was conducted with guides familiar with the study areas. For the group investigation into infrastructure and trade at the Lotus Park informal settlement, VPUU provided playmakers from the Chrysalis Academy, whose assistance in navigating the community and conducting interviews was greatly appreciated. The Heideveld fieldwork was undertaken with Dr. Cecil Madell, who also provided extensive background social and planning history on this community.

Copies of interview consent forms and transcripts are available on request.


PART I NARRATIVES


THE JUNCTION: STORIES FROM SITE

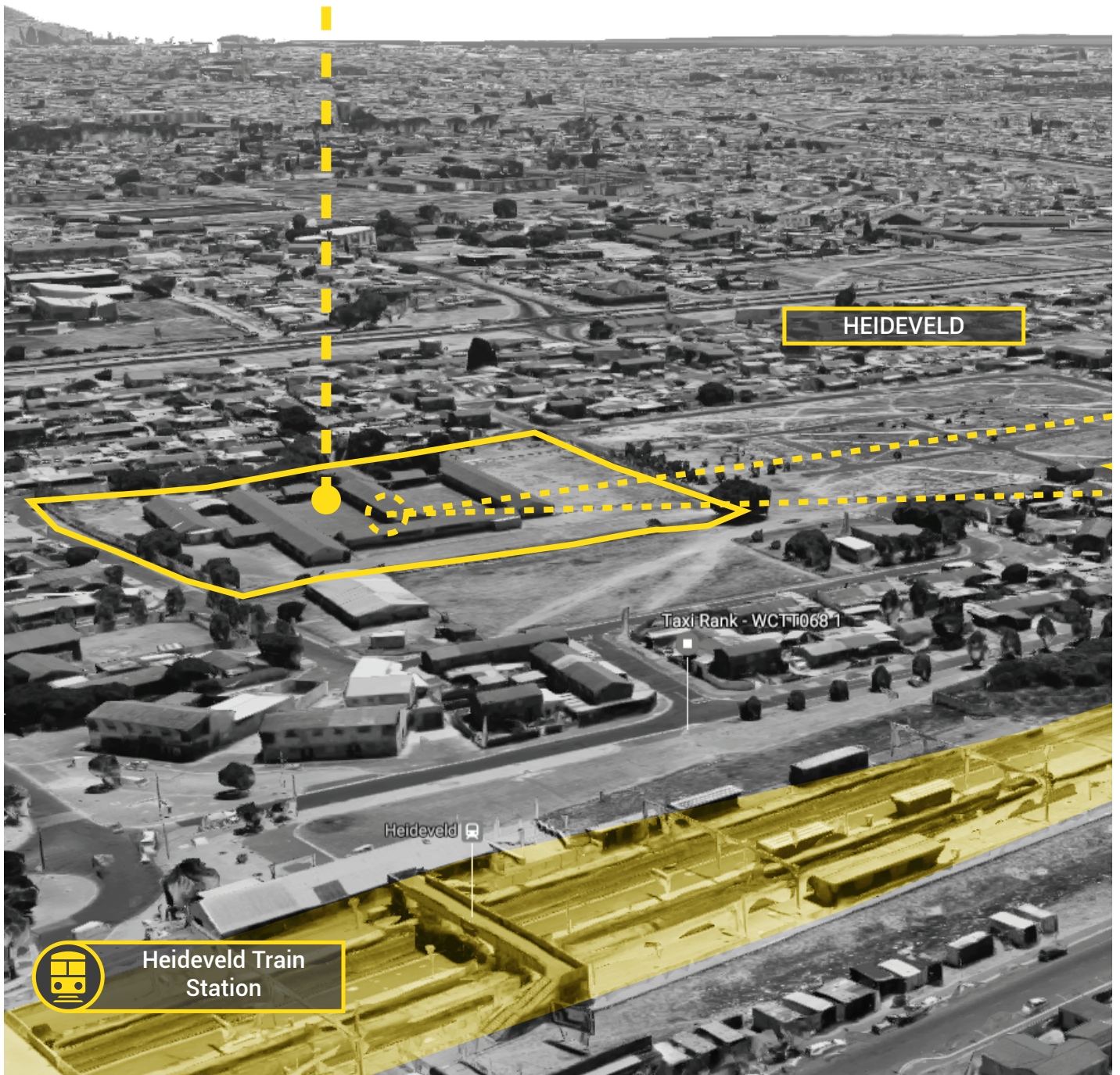
THE SOCIOTECHNICAL

PROGRAMME DEVELOPMENT

Fig.04 – The focus area of this design dissertation, between Heideveld and Gugulethu, Cape Town

 **Willows Primary School**

TYPE	PRIMARY			
ADDRESS	16 LONGKLOOFSIRKEL, HEIDEVELD			
PRINCIPAL	MNR. MK ABRAHAMS			
LANGUAGE	AFR / ENG			
LEARNERS				
ROOM TYPES	as per 2016 survey			
CLASSROOM	SCI.LAB	W/SHOP	COMPLAB	LIBRARY
28	0	0	1	1




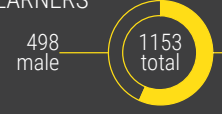
THE JUNCTION

stories from site

In this section, the rich social narrative of the site will set the scene for an architectural exploration. The site, it's defining features and history, and the football club that is so critical to its social fabric, will be examined. The theory of splintering urbanism will expand this social narrative, and from these two aspects a preliminary social programme will be presented.



 **Heideveld Secondary School**

TYPE	SECONDARY				
ADDRESS	WATERBERGWEG 1, HEIDEVELD				
PRINCIPAL	MR W.A. MECK				
LANGUAGE	AFR / ENG				
LEARNERS					
ROOM TYPES <small>as per 2016 survey</small>	CLASSROOM	SCI.LAB	W/SHOP	COMPLAB	LIBRARY
	33	5	2	1	1

 **New Pedestrian Bridge Crossing**

PROPOSED SITE

GUGULETHU NORTH

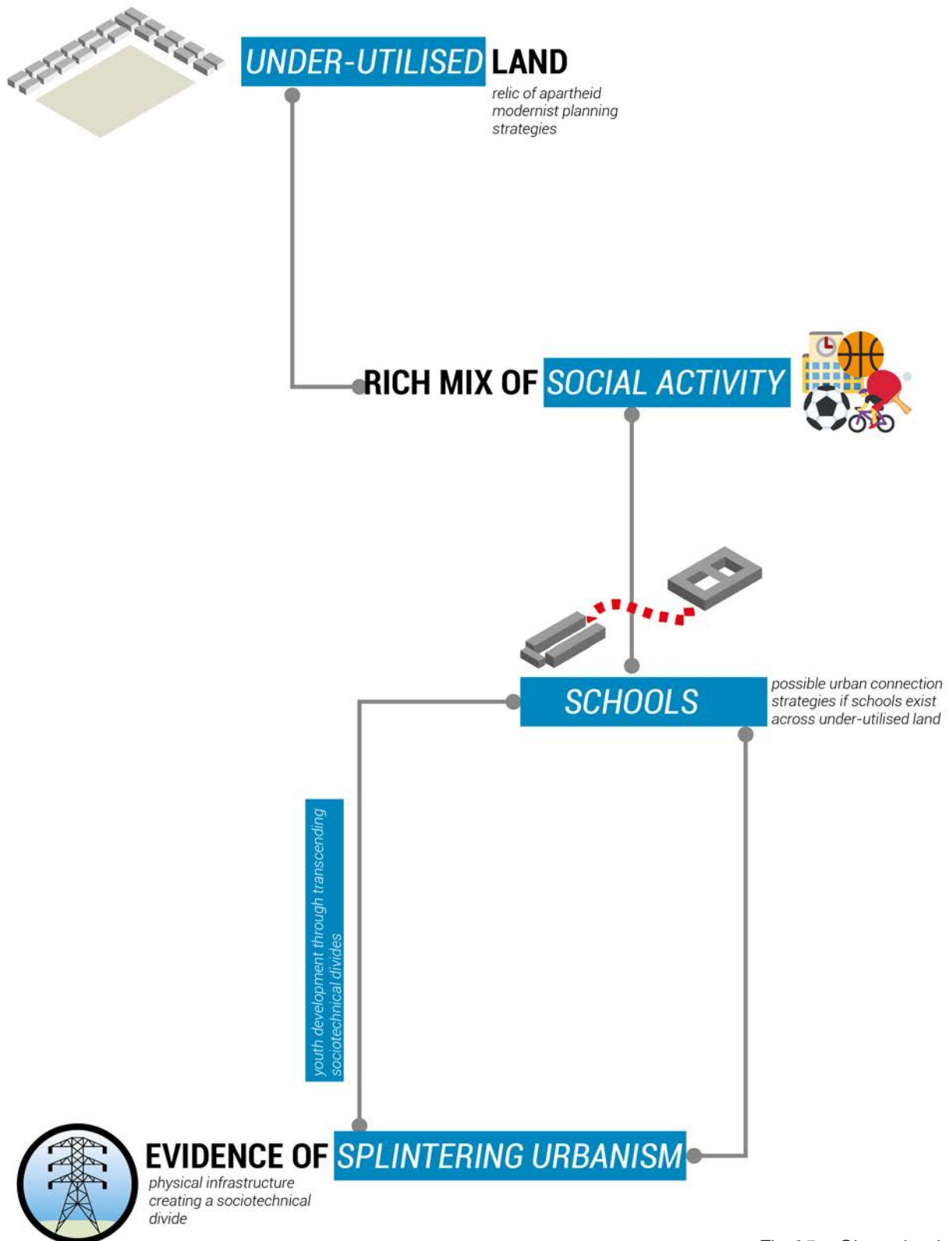


Fig.05 – Site selection criteria

SITE SELECTION

In order to test the idea of social infrastructure, an appropriate site with specific criteria was required (Fig.05):

» *Under-utilised land*

As a relic of apartheid modernist planning techniques, the site should have a portion of under-utilised land that present the opportunity for an architectural intervention that can introduce positive social presence.

» *A rich mix of social activity*

The site should have a rich, existing social fabric that can comprise sporting, cultural and educational activities. An activity analysis can reveal the possibility of leveraging this existing activity in developing a social programme to support the architectural design development.

» *Schools*

The possibility for connecting existing educational presence across under-utilised land can support a larger urban-scale strategy.

» *Evidence of splintering urbanism*

Specific to this design dissertation, the site should have evidence of splintering urbanism: physical infrastructure that has historically created a sociotechnical divide across communities. This allows the architectural argument to explore the idea of social infrastructure that leverages existing infrastructure to transcend these divides.

From this selection criteria, and based on the studio's focus within the Gugulethu region of Cape Town, a number of possible sites were identified. Focus was narrowed to the northern section of Gugulethu, where pockets of under-utilised land were identified for possible intervention.

However, early fieldwork exercises and interviews revealed a rich social life occurring at a junction between two communities: Heideveld and Gugulethu. Further examination of this possible site revealed a piece of under-utilised land abutting the train line running between Heideveld and Gugulethu North, with a new pedestrian bridge spanning this divide.

Speaking with town planner and former resident of Heideveld, Dr. Cecil Madell, I was introduced to the complexities of growing up in the Heideveld neighborhood. Through these discussions and further fieldwork in the area, a compelling narrative of sports, education and the potential for youth empowerment began to form.

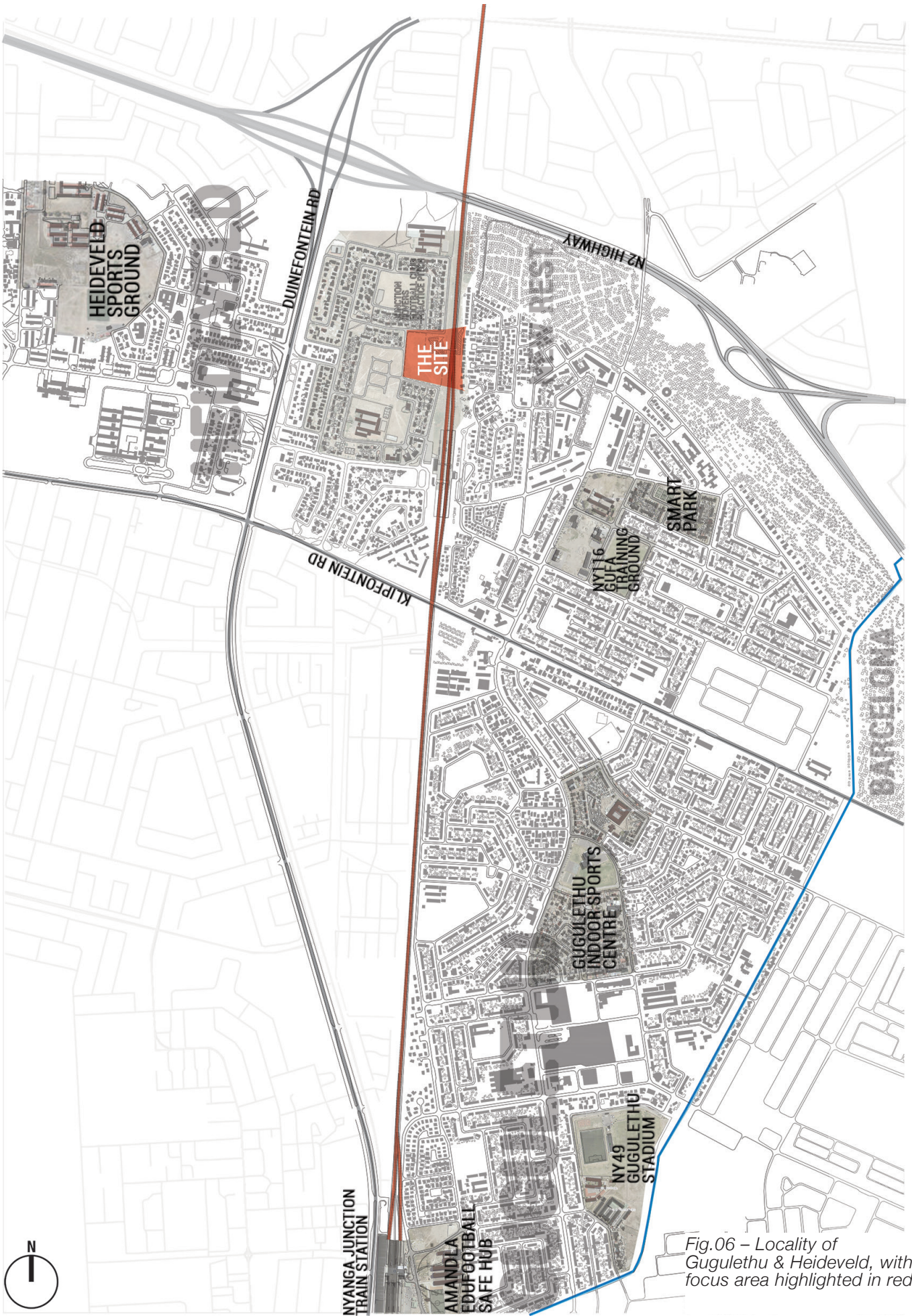


Fig.06 – Locality of Gugulethu & Heideveld, with focus area highlighted in red

HEIDEVELD: A BACKGROUND

...I would say the core for this community is sport and then religion...

– Dr. Cecil Madell

Heideveld was established during the apartheid-era forced removals act. The neighborhood was planned using modernist techniques derived from the American model of suburbanisation. However, where the American model proposed the idea of getting away from the hustle of everyday urban life by living in a well-serviced, idyllic suburbia, the apartheid model reversed this:

So that specific theory was used in the apartheid state, not for wealthy people, but for the low-income people. They were moved here to the suburbs, [but] they didn't have money to improve on the structure, the sub-economic structures you found in America. But also, things like greening, vegetation, all that was left out. [...] The rich city life, that was left out.

– Dr. Cecil Madell

According to Dr. Madell, the planning strategy under apartheid was extremely regulated, based on a strict set of planning standards. Land allocation was generous due to the low population growth, attributed to Heideveld not having a 'long history of informal settlements.' The suburb was established with approximately 6000-7000 residents, growing to around 11 000. Population growth is estimated

to be around 20 000 - 30 000 residents today.

A major circulatory axis through Heideveld is Ascension Road. The main town centre is located across Duinefontein Road; the entire suburb stretches to Vanguard and Welcome Estate, and eastward to this study's focus area.

The focus area itself is located as an isolated pocket bordered by Duinefontein and Klipfontein Roads, and the N2 highway at its northern edge (Fig.06). Whilst this separates the site from the rest of Heideveld, many civic and sporting activities occur in the central part of the suburb, requiring residents to cross the busy Duinefontein Road for activities such as athletics and soccer, and to access the local Heideveld Library (Fig.10).

Heideveld Station is located south of the proposed site, forming a major transport node that connects both Gugulethu and Heideveld residents to the city's transport network. Noticeably quieter than the bustling Nyanga Junction precinct at the southern edge of Gugulethu (Fig.06), Heideveld station still has minor trade facilities. However, as Dr. Madell said, for most residents in this precinct, 'this area is sort of self-contained; a lot of people do things here.'



WILLOWS PRIMARY SCHOOL

NEW HOUSING DEVELOPMENT

HEIDEVELD PRESBYTERIAN CHURCH
HEIDEVELD COMMUNITY CENTRE

REVELATION GOSPEL MISSION TABERNACLE

HEIDEVELD PRESBYTERIAN CHURCH

SITE FOCUS AREA

HEIDEVELD STATION



Fig.07 – Precinct plan showing civic, institutional and social facilities around the site, including the existing pedestrian infrastructure

Two schools – Willows Primary (Fig.09) and Heideveld High (Fig.08) – form anchor points at either side of this precinct (Fig.07). Pedestrian traffic flows across the proposed site to both schools. Many students come from New Rest, a housing development across the railway, and Barcelona, an informal settlement in Gugulethu North.

Both schools operate as Mod Centres (Mass participation, Opportunity and access, Development and growth programme). This is an initiative of the Western Cape Department of Basic Education. It seeks to provide ‘school-going youth with access to various fun-filled, play-based and modified activities in recreation and sport, as well as in arts and culture, on a daily basis.’ (Western Cape Government, 2017)

Because of the contained nature of this precinct, there isn’t any viable after-school space for youth to go to other than the schools themselves. According to Dr. Madell, ‘there’s no spaces, there’s nothing to go to [inside of this precinct] There used to be a notion around sport, and that’s not happening at the moment.’

Socially, the Heideveld Library (Fig.13) is an important nexus located within the suburb’s town centre (Fig.10). Visiting the space, I immediately realised that this is not a library in the traditional sense. As Dr. Madell noted in our interview, ‘The library has been one of the most dynamic places. It’s a social space, it’s where you meet... contrary to popular belief, a lot of people don’t have

smartphones. So getting access to the internet, looking for a job, socialising, finding your next girlfriend, the library is the biggest [space for that].’ Dr. Madell remarked during our visit that such a space would be interesting to develop within the focus area, perhaps at a smaller scale and funded by professionals who grew up in the area. This idea sparked initial notions around the possible social programme, which will be explored later in this section.



Fig.08 – Heideveld High School



Fig.09 – Willows Primary School



Fig.10 – Precinct locality map of Heideveld town centre, the focus precinct, and Gugulethu north



Fig.11 – Heideveld Sports Ground astro turf



Fig.12 –Cockscomb Park, current practice ground for Junction Rovers and athletics classes for Willows Primary

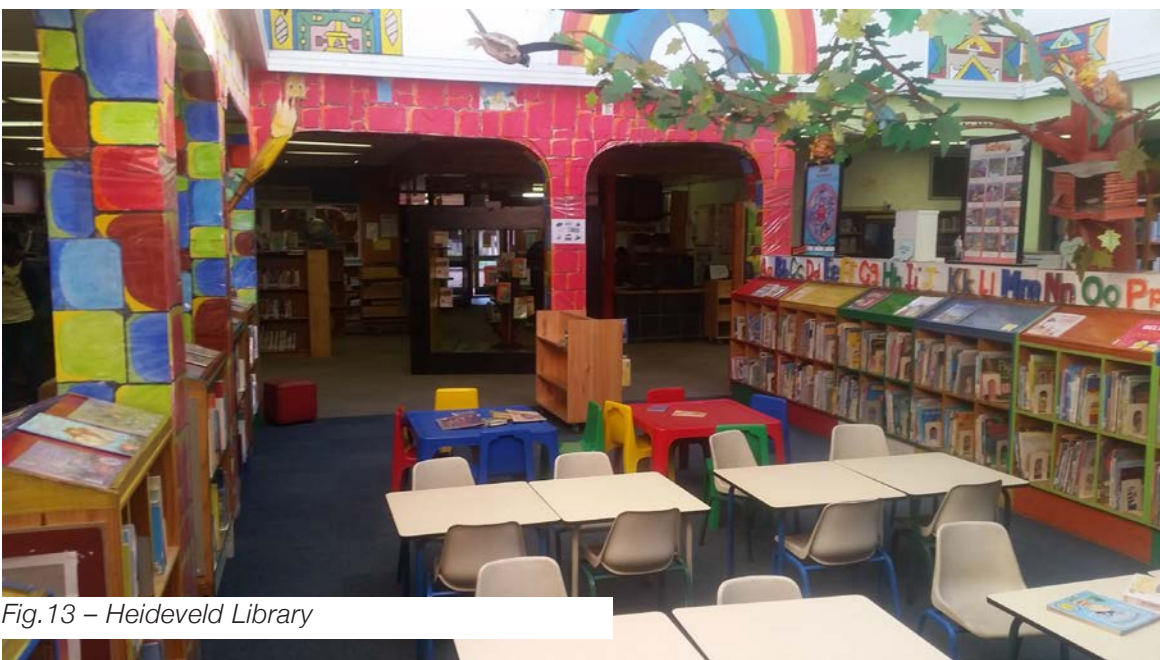


Fig.13 – Heideveld Library

Fig.14 – Heideveld Pedestrian Bridge



INFRASTRUCTURE

One of the site selection criteria was evidence of splintering urbanism. This is evident in the focus area, where a railway line separates Gugulethu and Heideveld. However, in 2010, a new pedestrian bridge was constructed that terminates onto public open space.

The Heideveld Pedestrian Bridge (Fig.14) was designed by P.D. Naidoo and Associates, in conjunction with Jakupa Architects and Urban Designers and Clare Burgess Landscape Architects.

The pedestrian bridge site was identified on the route that pedestrians take to cross the railway lines to get to schools in Heideveld. [...] There were reported incidents of accidents owing to pedestrians crossing the railway lines between stations. (City of Cape Town, 2011)

The bridge terminates on the Heideveld site through a long, curving ramp. ‘The woonerf concept’ (City of Cape Town, 2011) guided the design of this infrastructure, which limits vehicular access and ‘integrates the space available for pedestrians and residents for leisure and commuting activities.’ (City of Cape Town, 2011)

A large infill berm rises to meet the bridge, creating a strong physical presence at a corner of the open site. On the Gugulethu side, a long ramp descends towards New Rest. Stairs descend off the bridge towards a possible route linking to Heideveld Station. However, upon site visits, I discovered that this area is derelict backyard space that feels unsafe, and is sandwiched between the back of houses and the railway fence. Appendix D includes the engineering drawings for this bridge and the design options explored by the engineers.

The open land itself is expansive and exposed. However, many residents and commuters cross in specific patterns to particular destination points within this precinct. A movement analysis (Fig.15) based on observed desire lines and interviews with both schools’ principals revealed possible movement vectors, which indicates both destination and time. This analysis began to form an understanding of the social life of this precinct.

This existing infrastructure – the bridge, its berm and ramps – presented the opportunity for interrogating architecture as social infrastructure by, quite literally, building off the bridge and mound. Part II of this report will document the design experiments around this notion.

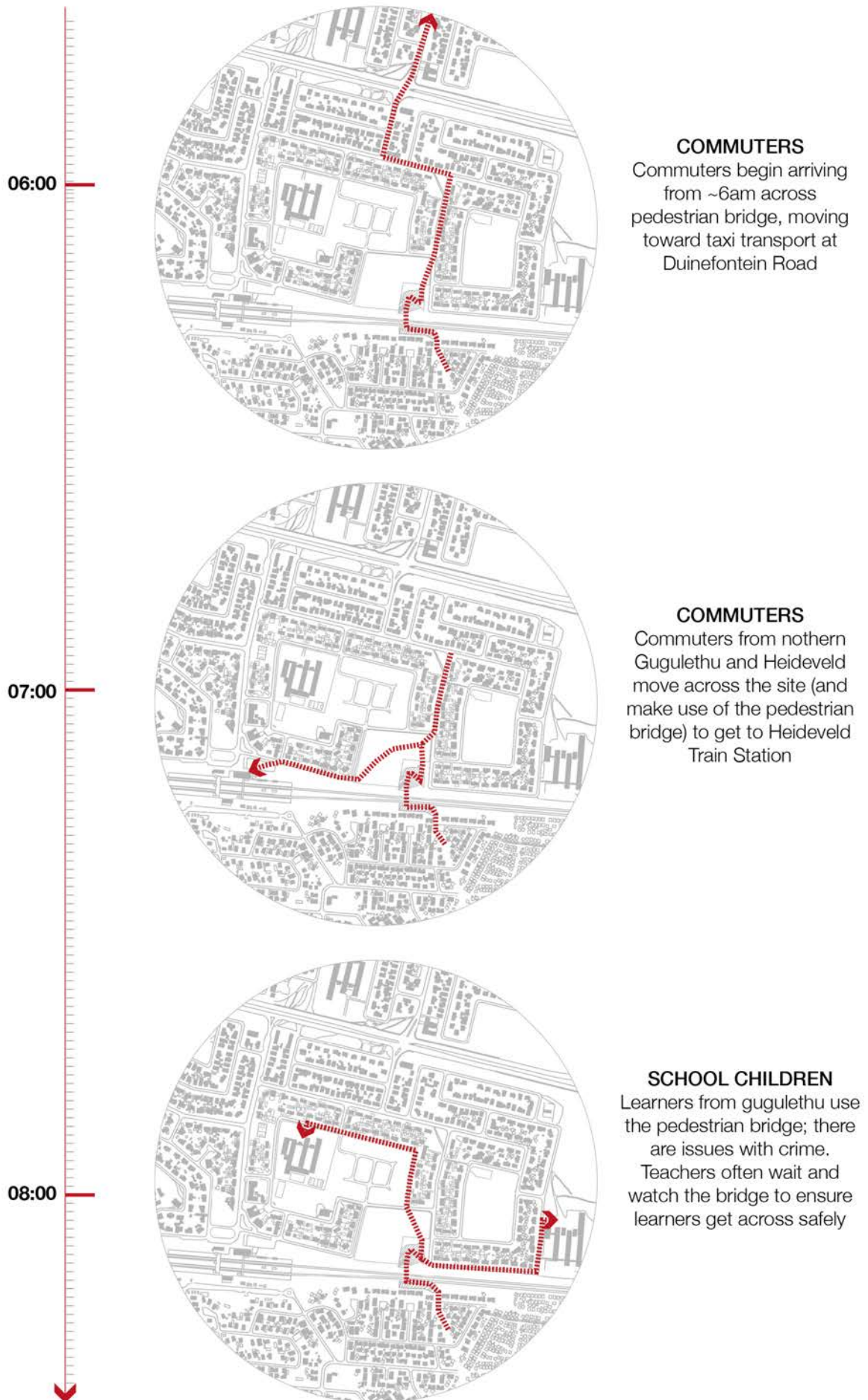


Fig.15 – Movement vectors around the Heideveld site

The site's infrastructure does, however, provide compelling design opportunities. Within the theme of social infrastructure, the bridge's function as a conduit between two communities begins to transcend sociotechnical divides. Its current failure, however, is its inability to properly integrate both communities at the junction it creates through its expressive design language. At either end the residual spaces it creates retain their characteristics of being underutilised, derelict, exposed and unsafe (Fig.16, 17 & 18).

The physical attributes of this site begin to set the scene for an architectural act that can, through its surfaces and articulation of social programme, begin to activate this otherwise derelict land fronted by powerful infrastructural moves.



Fig.16 – Looking onto the site from the bridge



Fig.17 – Looking onto the site from the ramp



Fig.18 – Backyard alley condition between houses and railway

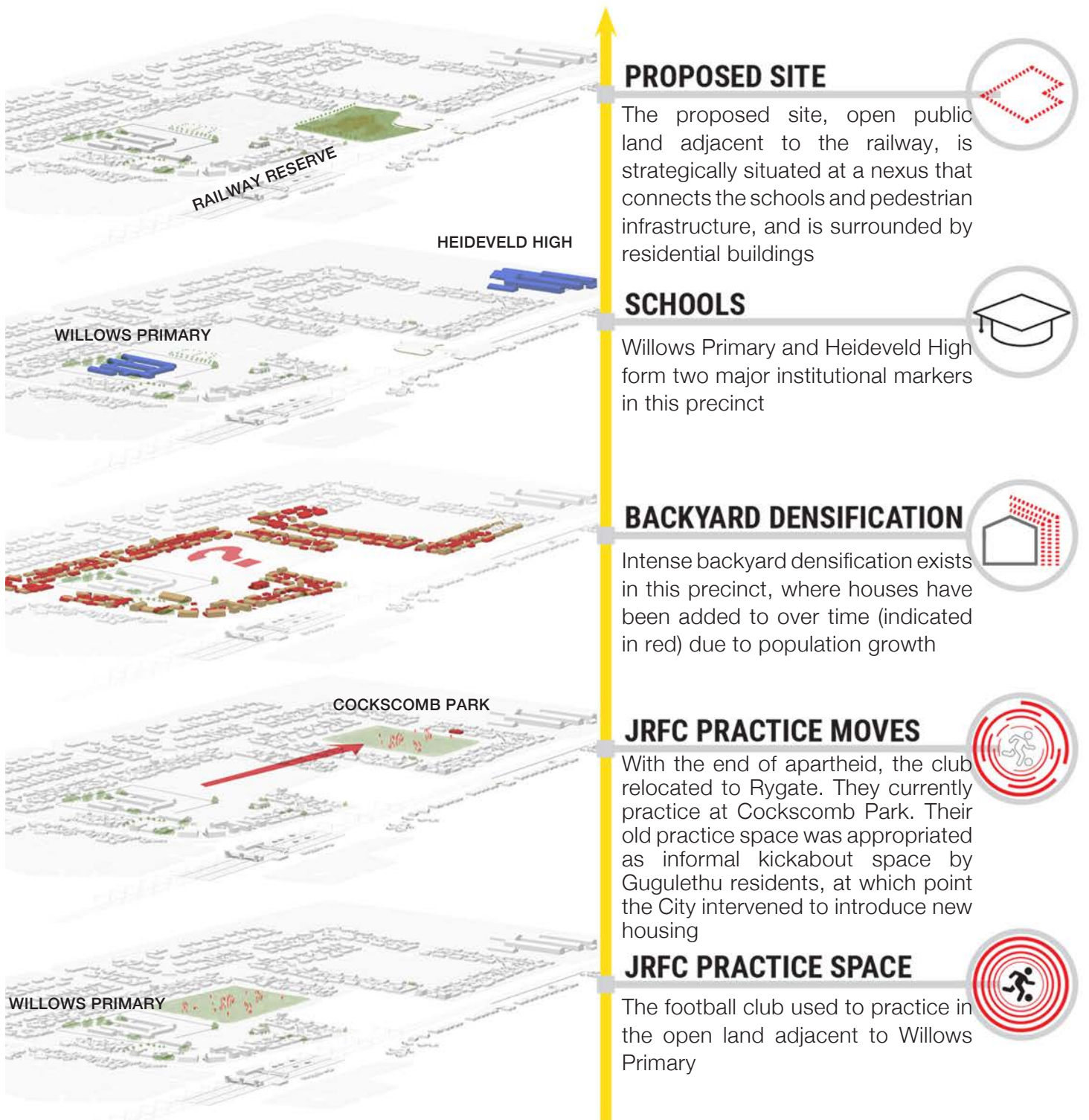


Fig. 19 – Site narrative of the local football club, Junction Rovers, and the site characteristics: intense backyard densification, schools, and the emergence of new infill housing on the previous site used by the club to practice.

THE FOOTBALL CLUB

...there is only one major soccer club here called Junction Rovers.

– Dr. Cecil Madell

This precinct has a strong sporting culture. Both schools have extensive extra-curricular programmes but lack many facilities to run these activities. According to Ms. Grootboom, deputy principal of Willows Primary, ‘we play a lot of sport. We have athletics at the beginning of the year, which is our summer sport, we have netball, soccer, basketball, and softball.’

Speaking with the principal of Heideveld High, I discovered that the high school has a strong basketball presence with coaching from a former national player. The sport is practiced in their new school hall completed in April 2017. It is seen as a popular sport because ‘they [students] play competitively, in a league, where they make the Western Cape team.’ Furthermore, basketball is seen to have a better structure to the way soccer is managed within this region. This was corroborated with Dr. Madell, who lamented the regression of soccer in the past few decades, particularly due to its management: ‘The way clubs were run 20 years ago has gone backwards. [...] it’s a lot of dynamics.’

Nevertheless, Dr. Madell describes this as a ‘football mad community.’ There is a rich history of running soccer clubs, fostering a deep sports culture that permeates the schooling life as well. Ms. Grootboom elaborated this point when she mentioned that Junction Rovers has a significant presence in the area.

...everybody knows about Junction Rovers, and they have the same colours as this school [Willows Primary], so we’re integrated very nicely with the club. – Ms. Grootboom

Many of the children come from families that belonged to the club; its history is well-ingrained into the social fabric of this precinct. Their fathers, once members of the club, are now coaching for Junction Rovers.

The club has since been decentralised from this community due to numerous factors (Fig.19). With the collapse of apartheid, freedom of movement enabled local clubs to become better integrated across communities. As such, Junction Rovers and other clubs relocated to Rygate (Fig.10).

With apartheid being demolished and sporting clubs having more mobility, some clubs in certain areas then decided that they'd rather play in Rylands.' Before this, the club would train at Cape Flats, a field in Heideveld. When I played soccer here, in the 70s and 80s, there was more sense of community cohesion. Because it was easier for parents to watch the game, [for example] on a Saturday morning. [...] So the connection between the community and the club was much closer.

–Dr. Cecil Madell

Furthermore, the club's original practice ground adjacent to Willows Primary was vacated when they moved to Rygate, and was subsequently adopted as an informal kick-about space used primarily by residents from Gugulethu (Fig.19). This unprogrammed scenario caused the City of Cape Town to intervene; currently, this former home of the club, once located at the very heart of this community, is being developed into new housing.

The club currently uses Cockscomb Park (Fig.07) for their practices. This space does not have any defining characteristics for soccer, nor is it spatially conducive to such activity. It is fenced-off and a path cuts directly across the park. However, it is situated across the road from the current chairman's house, making it logistically efficient for safety and practice sessions.

[Junction Rovers] always wanted a sports club, so they could be focused, but now that has been kind of lost... – Dr. Cecil Madell



Fig.20 – Street façade of the Oliver Kahn Safe Hub in Nyanga Junction

IMAGEABLE BUILDINGS

New architectural interventions, especially within under-serviced communities have a public perception issue. In my visit to the Oliver Kahn Safe Hub run by Amandla EduFootball in Nyanga Junction in southern Gugulethu, I discovered that the building operators had an issue conveying the building's purpose to the local community.

The Oliver Kahn Safe Hub (Fig.20) is a facility comprising a youth café (Fig.22) that hosts open mic sessions and has computer terminals with internet access, a seminar room, offices and an AstroTurf training pitch (Fig.21). However, concerns around safety have led to pragmatic moves which subsequently do not convey the building's purpose of being a space for youth at-risk to socialise and partake in healthy lifestyle programmes (Fig.23).

This is partially a branding and marketing issue which they explained is being developed. However, new buildings like the Safe Hub seem to convey a message through their vertical surfaces that contradict their internal programme. According to Ms. Yanga Dudumashe of Amandla EduFootball,

...when they see a building like this, they see, 'office space.' They don't see a fun space to be in. They see, ok, that's office, that's corporate, you don't go there. We've hosted open mics; people will still stand outside the fence.

This brought to my attention the importance of imageability and institutional presence. As explored in my Theory and Technology Studies paper, architectural presencing is a key factor in any pursuit of genius loci and the integration of architecture into communities (Dowlath, 2017).

The Safe Hub falls short of good imageability because its surface architecture conveys a corporate feeling. The use of high-level security fencing, a necessity given the vibrant pedestrian activity of the commercial Nyanga Station transit area, begins to distance the building from its surroundings.

The Safe Hub is primarily a youth-centred space. However, its most dynamic space – the youth café on the ground floor that connects to the practice field – is hidden from pedestrian activity. A key factor driving the creative inquiry, then, is what youth-centred architecture can look and feel like, and how could it contribute to a good institutional and programmatic imageability.

Architectural imageability can be related to the idea of 'surface architecture', a concept developed by David Leatherbarrow and Mohsen Mostafavi. As expanded upon in my Theory & Technology Studies paper, surface architecture denotes not only 'how surfaces and signs signify their presence', but also the notion that they can be 'social fields that enable identity building.'

The site narratives and the issue with architectural imageability, when read together, began to develop the social landscape within which the architectural inquiry could locate itself. Furthermore, the idea of splintering urbanism, a concept developed by Graham and Marvin, will provide a compelling theoretical foundation for understanding the fragmented phenomenon of post-apartheid South African cities.

Together, this social landscape and theoretical underpinning will set the stage for the architectural development from an urban precinct scale to the built interventions that seek to socialise urban infrastructure through youth-centred programmes.



Fig.21 – Field-side of the Safe Hub showing the AstroTurf practice pitch



Fig.22 – The youth café on the ground floor



Fig.23 – Youth development and leadership programmes run by Amandla EduFootball

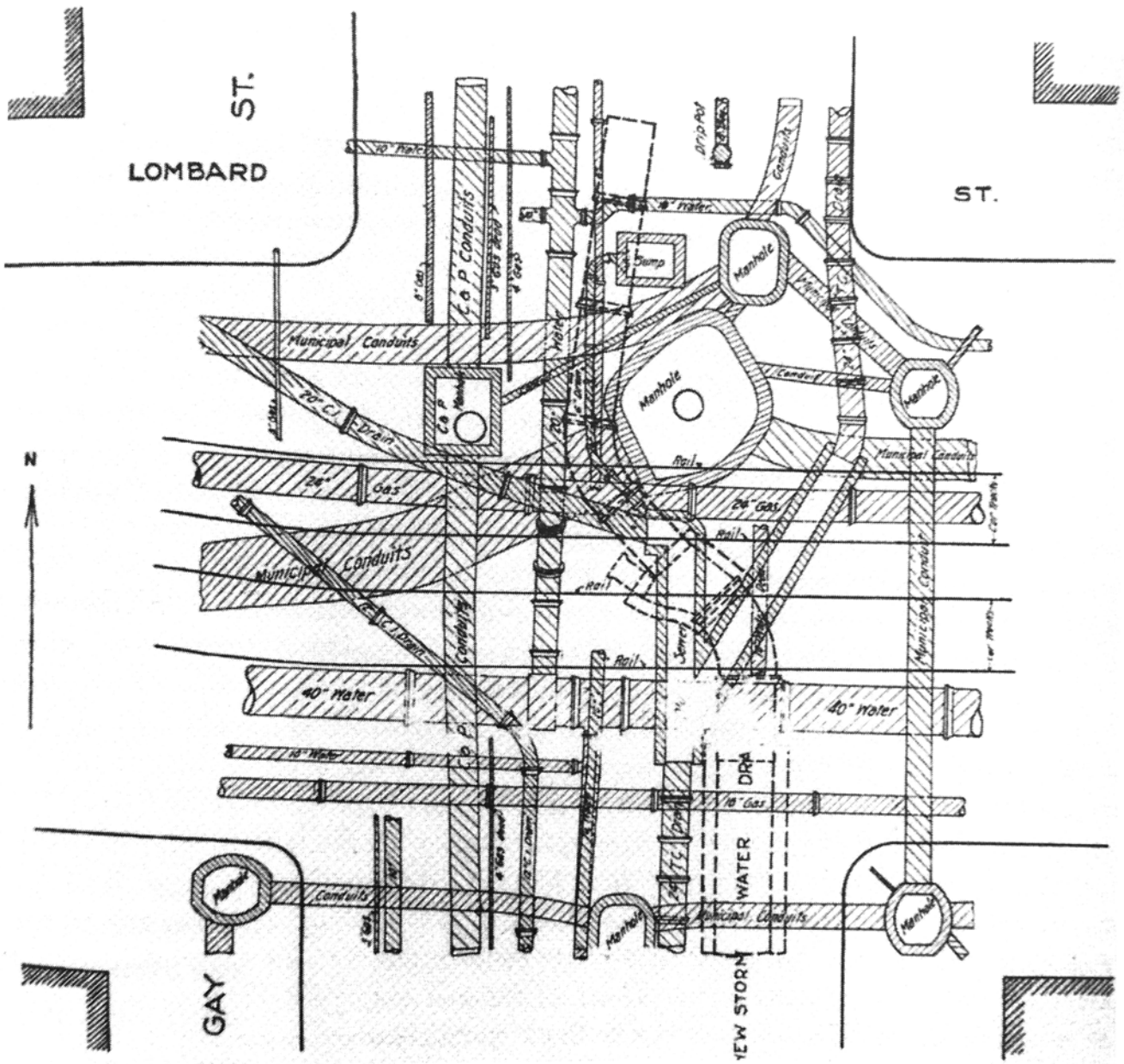


Fig.24 – A drawing by Lewis Mumford of what he called the invisible city: the underground pipes and conduits that sit at the junction between Gay and Lombard Streets, Baltimore, Maryland.

THE SOCIOTECHNICAL: SPLINTERING URBANISM IN CAPE TOWN

There is an intrinsic relationship between the infrastructural systems and the spatial experiences of cities. Infrastructure becomes a shaper of space. Urban society is increasingly dependent on networked infrastructures in order to survive (Fig.24). As evidenced in our group's fieldwork with VPUU at the Lotus Park Informal Settlement, spatial experience is intrinsically defined by infrastructure, and the lack of it in most cases.

The idea of the sociotechnical, therefore, denotes an interplay between the social fabric of a city, and the physical infrastructure that supports this social life. As Stephen Graham and Simon Marvin note,

We must therefore recognize how the configurations of infrastructure networks are inevitably imbued with biased struggles for social, economic, ecological and political power to benefit from connecting with (more or less) distant time and places. (Graham & Marvin, 2001, p. 11)

In *Splintering Urbanism*, the authors further discuss how infrastructure can fragment the urban experience: '...infrastructure networks, and the sociotechnical processes that surround them, are strongly involved in structuring and delineating the experiences of urban culture and what Raymond

Williams (1973) termed the "structures of feeling" of modern urban life." (Graham & Marvin, 2001, p. 12)

The authors add an additional layer of complexity to the reading of urban infrastructure: that it is inextricably woven into social practices, meanings and values of contemporary urban society. In viewing infrastructure as a key factor in shaping the urban experience, 'cities and urban regions become, in a sense, staging points in the perpetual flux of infrastructurally mediated flow, movement and exchange.' (Graham & Marvin, 2001, p. 8)

If modernism was considered in part as an attempt to create order through the ubiquitous development of infrastructural systems (enabled by events such as the Industrial Revolution), then the cultural construction of modern cities is based on networked infrastructures. This concept denotes public goods that are 'integrators of urban spaces' (Graham & Marvin, 2001, p.8). Continuing the use of increasingly complex infrastructure to support urban growth, networked infrastructures are perceived to 'bind cities, regions and nations into functioning geographical or political wholes.' (Ibid.) They are symbolic of the formation of welfare states and are 'tools to reinvent the urban as a sanitised and functional place.' (Caletrío, 2013)

However, the authors argue that a lack of understanding this immense role of modern urban infrastructure has become detrimental to the social

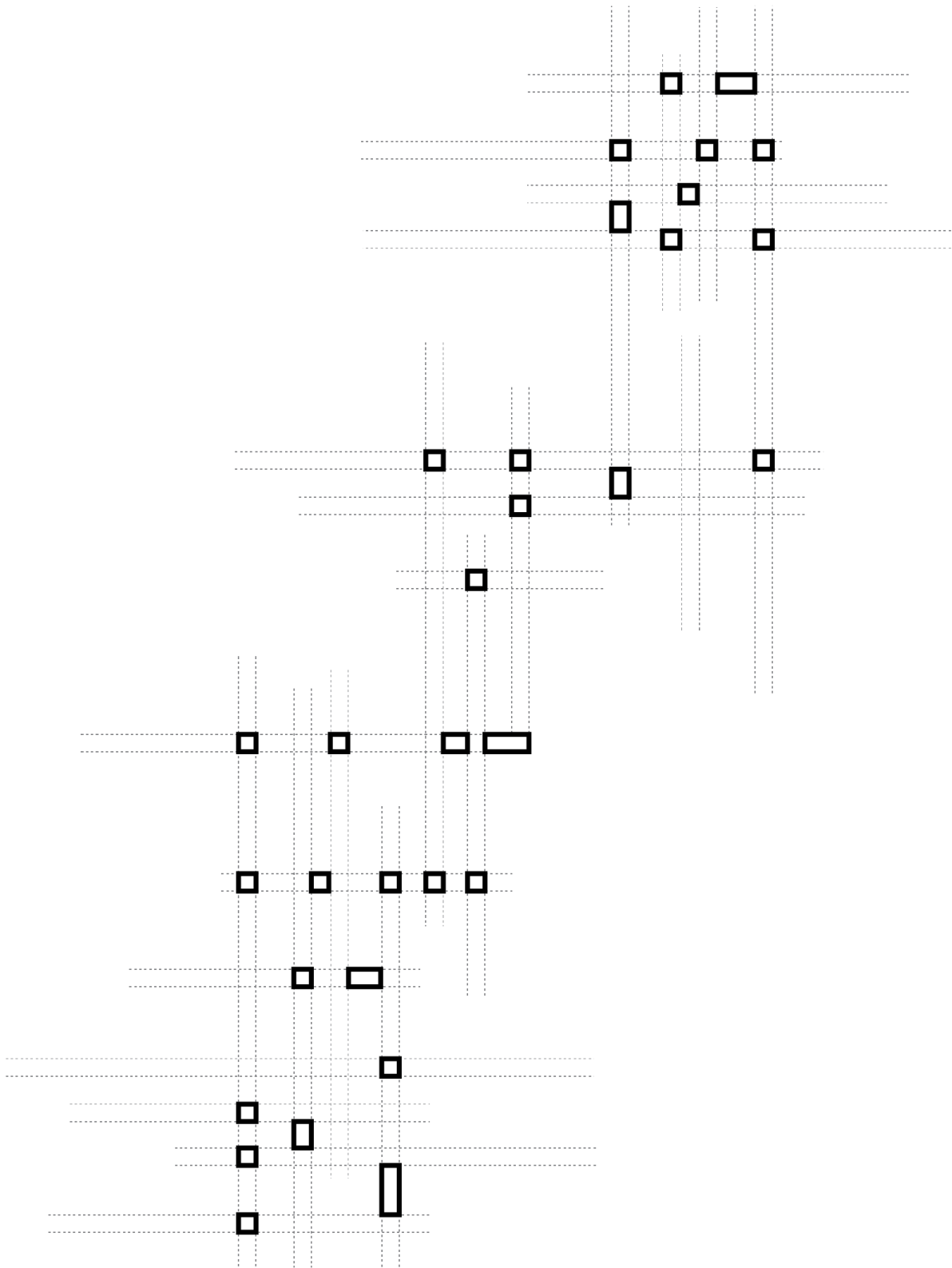


Fig.25 – An abstraction of the networked nature of the contemporary metropolis, where infrastructure has the power to connect, but also fragment the experience of the city.

development of many cities. They attempt to address a fundamental question surrounding the discussion on splintering urbanism:

How can we understand the emerging infrastructure networks and urban landscapes of internationalising capitalism, especially when the study of urban infrastructure has been so neglected and so dominated by technical, technocratic or historical perspectives? (Graham & Marvin, 2001, p. 9)

In South Africa, planning policy in the form of the Group Areas Act of 1950 was a mechanism of apartheid, the neighborhood unit being the primary example of racial segregation and its related spatial distribution. As part of this strategy, infrastructural systems such as highways and railways became spatial delineators separating communities. As a form of splintering urbanism, then, these infrastructural divides continue to foster spatial inequality and social division due to the entrenched nature of this historic planning policy. Cape Town's notorious fragmentation and decentralisation further strengthens the role of infrastructural divisions. It is, in essence, a manifestation of a sociotechnical paradigm: networked infrastructure in the form of transportation becomes a key social and spatial system that connects various urban factions, but also perpetuates societal divides in its containerization of communities through its delineation.

Whilst Splintering Urbanism deals mostly with the large-scale concerns of infrastructural experiences in terms of planning, it presents compelling ideas around the notion of the sociotechnical. These ideas inspired the exploration of architecture as social infrastructure.

Architecture acts as the material and spatial translation of a social programme. It is a shaper of

space that is imbued with meaning derived from the flows of activity and social lives of its inhabitants. However, when juxtaposed with adjacent networked infrastructures, architecture takes on an additional role. Not only is it reacting to the social forces of people, but also the technical forces that come with these infrastructures.

How, then, can architecture react to such phenomena? A study into architectural presence, explored in my theory and technology studies paper, introduced the idea of existential space. Christian Norberg-Schulz proposed that existential space comprises proximities, continuities and enclosures. The architectural corollary to this are the levels of architectural space (landscape, urban and architectural). Between the urban and architectural scales resides surface architecture, where 'buildings appear as surfaces rather than masses.' (Norberg-Schulz, 1971, p. 83)

Leatherbarrow and Mostafavi's ideas surrounding surface architecture thus instigate the possibility that in order for architecture to perform as a piece of social infrastructure, one must consider the development of its surfaces.

Expanding this notion and based on Leatherbarrow and Mostafavi's ideas, combined with Norberg-Schulz's concepts around architectural presencing and phenomenology, I propose the definition that surface architecture comprises vertical surfaces of social presence, and horizontal surfaces of social purpose. This will be expanded upon in Part II.

Working together with a social programme that is derived from social patterns of inhabitation, these two concepts – Surface Architecture and Social Programme – combine to form the framework for sociotechnical architecture. In this system, surfaces act as the physical (or technical) component, and programme as the social aspect that combine to form the sociotechnical.



Fig.26 – Conceptual site collage of the imagined social activation of the Heideveld site



PROGRAMME DEVELOPMENT

From my fieldwork interviews, where I discovered the rich stories of Heideveld and its residents, and reading Graham and Marvin's Splintering Urbanism theory, a compelling narrative began to emerge.

The importance of football in this community, the displacement of the local soccer club, its relationship to the two schools, and the challenges children face in navigating this complex social landscape began to sketch a possible social programme (Fig.26).

This design dissertation posits that social infrastructure is possible by a combination of a social programme and the articulation of surface architecture. Through fieldwork, a social programme involving the notion of youth space became an entry-point into developing the architectural programme.

A clubhouse is an exciting metaphor that speaks to the vibrancy of community gathering, collecting around a central idea (that of sport), and the various activities that support this goal. Thus, the idea of youth space in the form of a clubhouse, where the history of this local club, Junction Rovers, provided the backdrop for transcending sociotechnical divides.

The Heideveld Pedestrian Bridge currently descends onto vast open space on the Heideveld side. Conversely, the Gugulethu side lands onto the awkward middle-ground between the backyards of houses and the railway. Both sides, however, present the opportunity for activation if a social programme were to stretch across the tracks. The driving programme question became: can we distribute an architectural programme across urban infrastructure?

SITE ACTIVITY STUDY

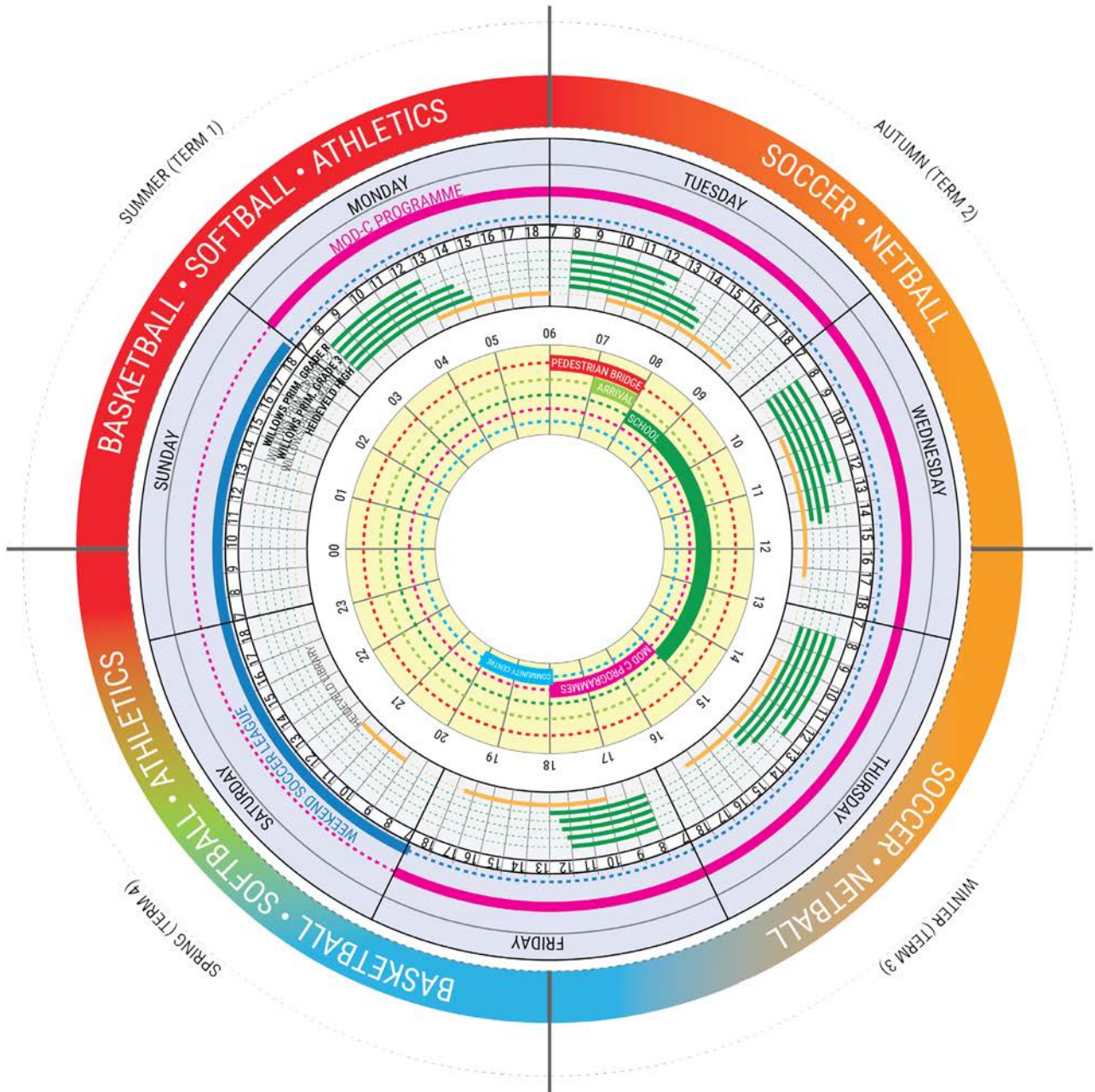


Fig.27 – Site activity study

The diagrams on pg.46-51 were used to extract key findings from fieldwork. Fig.27 shows the overall site activity during different time periods and scales (from seasonal to daily). This study provided insight into the diversity of sporting and civic activities and the times during which they occur. The social programme could then take its cues from these patterns of activities, either capturing the interstitial spaces to deploy the architectural intervention's programme, or enhancing the existing site activities by extending their presence and supporting them with the proposed new spaces.

Fig.28 is the first programmatic study that synthesised the fieldwork into a series of spaces. This exercise explored the spatial requirements, the possible major spaces and emerging spatial adjacencies. The space syntax method developed by Bill Hillier and Julienne Hanson (Hillier & Hanson, 1984) was tested as an exercise in understanding possible spatial depths from designated vantage points.

Using a plugin for Grasshopper (SYNTACTIC), the algorithmic environment in the 3D digital modeling program Rhinoceros, the preliminary programme was set-up and then certain spaces, such as the clubhouse or youth cafe, were selected as

vantage points. This study allowed me to quickly determine how deep other spaces in the proposed architectural programme were in relation to the selected vantage point. This revealed possible issues with spatial adjacencies and ensured certain spaces could be locked-down for security purposes whilst not impeding the operation of the rest of the building (Fig.31).

In addition to these experiments with the early social programme, an activity matrix for the architectural project was devised (Fig.30). This is an imagined timetable, based on the site activity study and the emerging programme, of when certain spaces might be used. This study revealed the possible overlapping of activities and spaces and the need for certain spaces to be secured after-hours whilst other activities continued.

These studies began to also suggest, through early understanding of spatial adjacencies and spatial requirements, what the possible institutional arrangements might be.

Part II continues this investigation as the programme, spaces, institutional and urban frameworks are explored in relation to the emerging architectural synthesis.

Fig.28 – Initial programme

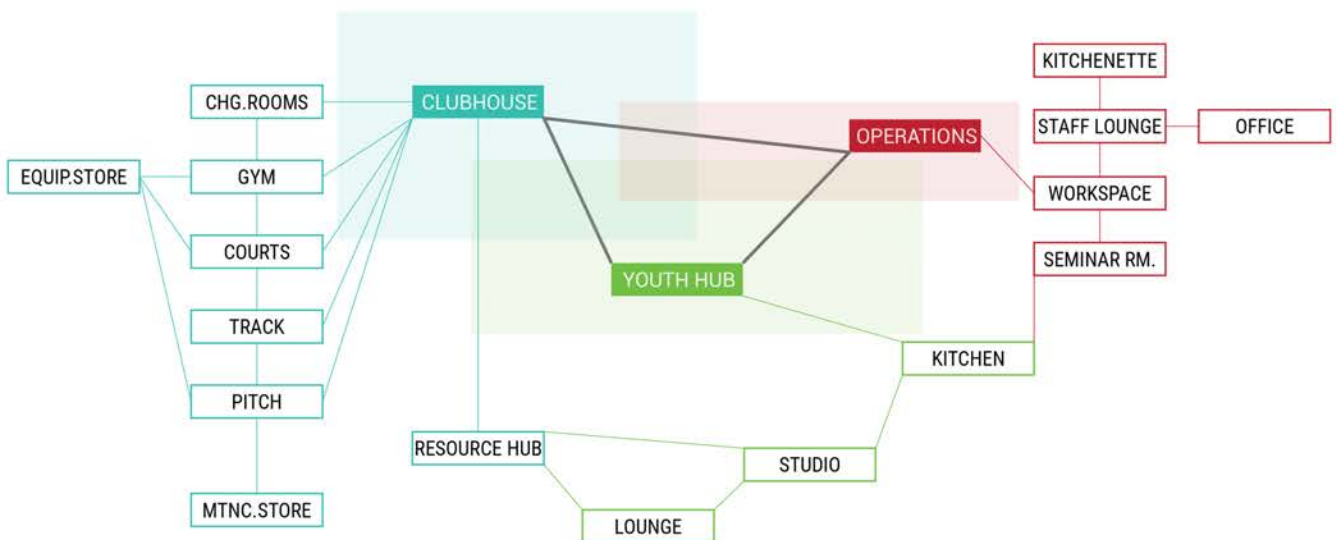
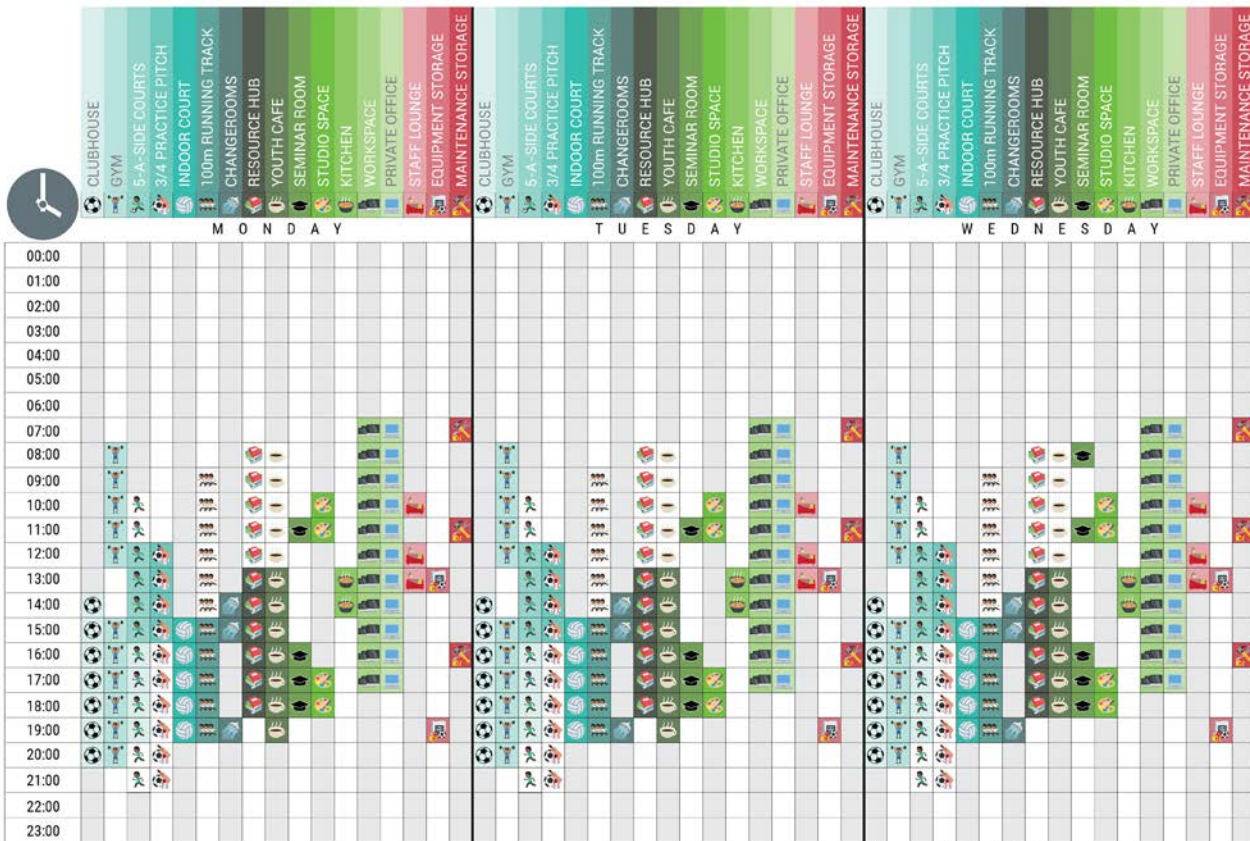
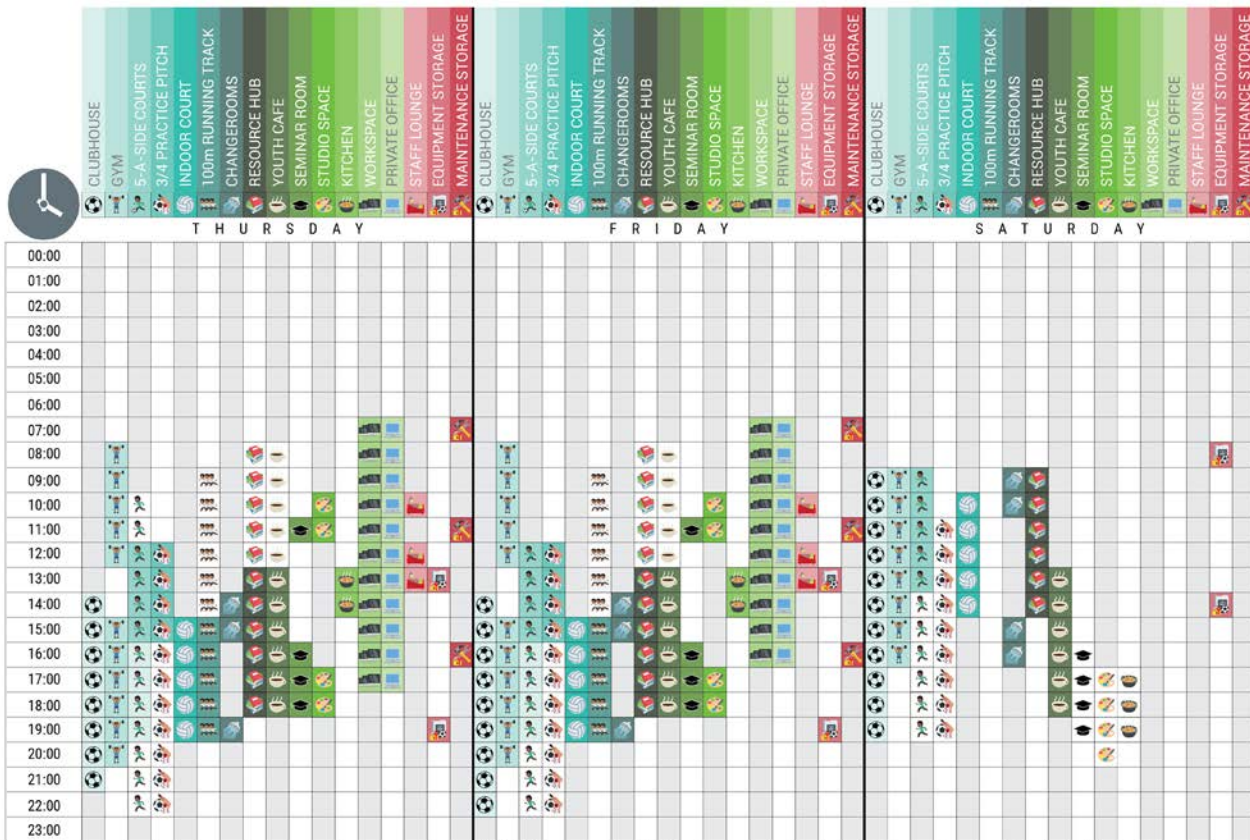


Fig.29 – Initial spatial adjacencies derived from programme



Management Meetings in Seminar



Weekly night league runs until 10/11pm

Resource centre operates 9am-2pm under supervision
Weekend sports booked from 9am-2pm
Seminar/Studio/Kitchen booked for events in evening

Fig.30 – Imagined activity matrix of spatial use based on the preliminary programme

DEPTHMAP

0	CHANGE ROOMS
1	GYM
2	COURTS
3	TRACK
4	PITCH
5	CLUBHOUSE
6	YOUTH HUB
7	OPERATIONS
8	RESOURCE HUB
9	LOUNGE
10	STUDIO
11	KITCHEN
12	KITCHENETTE
13	STAFF LOUNGE
14	WORKSPACE
15	SEMINAR
16	OFFICE
17	EQUIPMENT STORAGE
18	MAINTENANCE STORAGE

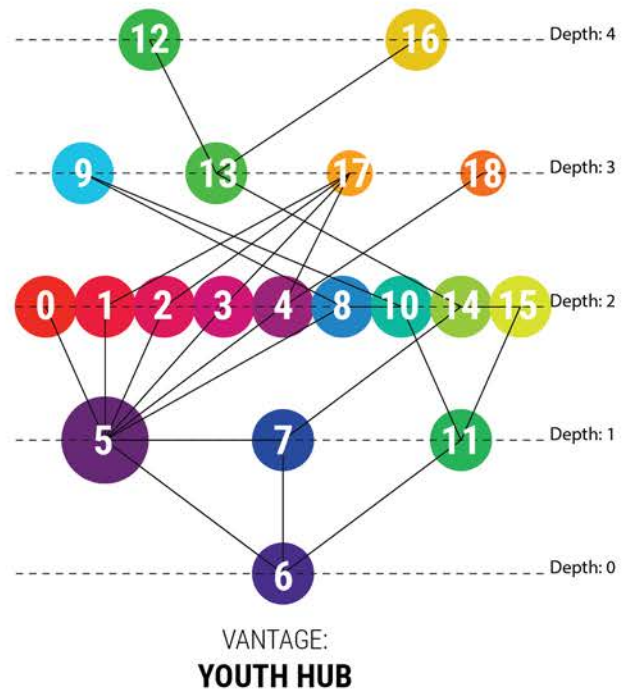
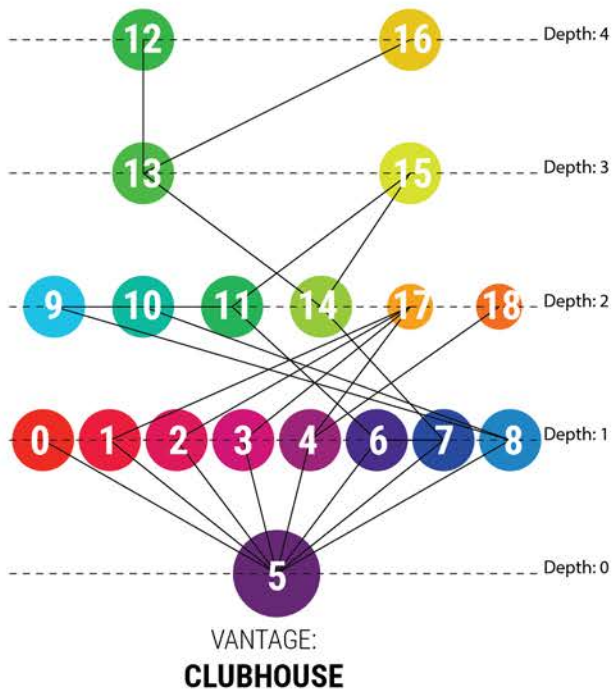
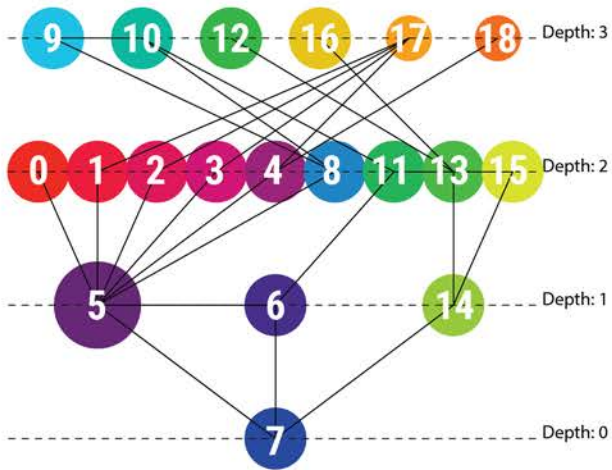
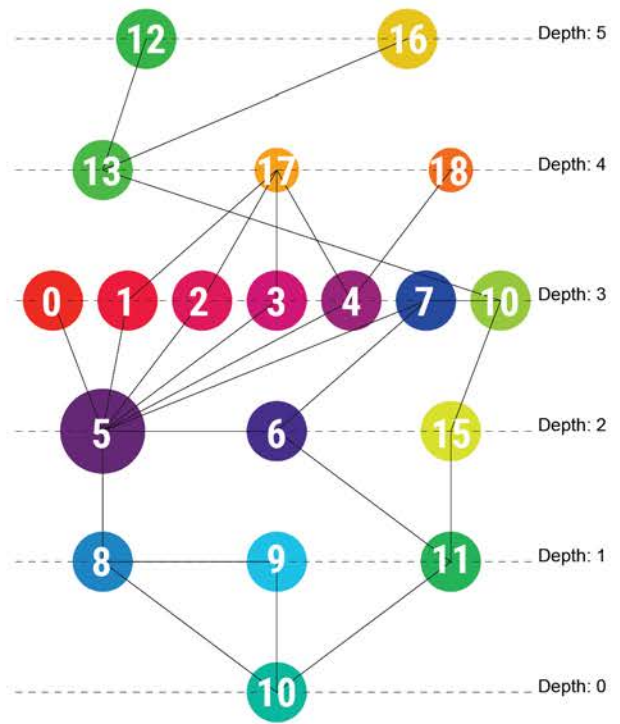


Fig.31 – Justified graphs based on the space syntax methodology, created with the SYNTACTIC plugin in Grasshopper, indicating the depth of spaces relative to a selected vantage point



VANTAGE:
OPERATIONS



VANTAGE:
STUDIO

PART II SYNTHESIS

URBAN DEVELOPMENT PLAN

*SOCIAL INFRASTRUCTURE: DEFINING, TESTING,
DIAGRAMMING*

TRANSLATING PROGRAMME

INSTITUTIONAL ARRANGEMENTS

YOUTH SPACE

DESIGN RESEARCH FINDINGS

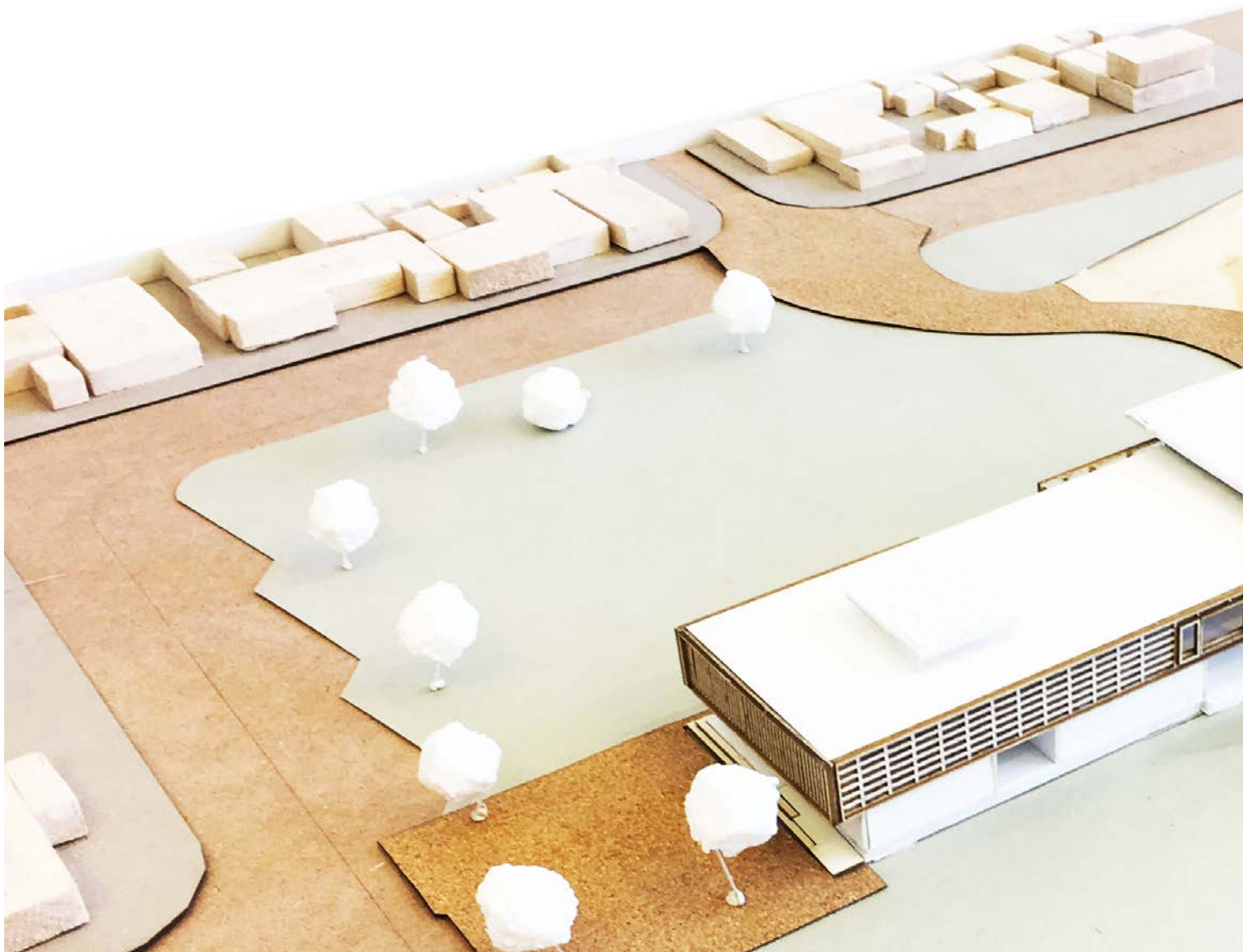


Fig.32 – Activating infrastructure across communities (final presentation model)

THE JUNCTION

transcending sociotechnical divides

Transcending sociotechnical divides requires the development of a social programme across urban and architectural scales, consideration of ideas around surface architecture in relation to imageability, and the architectural definition of social infrastructure. This section explores the architectural evolution of the design dissertation, from the urban development framework to the surfaces that create institutional and social presence on site. It concludes with the design research findings of creating sociotechnical architecture that interrogates apartheid's infrastructural divides.

The architectural synthesis seeks to address the following design research questions:

» *How can architecture spatialise urban infrastructure?*

» *What is the minimum architectural fixity within an urban precinct to enable a maximum flexibility of social use?*

» *How can surfaces and social programmes combine to create legibility and imageability in public buildings?*



Fig.33 – Site zoning



IDENTITY

WARD	44
ADDRESS	37 WATERBERG ROAD
ALLOTMENT	CAPE TOWN
LEGAL STATUS	REGISTERED
PROPERTY #	101213
ZONING DESCRP.	COMMUNITY 1: LOCAL

AREA: 14 966m²
ZONING "COMMUNITY 1:LOCAL"
 Primary uses: Place of instruction, place of worship, clinic, rooftop base telecommunication station, open space
 Consent uses: Institution, hospital, place of assembly, cemetery, freestanding base telecommunications station, urban agriculture

Floor factor: 0,8
 Coverage: 60%
 Max. height above base level: 12m

BUILDING LINES
 Street boundary: 5m
 Common boundaries: 5m
 Street centreline setback: N/A

Other provisions: Parking
 Access loading
 Noise mitigation
 Screening

URBAN DEVELOPMENT PLAN

Public open space in under-serviced communities is a complex spatial challenge. From work which our studio, *Fields of Play*, undertook in collaboration with VPUU, I discovered the importance of structured urban spaces that comprise distinct characteristics:

» *Legible safe routes that link residents to specific destinations (usually transit hubs, as is the case in Harare Park, Khayelitsha)*

» *High-level street lighting along these routes that ensure continuous visibility*

» *Activation of safe routes through a series of built interventions that ensure continuous surveillance*

(Cooke et al., 2015)

In the case of the Heideveld site, there is a vast expanse of open space (approximately 14 966m²) that is structured only at one corner – the berm that meets the Heideveld Pedestrian Bridge. Analysis of desire lines and fieldwork narratives suggested that this space is continuously active and well-utilised as a surface that connects the bridge with the precinct's two schools, the train station and a transit node at Duinefontein Road. However, the site is inactive, poorly lit and unsafe.

The first step, therefore, was to consider at the urban scale a precinct plan that, following tested principles by VPUU, would structure this open space in order to create safety, facilitate major movement patterns, and begin to suggest potential architectural interventions.

It is understood that a city is built by many designers. Therefore, master-planning proposals were avoided in favour of an urban development strategy that facilitated growth and used the architectural intervention as a catalyst for activating this precinct.

The site is currently zoned as Community Zone 1: Local (Fig.33). This allows for programmes such as a place of instruction, institution or place of assembly. Using this as a guideline, the urban development framework proposes incremental growth that can encompass a range of community activities. Dominant desire lines, such as the one connecting the site to the schools and Heideveld Station, becomes a major axis that can begin to structure this open public space. The site has the potential to become a community nexus, with the possibility of future community development that addresses the street edge of Longkloof Circle. This is in addition to the catalytic intervention that this design dissertation's architectural inquiry seeks to become.

Initial concepts focused primarily on the Heideveld site, with the intention of programming this space through a series of small buildings (Fig.34, 35 & 36). The anchor building would be a clubhouse that emerged directly off the Heideveld Pedestrian Bridge.

However, subsequent exploration evolved this idea. The idea of transcending sociotechnical divides suggested working across the railway line by socialising spaces on the Heideveld site and the backyard space between the railway and houses on the Gugulethu site.

The site development strategy evolved to consider these two areas (Fig.37). The existing bridge already has significant urban presence. However, the remainder of the Heideveld site remains unprogrammed and presents the opportunity for spatialising it through an urban development strategy.

Conversely, the Gugulethu side, with its linear site geometry, began to suggest the idea of athletics programmes. This would begin to socialise the infrastructure as the Heideveld schools could use this space, traversing the infrastructure and in the process coming into contact with the proposed interventions on the Heideveld site.

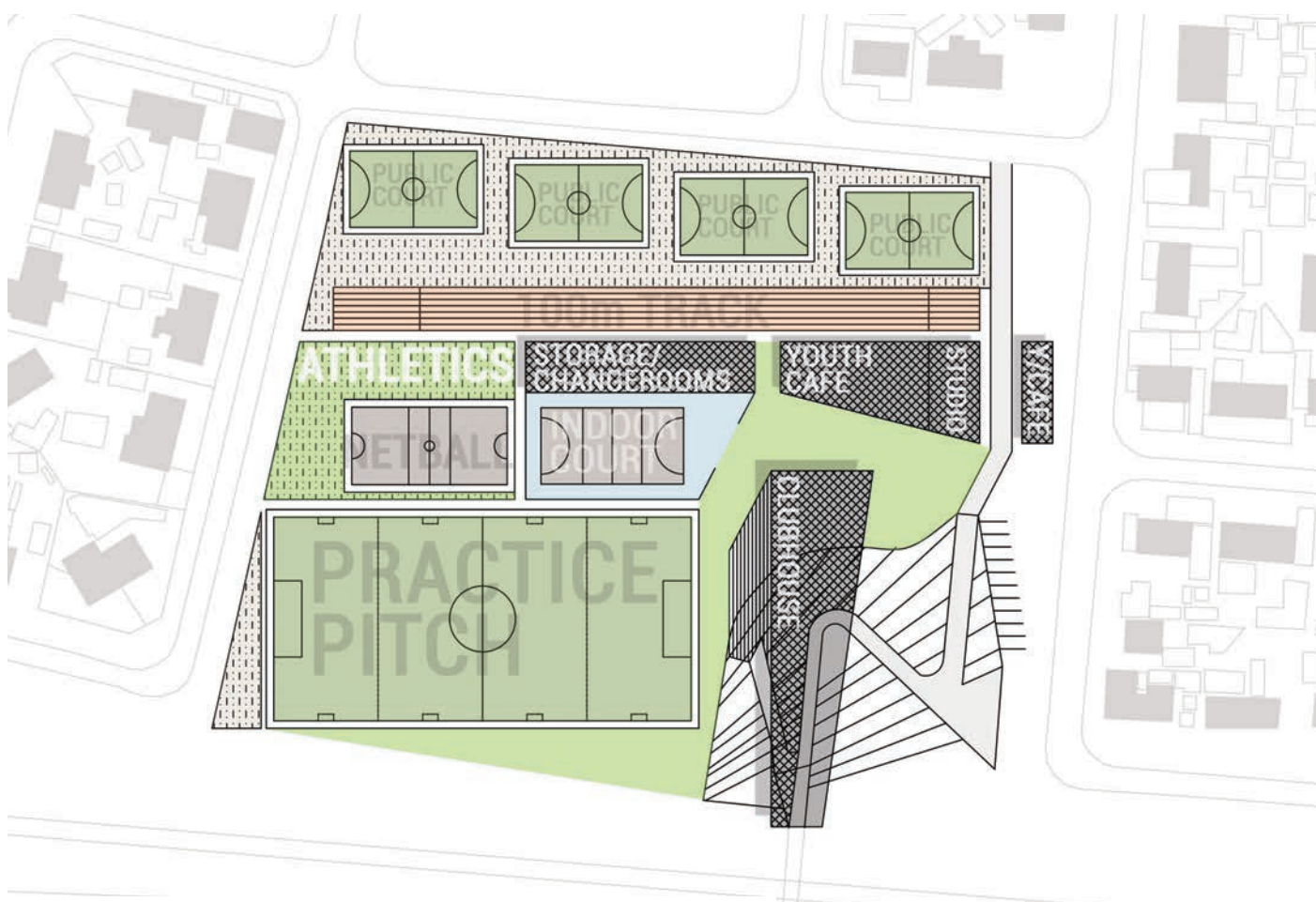


Fig.34 – Initial site development plan, at the end of first semester

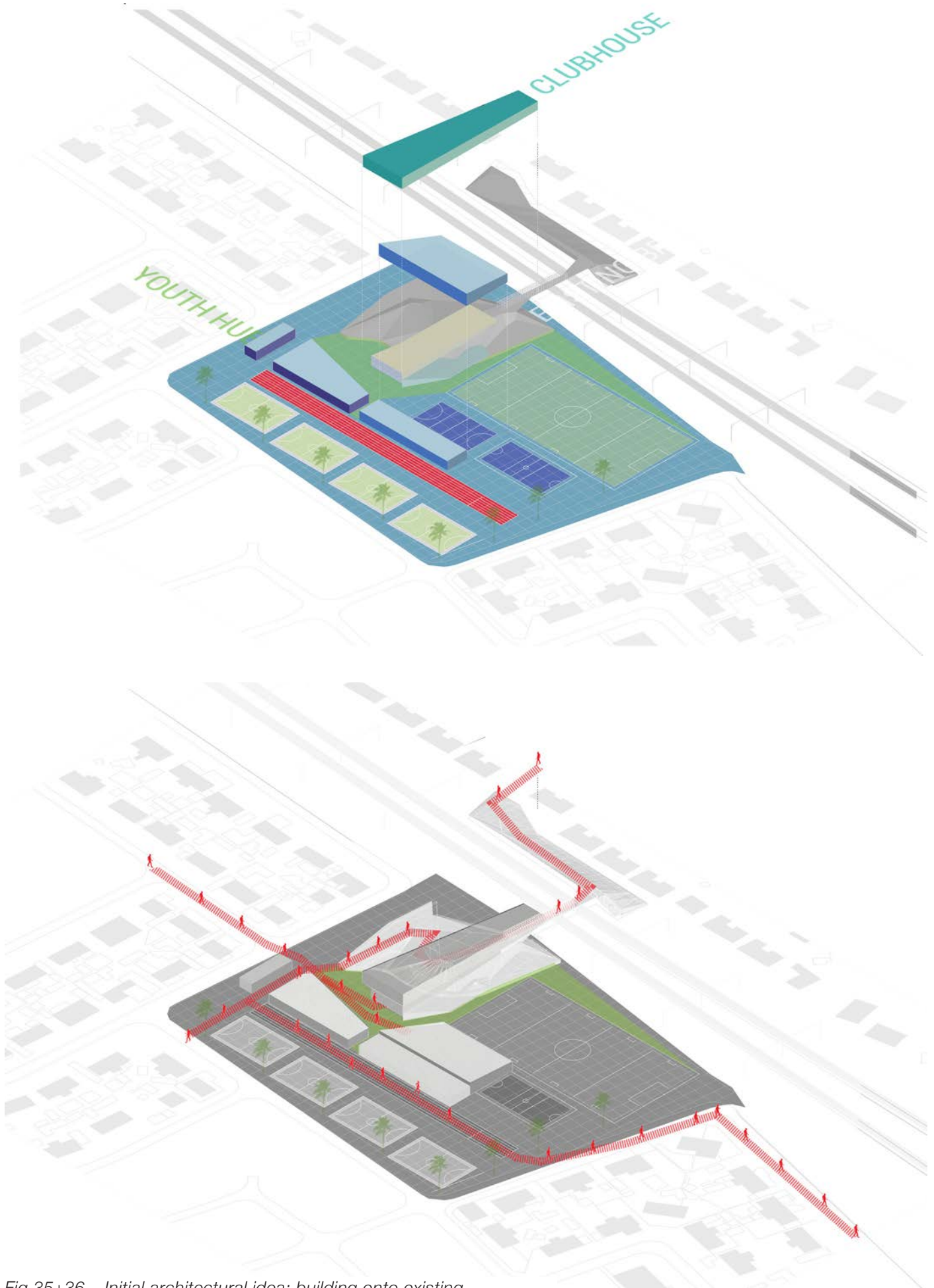
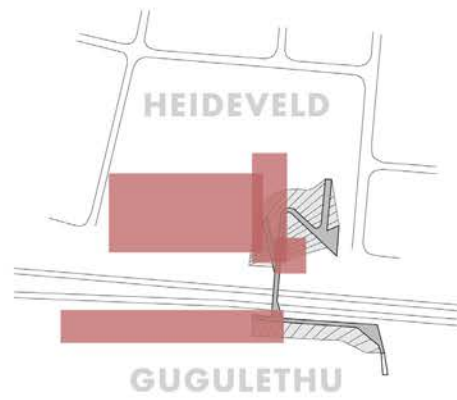
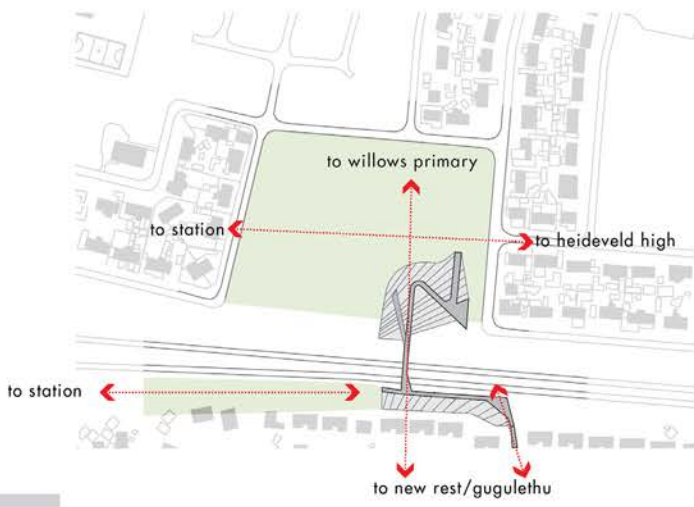


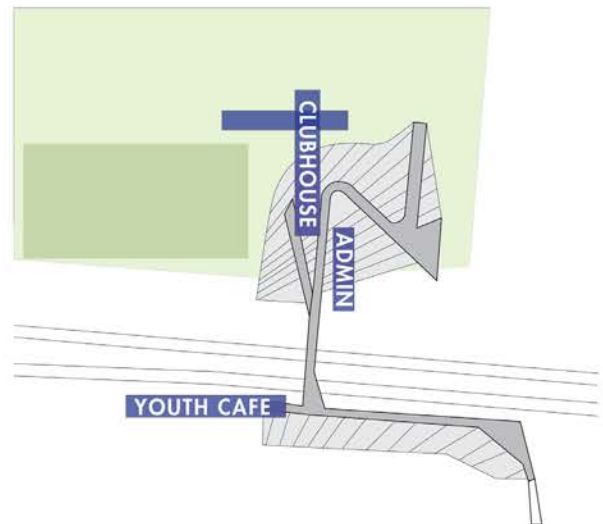
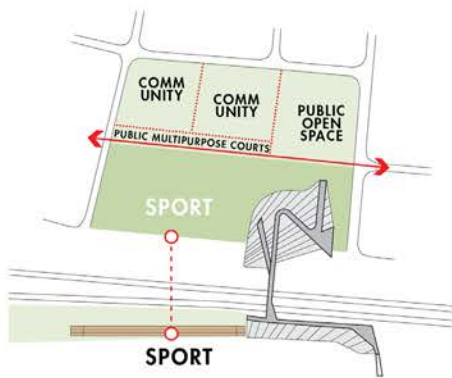
Fig.35+36 – Initial architectural idea: building onto existing infrastructure in order to socialise it

1 CONNECTIVITY 2 ACTIVATION 



SITE DEVELOPMENT

3 SITE PROGRAMME 4 ARCHITECTURAL PROGRAMME



5 PROGRAMME LINKS 6 "SLIDING PROGRAMME"

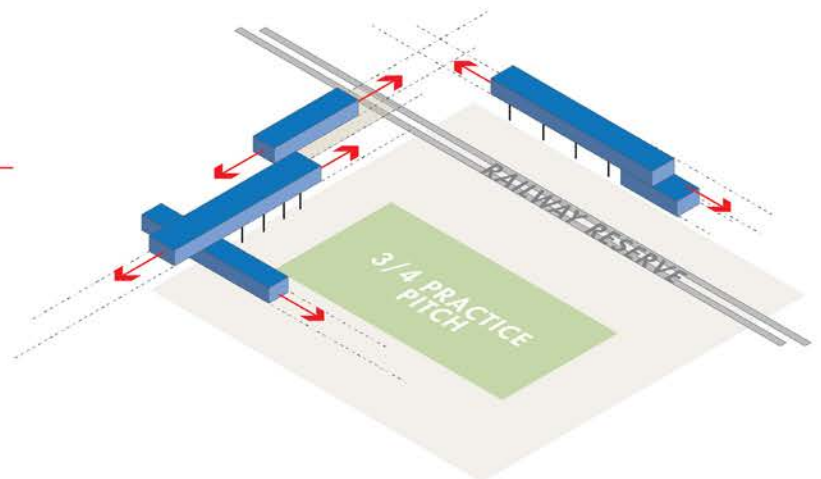
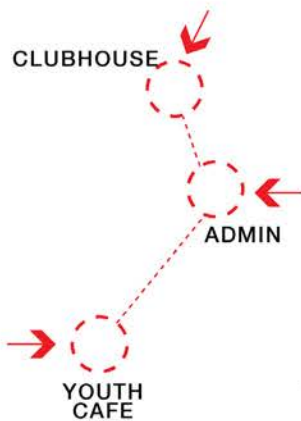


Fig.37 – Site development progression from initial ideas at the end of first semester, to the eventual urban development plan

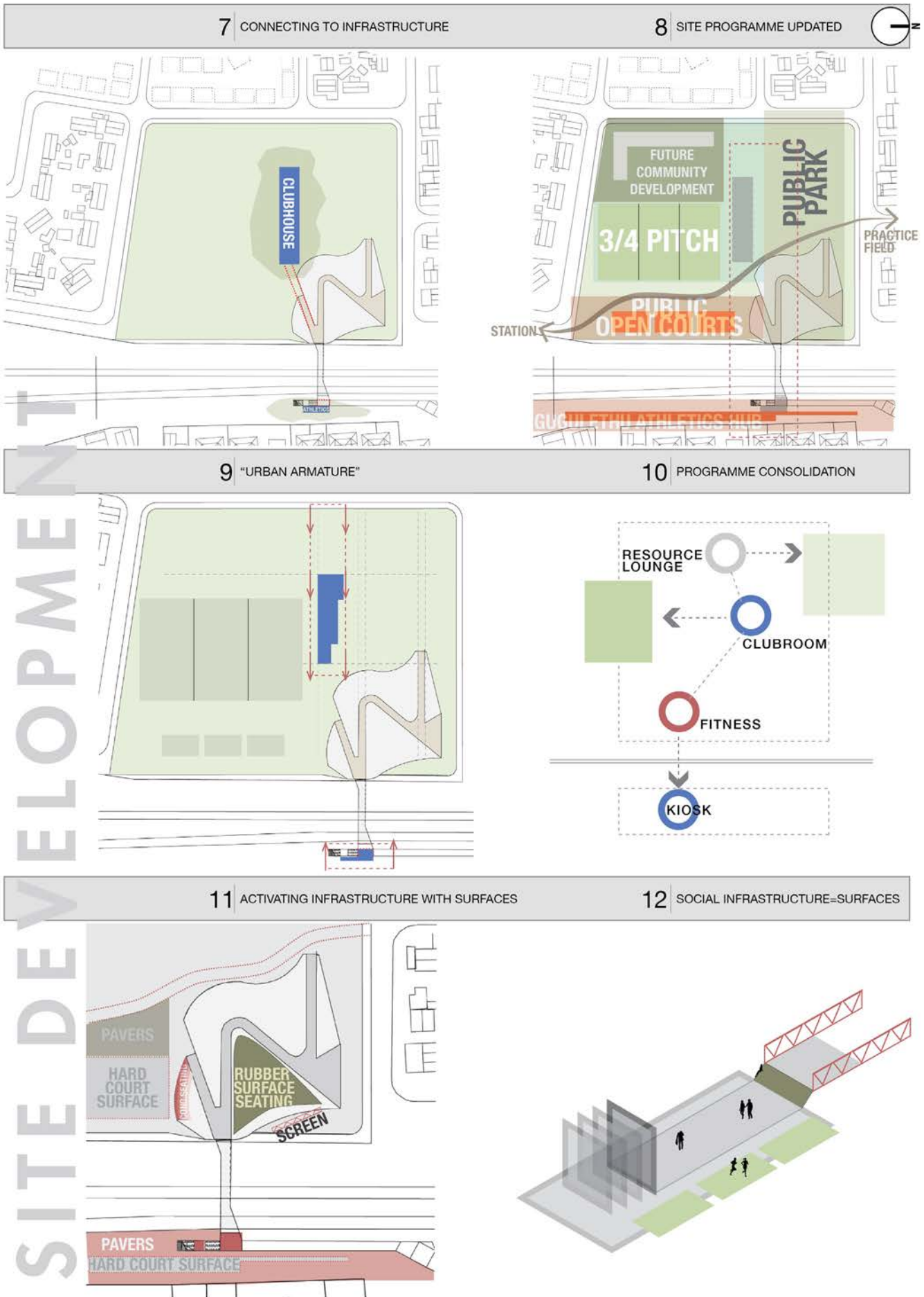
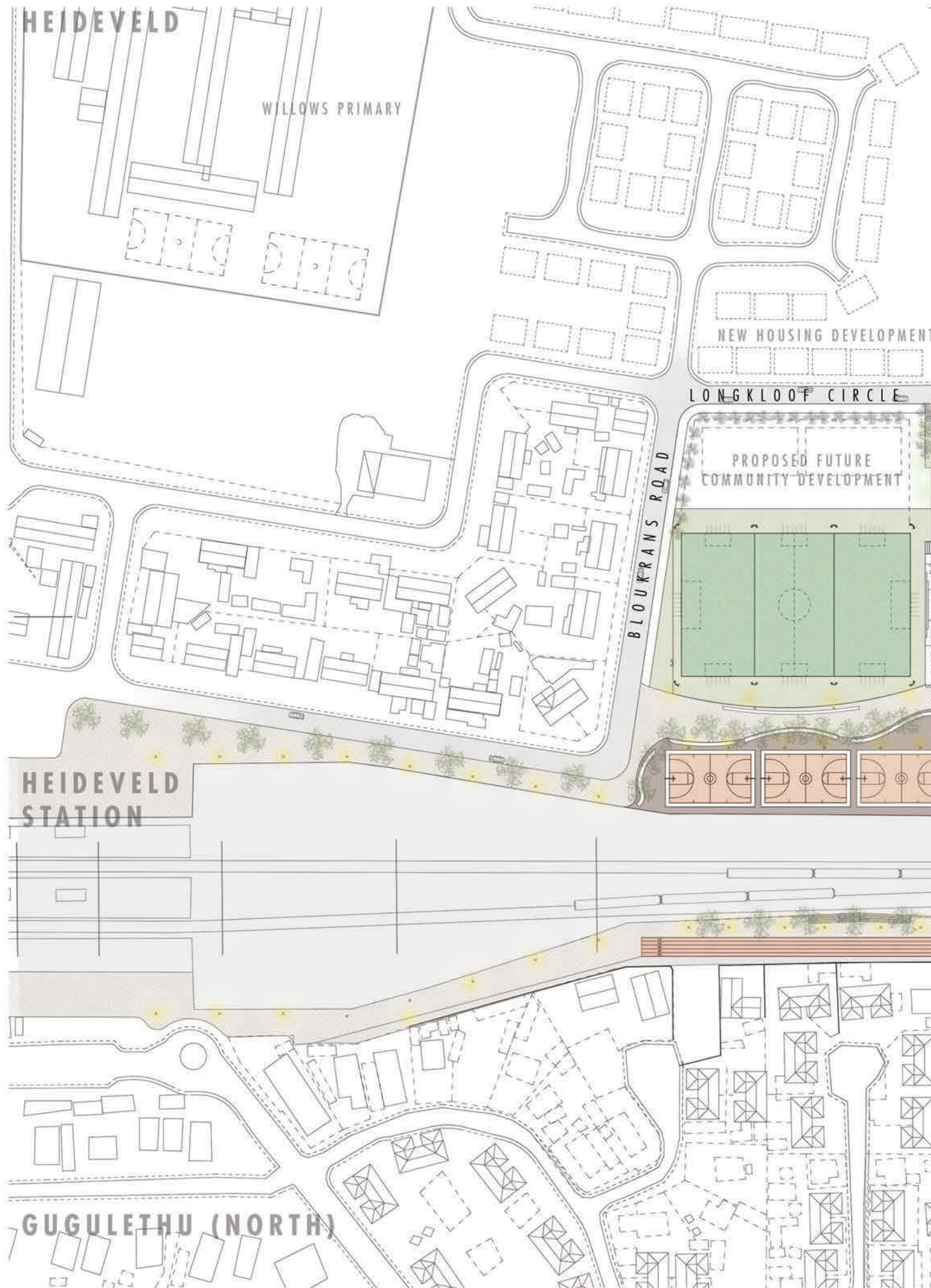
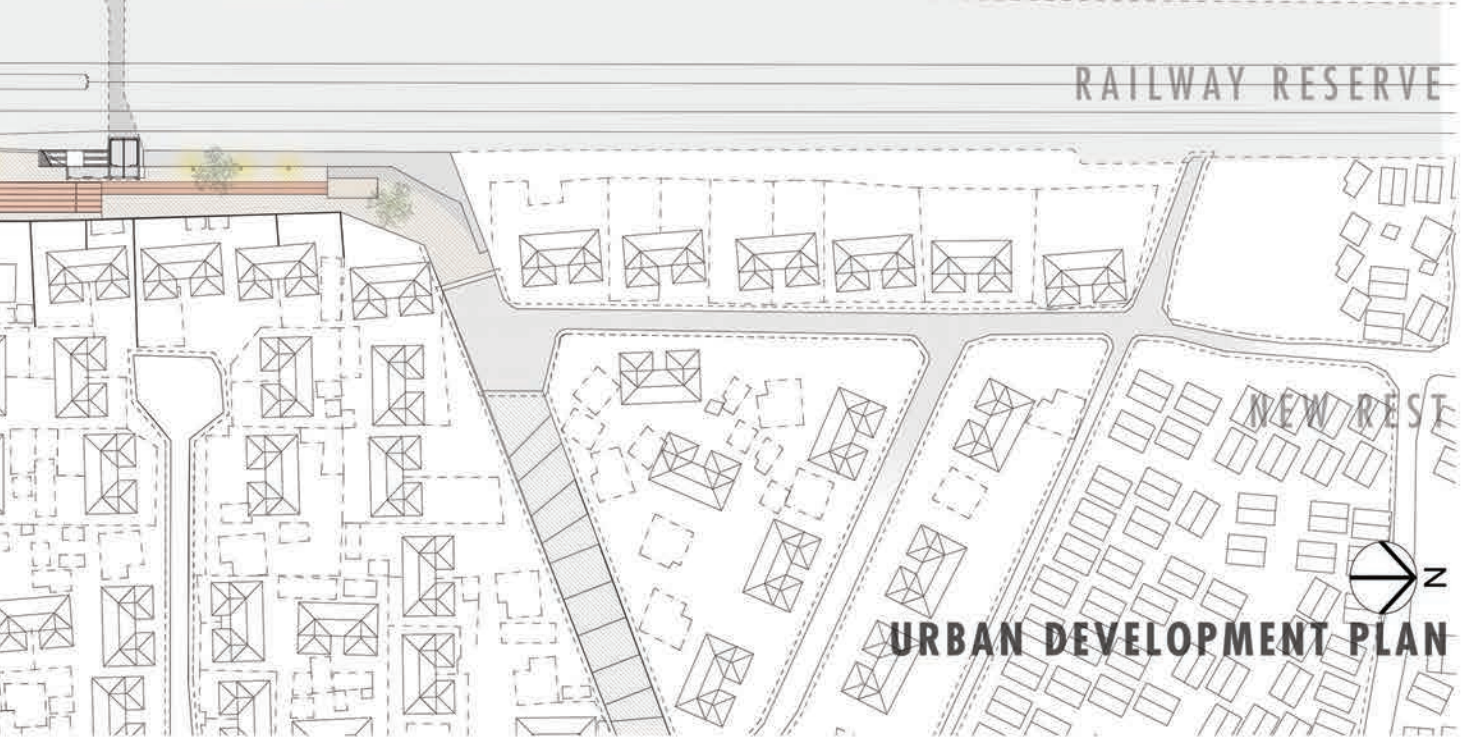


Fig.37 (cont.)

Fig.38 – Urban Development Plan





URBAN DEVELOPMENT PLAN

Site development continued to evolve as the design developed. Fig.38 shows the final urban development framework, where the urban strategy proposes bands of programmed activity. The Gugulethu site becomes an athletics-focused hub with a 100m track that doubles as a pedestrian pathway to the station. Long and triple jump tracks are served by a small built intervention comprising toilets, storage, a playleader's office and a kiosk off the bridge. The Heideveld site contains three unfenced public open courts and a fenced Astroturf practice pitch. These flank a new paved pedestrian path that links the site to the Heideveld station in the south and Cockscomb Park in the north, which is the current practice ground for Junction Rovers. This space is proposed to be reclaimed as a full-size football pitch and public park.

The clubhouse building then becomes an urban armature that plugs-in to the urban strategy, forming a threshold between public open space and the practice pitch.

The framework makes provision for future community development that addresses the Heideveld precinct, with the possibility this being a civic function such as a community hall or library.

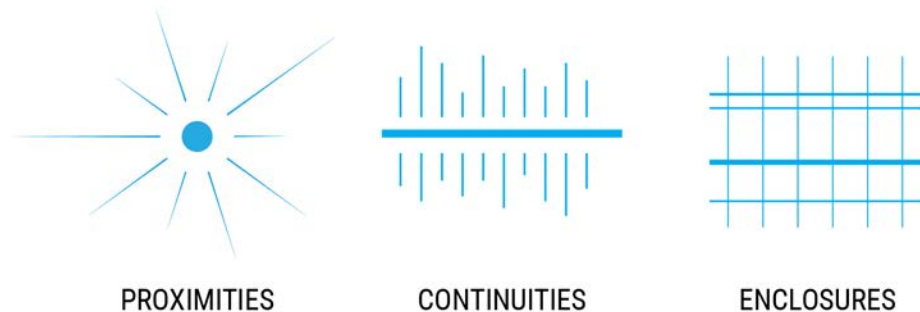


Fig.39 – Norberg-Schulz's theory of existential space, comprising proximities, continuities and enclosures

SOCIAL INFRASTRUCTURE: DEFINING, TESTING, DIAGRAMMING

The programme began to settle into three distinct functions: the soccer clubhouse, a youth café, and an administration wing to support these social activities. These began to translate into three distinct structures that, when superimposed on the site's infrastructure, could be connected by the bridge acting as an urban corridor.

An early idea for social infrastructure involved building directly onto the Heideveld Pedestrian Bridge. By weaving the social programme with networked infrastructure, the sociotechnical relationship between architecture and infrastructure could quite literally be achieved.

These ideas were extensively interrogated through a series of diagrams. Concurrently, engineering drawings of the bridge were obtained from Mott MacDonald. As the programme developed and the focus began to narrow towards the architectural scale, numerous challenges with this concept emerged.

Conceptually, the idea of social infrastructure suggested the literal socialisation of the existing bridge. This entailed building a series of three dynamic forms that connected to the structure, and leveraged its movement patterns to draw pedestrians into the architecture. However, social,

spatial and technical issues emerged. Building on the existing infrastructure required structural stability from the berm; as this is compacted fill and not natural ground, significant piling would be required. The practicality of getting a piling rig to achieve the construction of a cantilevered space extending from the bridge was examined in design crits with our studio's teaching partner, Arup (Fig.41, 42 & 43).

A series of structural points were established that would be required to support this structure, with numerous points being deep within the berm structure. A superstructure idea was then explored as an alternative, which would entail a series of external rigs located around the periphery of the berm that could suspend the building. The architecture now conceptually touched the infrastructure at a strategic point.

However, whilst these ideas (Fig.41) proved compelling experimentation, translating the evolving programme and dealing with the urban conditions of the site began to contest this literal form of social infrastructure.

As such, the project required a clear definition of what social infrastructure means architecturally. In addressing the notion of 'sociotechnical', and revisiting the design research findings of the theory studies paper, a new design framework was developed.

What is Sociotechnical Architecture?

As any landscape offers a limited range of possibilities for orientation and identification, we may say that it has a certain “capacity” determined by its structured properties: places, paths, domains. (Norberg-Schulz, 1971, p. 28)

Norberg-Schulz writes of ‘organisational schemata’ – structured properties that contribute to enabling identification within space (Fig.39). These schemata are: Proximities, Continuities and Enclosures. By considering the bridge as a shaper of space that attends to a portion of the site, there exists opportunity to address the remaining, unorganised space on both sides of the railway by beginning with this concept of organisational schemata.

In this case, the social programme becomes distributed on both sides of the line, rather than localised onto the infrastructure, thus creating a proximity. A continuity, or path, is forged by the existing bridge acting as the corridor that connects this social programme (Fig.40). Subsequently, the programme at each end forms enclosures (or places) – destinations that activate two distinct urban conditions: the backyard spaces between houses and the railway at Gugulethu, and the vast open space at Heideveld.

Building off this abstract theory posited by Norberg-Schulz, the idea of surface architecture and its relationship to social infrastructure began to suggest the theoretical framework.

In this framework, I propose that social infrastructure comprises surface architecture and social programme. Surface architecture uses horizontal surfaces of social purpose (landscape/ground articulation in relation to programme) and vertical surfaces of social presence (building façades) to form architectural imageability – a means for people to identify, understand and engage with a building. Social programme emerges from an understanding of site activity, history and genius loci.

Using these two mechanisms – surface architecture and social programme – it becomes possible to frame how architecture can potentially react not only to the flows of people, but infrastructure itself. Spatialising urban infrastructure, therefore, is not merely building on existing systems, but extending them through surface articulation and social programmes that activate the edges of this infrastructure.

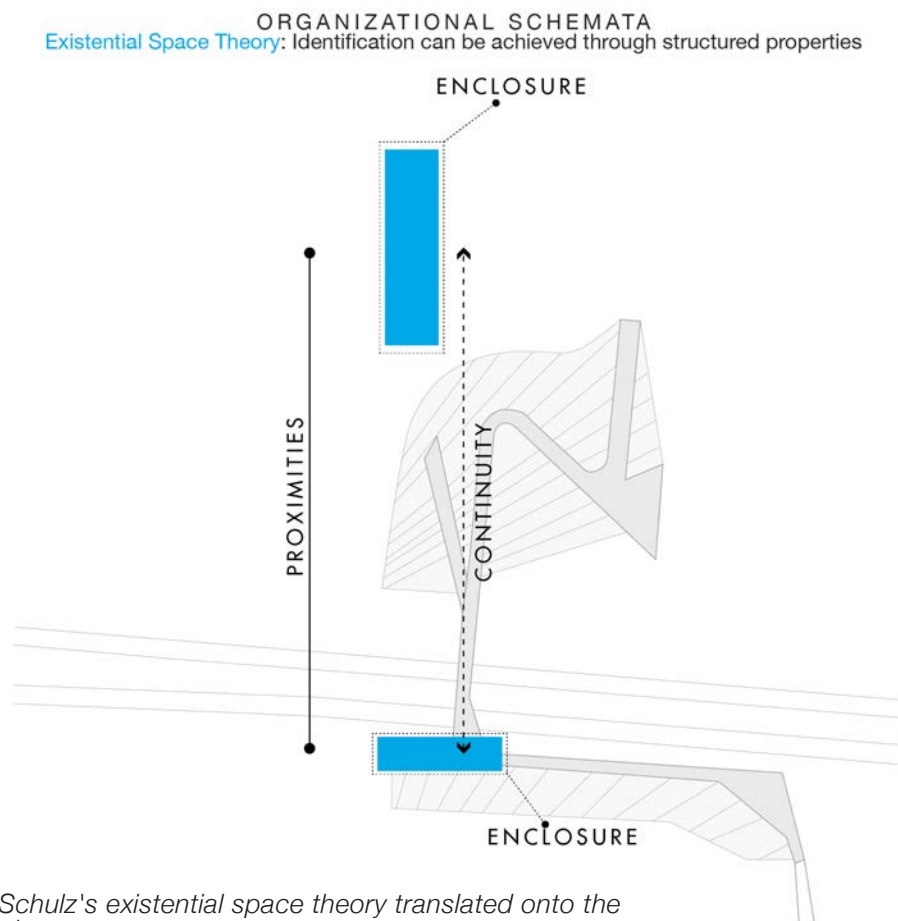


Fig.40 – Norberg-Schulz's existential space theory translated onto the site development plan

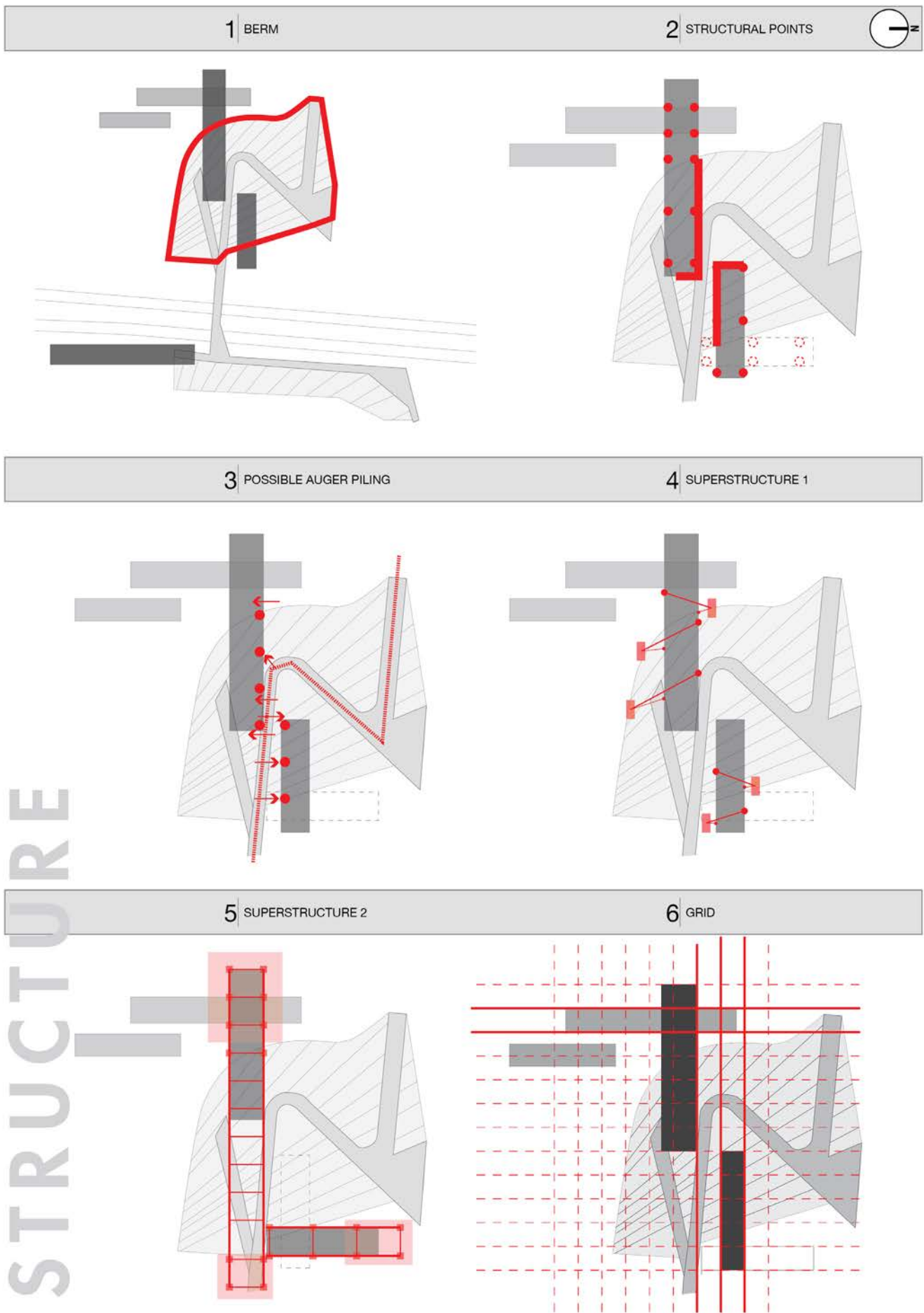


Fig.41 – Structural experimentation to explore the possibilities of socialising the Heideveld Pedestrian Bridge

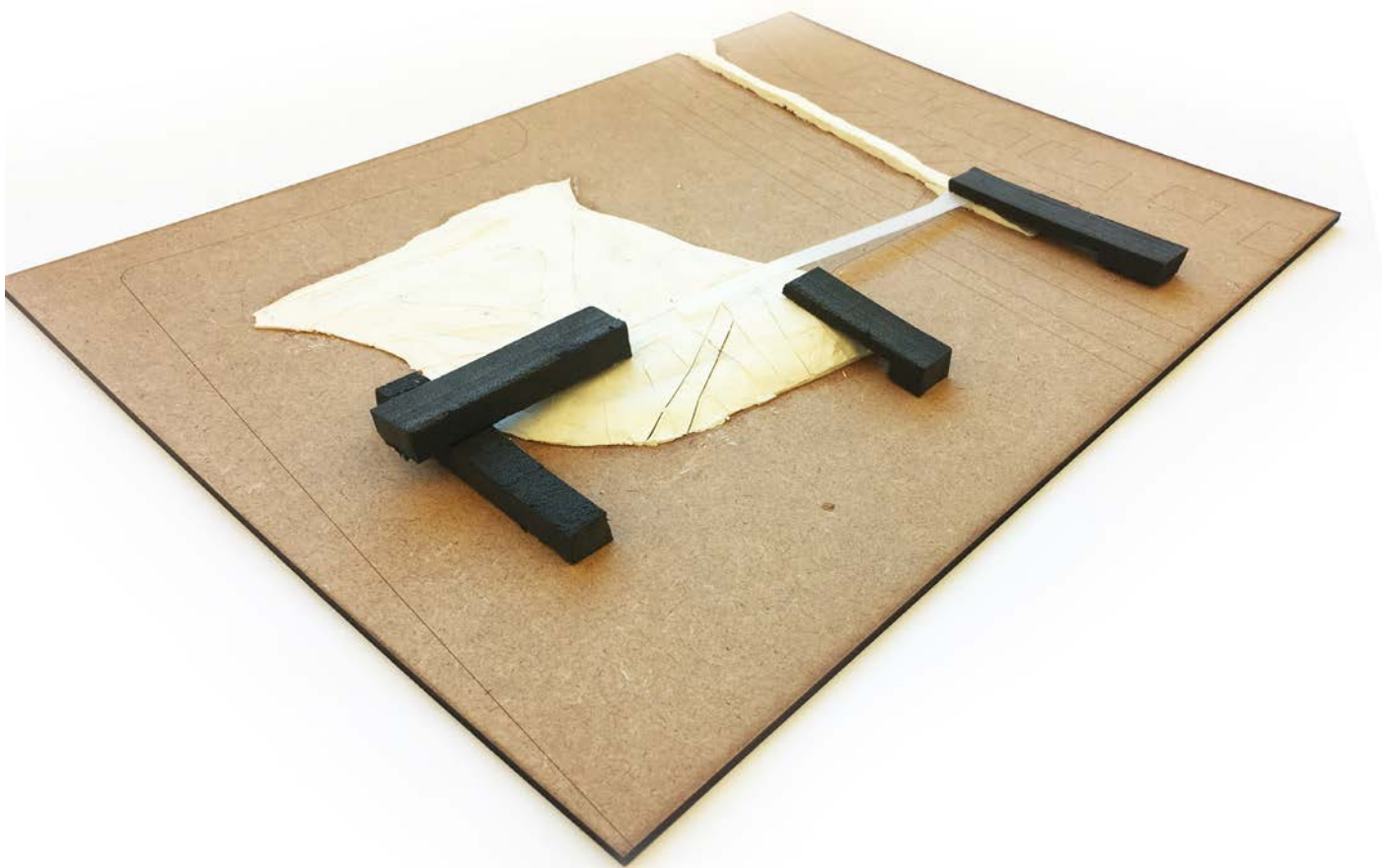


Fig.42 – Concept model: testing the idea of a series of buildings that are built directly onto the Heideveld Pedestrian Bridge's berm on the Heideveld site – an early, literal idea of translating the concept of social infrastructure to architecture.

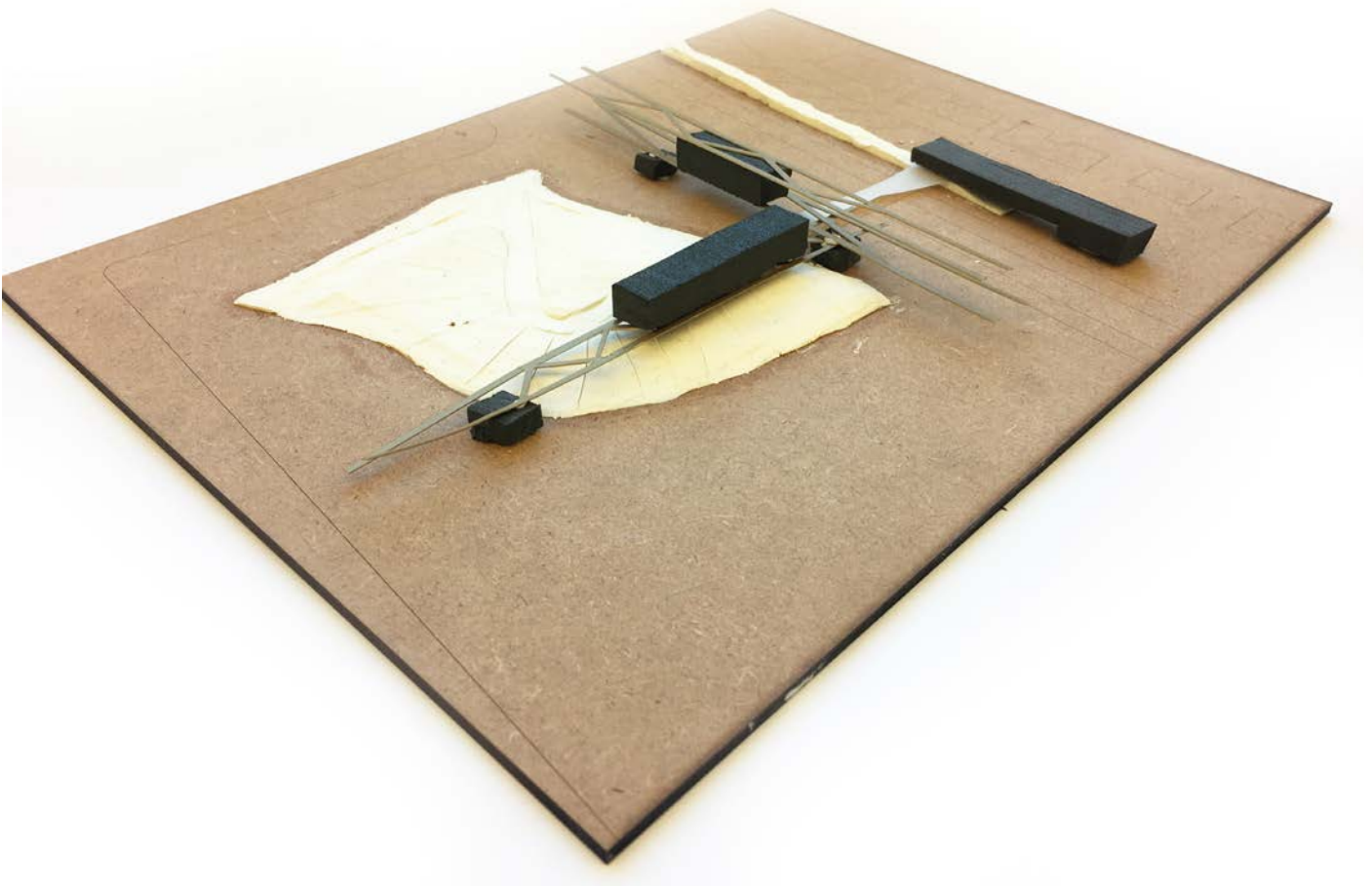


Fig.43 – Concept model: testing the idea of a superstructure to build onto the Heideveld Pedestrian Bridge

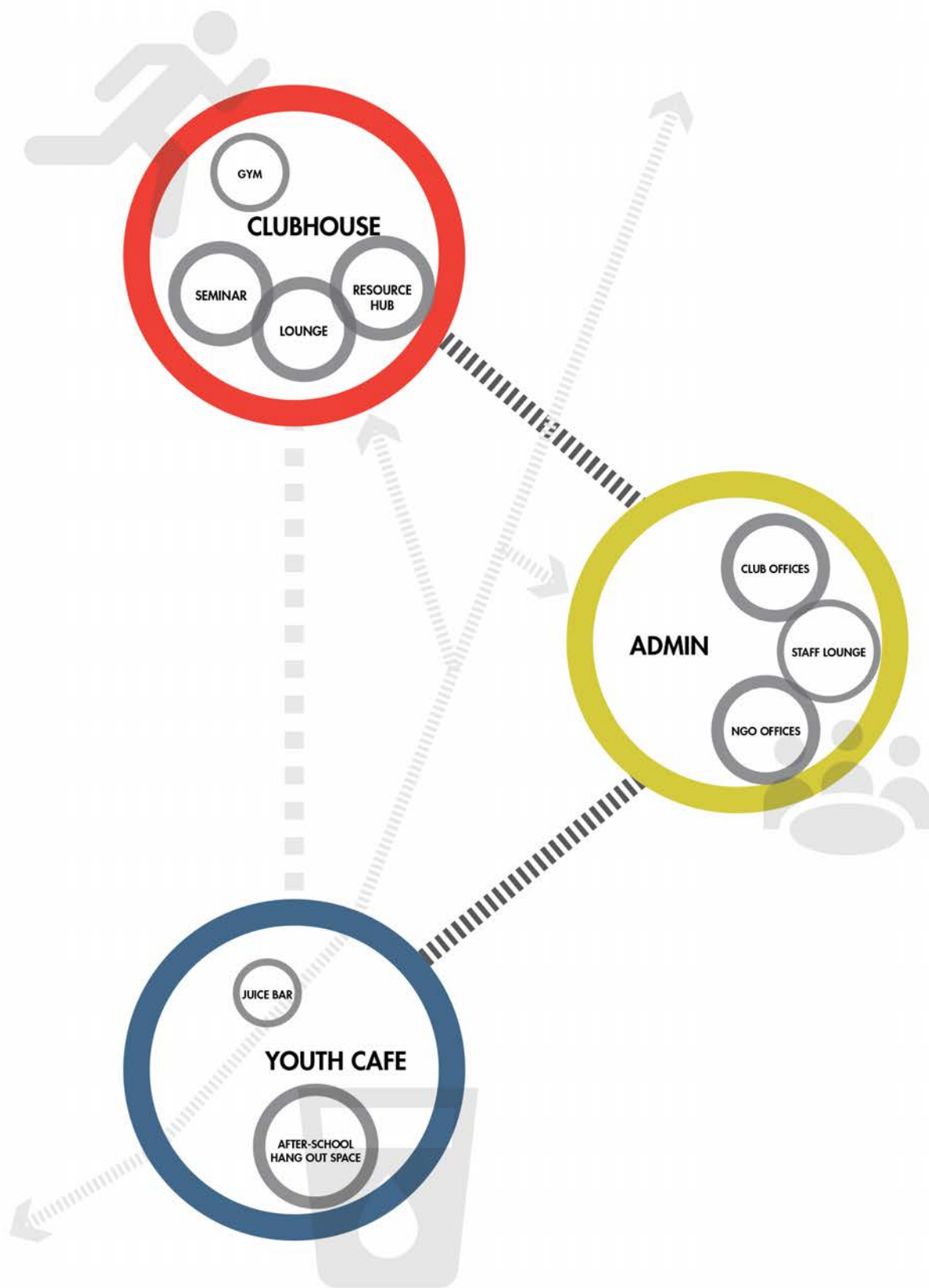


Fig.44 – Initial programme framework, indicating three major spaces that were emerging from early design development work

TRANSLATING PROGRAMME: SPATIAL ARRANGEMENTS & ADJACENCIES

Now that social infrastructure within this design dissertation has a tangible framework, it became possible to consider how the evolving social programme could be translated onto both sides of the railway in order to spatialise this piece of urban infrastructure.

In transcending the apartheid-created effects of splintering urbanism, an appropriate social programme was required. The opportunity to activate both the open land at Heideveld and the unsafe alley spaces at Gugulethu, coupled with the compelling narratives discovered from this precinct, inspired the notion of using youth space as the conceptual means of developing a social programme.

The metaphor of a clubhouse, derived from site narratives, became the conceptual space that held this idea of a youth-centred programme stretching across infrastructural divide (Fig.44).

Rather than focusing energy within a singular space - the public open space at Heideveld – it became apparent that attending to both urban conditions was necessary. By distributing programme across the urban infrastructure, rather than centralising it, the opportunity to spatialise both conditions was possible.

The programme thus translates itself as a series of activity bands that run across both sides of the railway. These activities are sports-inspired, taking their cue from site narratives. On the Gugulethu side, attending to the narrow band of backyard alley space, a series of athletics-inspired activities locate themselves sequentially. This linear site inspired linear, dynamic athletic activity in the form of a running track, long jump and triple-jump tracks, and high jump. Conceptually, by locating school athletics practice across the line, the bridge acquires a new social role: as a continuity that enables movement not only with a destination, but purpose. The athletics programme is intended to be a flexible space that can be used for specific events – school athletics practice and informal play – and a part of the new paved pedestrian surface that connects the bridge to the Heideveld Station on the Gugulethu side.

At the Heideveld end, taking its cue from the infrastructure, the clubhouse building connects visually to the bridge's staircase. Its angled geometry directs flow beneath the dynamic activity of a fitness centre above the entrance to the training facilities. A series of public open courts – unfenced, open and shaded – activate the dominant desire line path that obtains a new hard-paved surface. This dominant path takes its curved geometry from the berm, and connects from the existing Junction Rovers practice ground at Cockscomb Park to the Heideveld Train Station (Fig.38).

The path sits between the public courts and a $\frac{3}{4}$ practice pitch managed by the clubhouse. This ensures a series of diverse sporting activity flanking the public pedestrian route, establishing this as an active safe route. The path furthermore includes a line of high-level lighting that continues down to the train station, and is mirrored on the Gugulethu side.

A clubhouse suggests the idea of a diverse gathering of people for an event – in this case, participating in the many activities that surround the practice and competition of soccer. The clubhouse thus becomes the anchoring point of the larger urban development that comprises a series of horizontal surfaces of activity. As a form of youth space, what activities – at the urban and architectural scale – would this potential clubhouse inspire?

Two specific overarching activities, initially established at the early programme development stage, structured the design development: operations and social space. In order for this building and its social programme to function, it requires a series of service facilities. These locate themselves at the ground surface, fronting ground-based activities. Change-rooms, toilets, field and equipment storage and management workspaces all address the $\frac{3}{4}$ practice pitch (Fig.47).

This frees a plane above the ground to become the social youth space that translates the metaphor of a clubhouse into architectural terms.

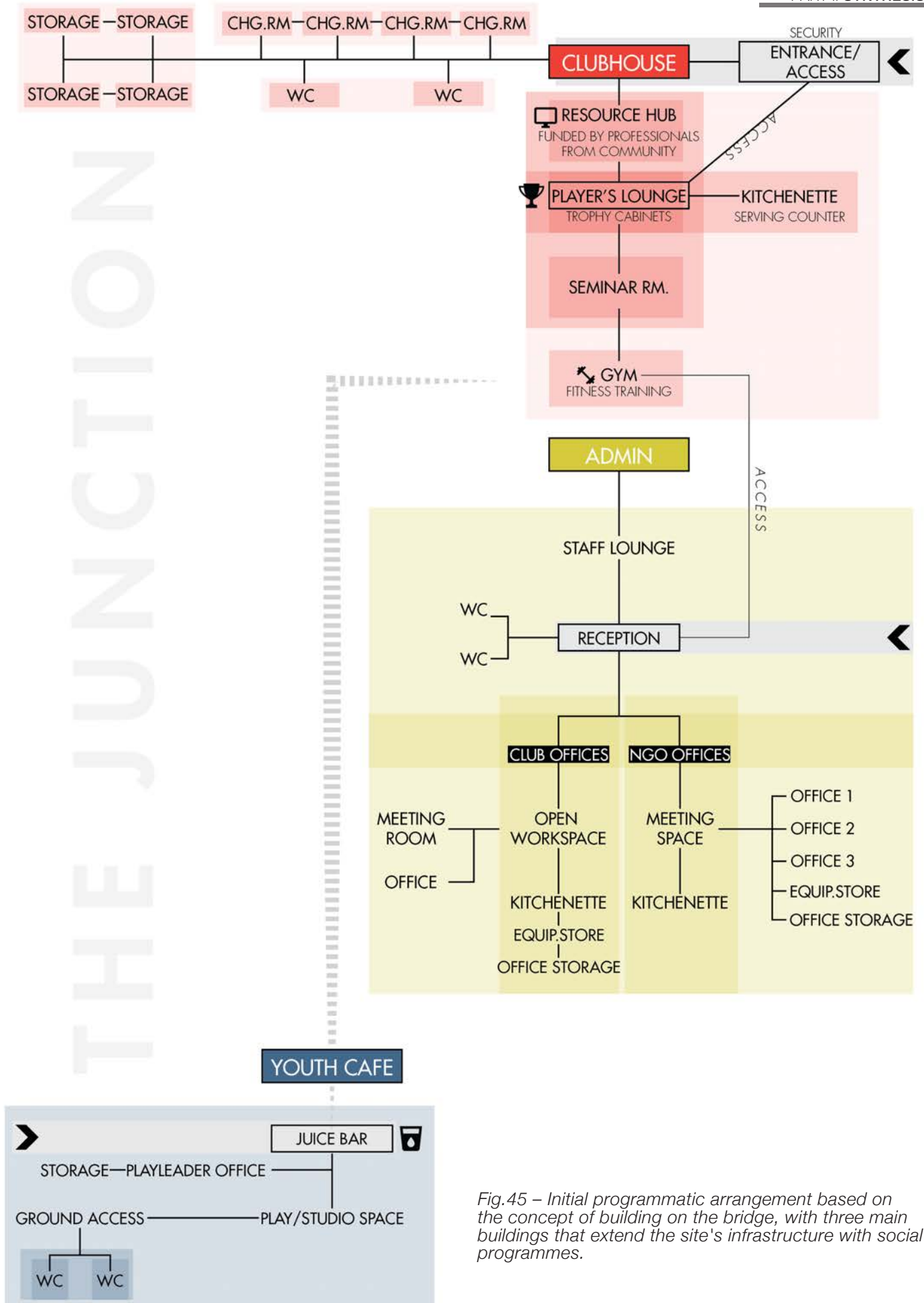


Fig.45 – Initial programmatic arrangement based on the concept of building on the bridge, with three main buildings that extend the site's infrastructure with social programmes.

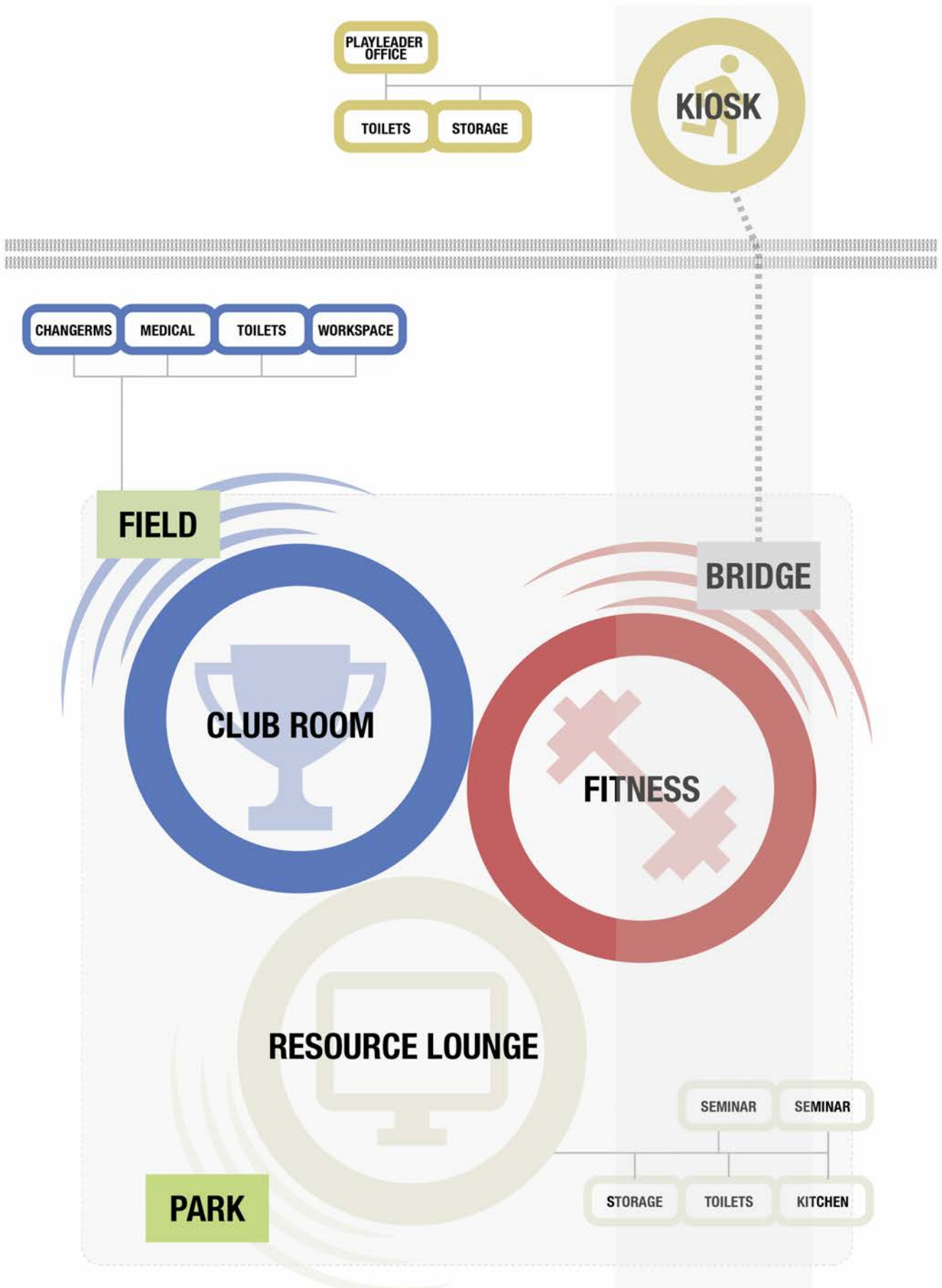


Fig.46 – Evolved programme with consolidated spaces. This diagram shows the three major spaces on the first floor, and the programmatic distribution of the project across both communities

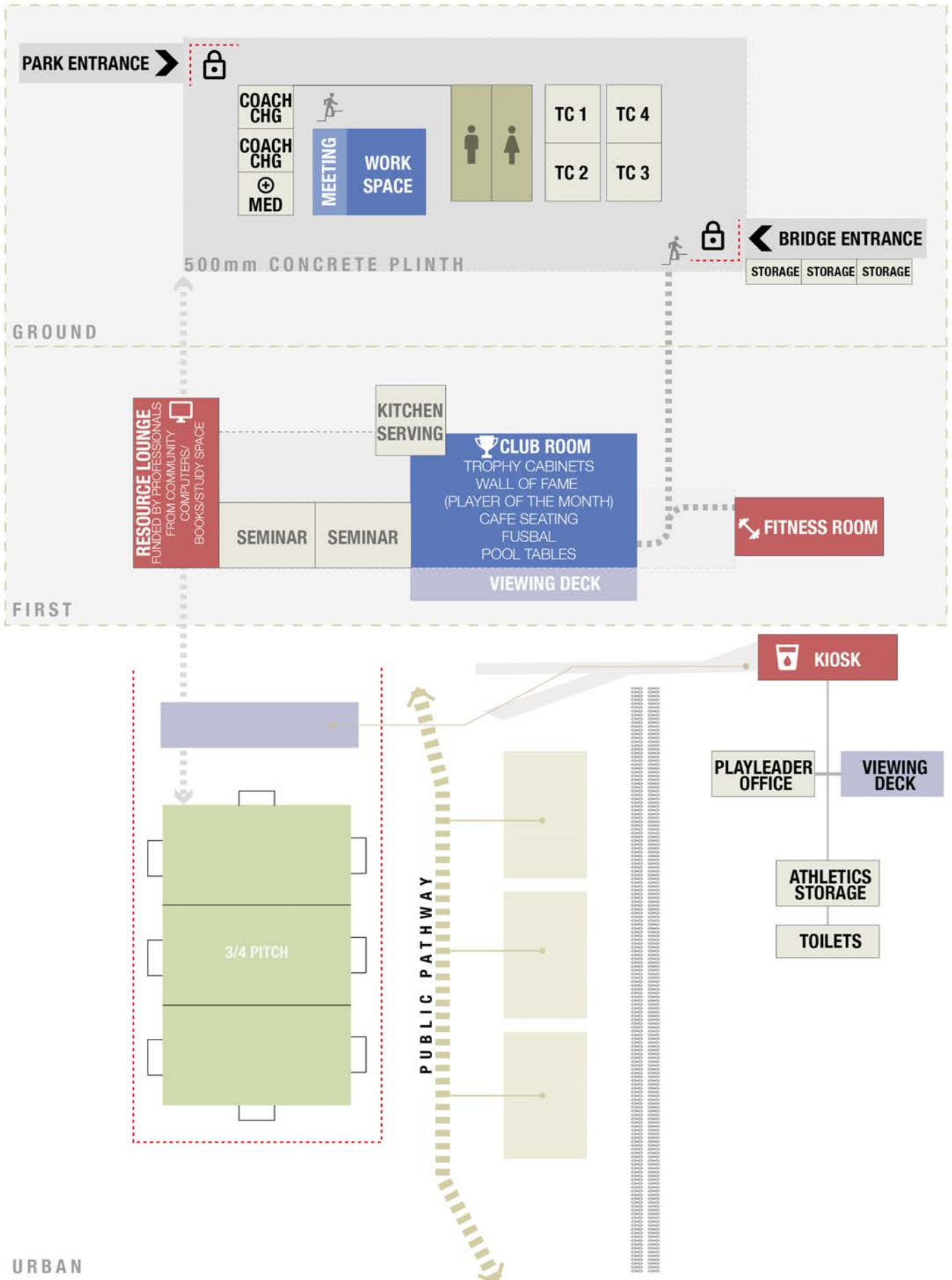
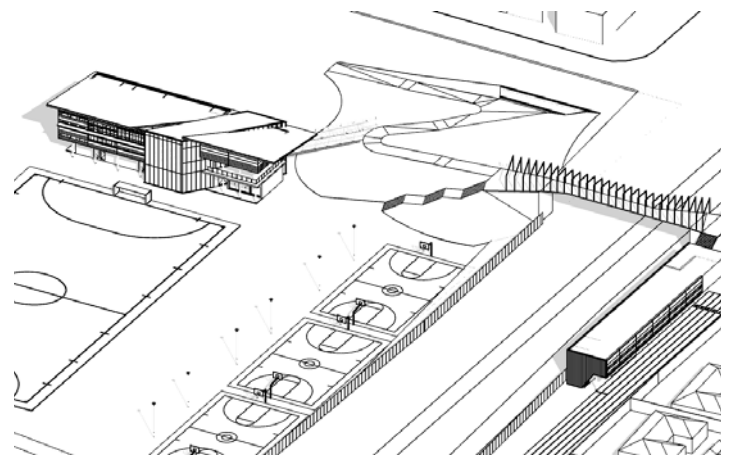


Fig.47 – Evolved programme with consolidated spaces. This diagram shows all spaces and their adjacencies, and the programmatic distribution of the idea across both communities through two distinct built projects

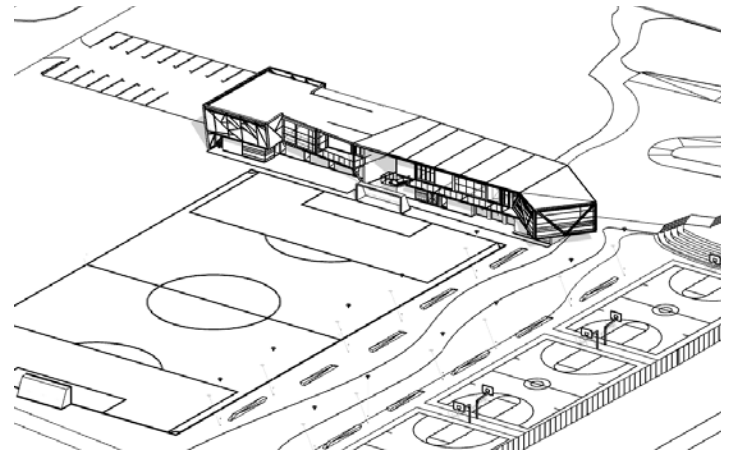
Multiple design concepts were tested based on the different proposals of what social infrastructure could be (Fig.48). These are reflected in the following floor plan iterations where the idea of connecting to the existing infrastructure through an additional bridge element was tested, then evolved into an urban armature concept.

Once it became apparent that building onto the existing structure was not feasible (through the structural experimentation), the idea to physically connect to the bridge was tested. This would entail a three storey building that took datum levels from the bridge. However, this idea was abandoned as, although it still operated under the theme of

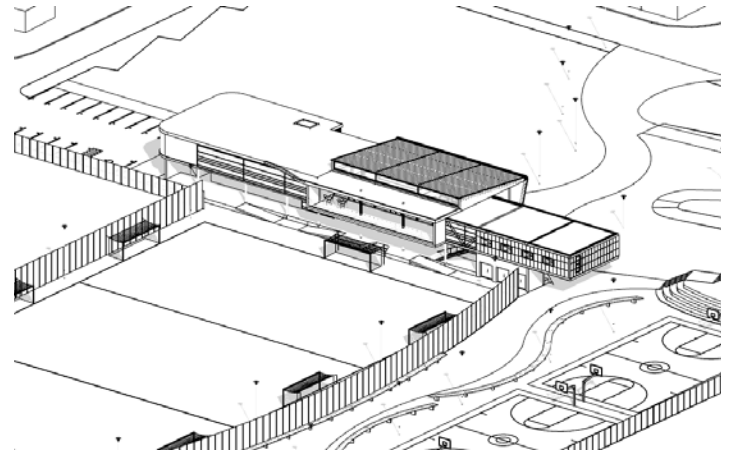
'social infrastructure' through physical connection, it created further issues with the building's security and legibility of entrances. The urban armature concept (Fig.50, 51 & 52), which was then further developed, became more compelling: a linear building, now two stories rather than the previous three, consolidated the programme into outdoor service spaces below and clubhouse activities above, and extended the movement patterns from the bridge's staircase through the building. It fronted two urban edges: the bridge on the east and the Heideveld precinct on the west (Fig.52). The eastern edge would make a gesture to the urban scheme through a dramatic cantilever that soars over the pedestrian path (Fig.53).



Concept A

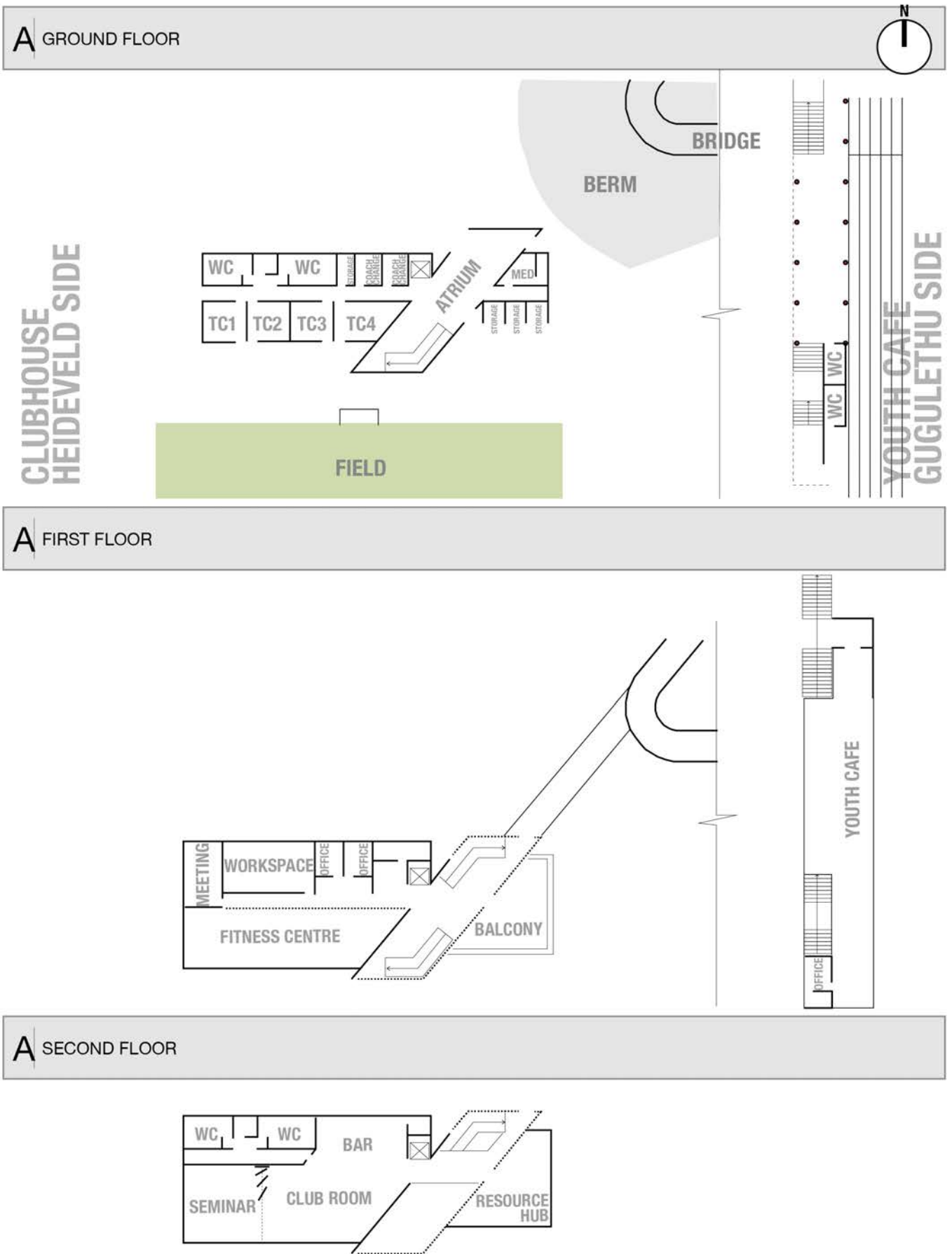


Concept B



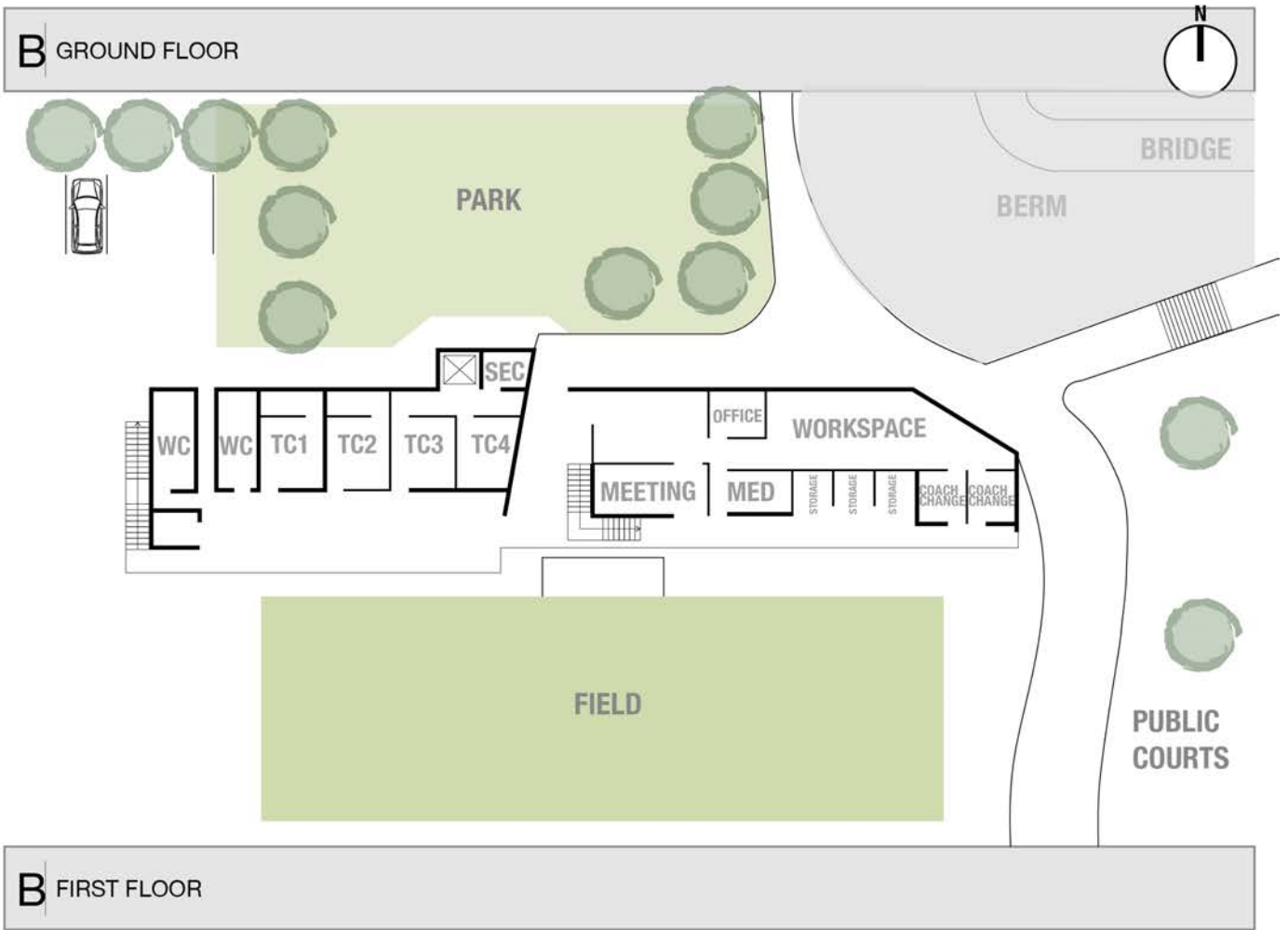
Concept C – Initial Design before final presentation

Fig.48 – Axonometrics of the design iterations explored overleaf



CONCEPT A | CONNECTING TO INFRASTRUCTURE

Fig.49 – Design iteration A



CONCEPT B

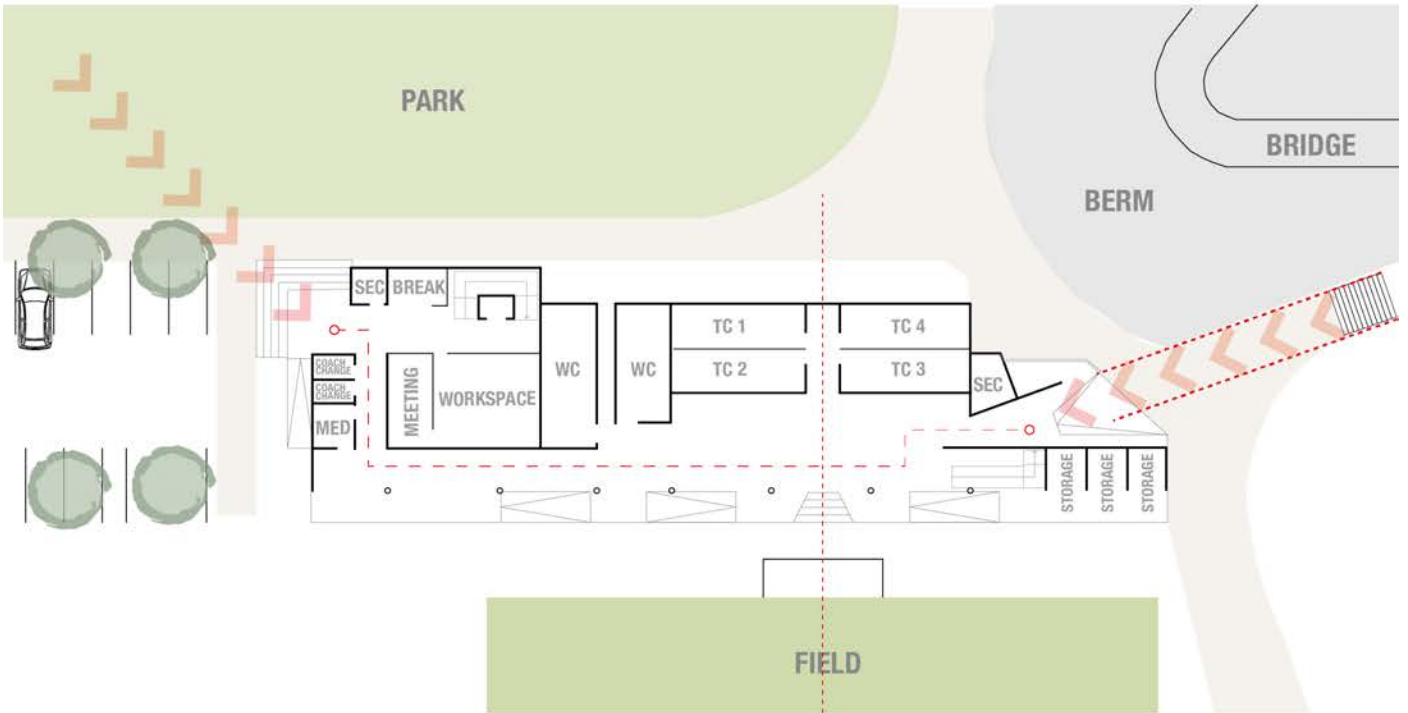
BUILDING OFF INFRASTRUCTURE

Fig.50 – Design iteration B

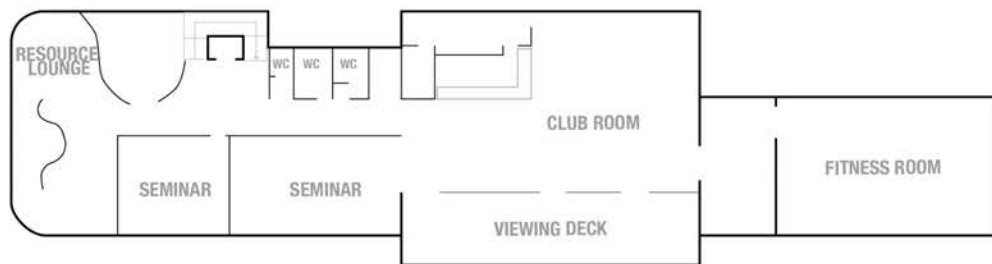


Fig.51 – Design iteration B concept model

C GROUND FLOOR



C FIRST FLOOR



CONCEPT C

BUILDING OFF INFRASTRUCTURE
CONNECTING TO INFRASTRUCTURE

Fig.52 – Design iteration C

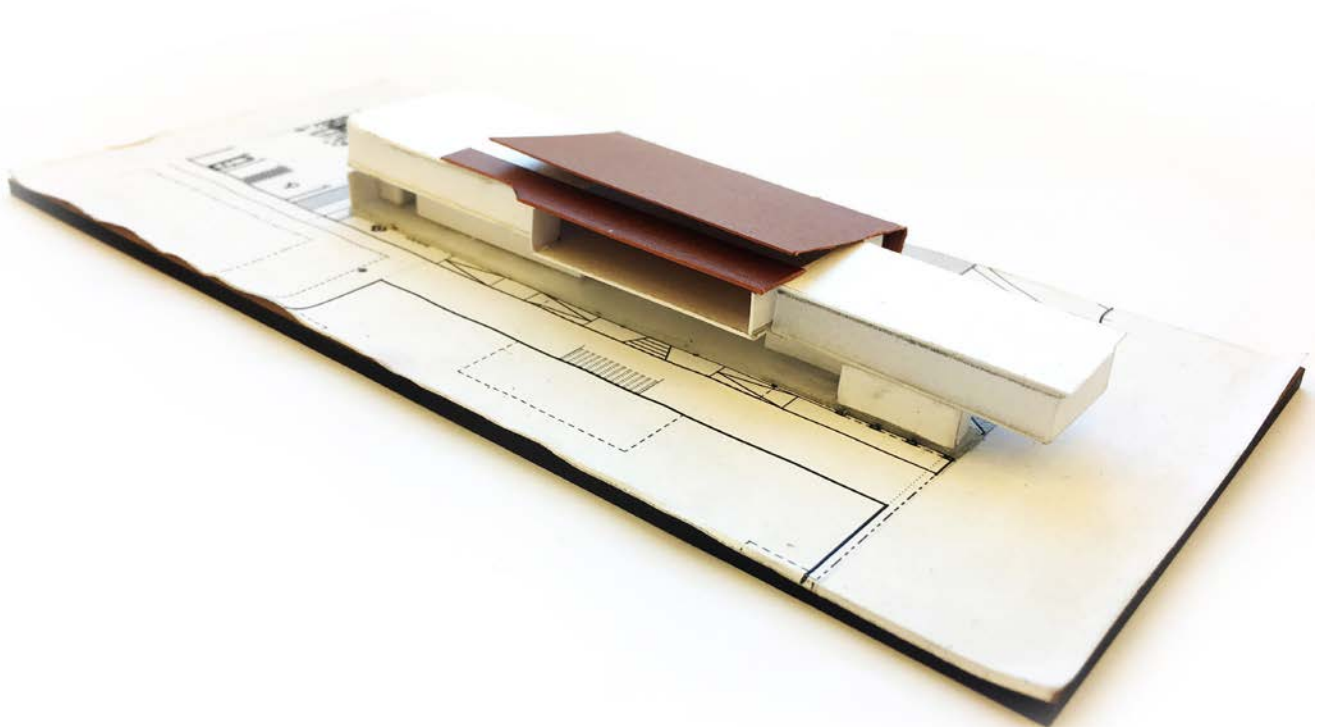


Fig.53 – Design iteration C concept model

Based on the experimentation and design development, from early programmatic tests, to structural exploration and defining what social infrastructure is architecturally, the design arrived at the following spatial arrangements.

These floor plans (Fig.54) represent the design at its final iteration as presented at the final design dissertation examination in December 2017.

In these floor plans that stretch across both communities, indoor spaces are highlighted in yellow. This illustrates the attempts to explore what minimal architectural fixity is possible to support a vast urban development scheme.

The ground floor plan also shows the 500mm plinth, which became a strong design idea that drove much of this design iteration's development. The idea of a plinth became a robust anchor to organise and connect the various ground-floor outdoor spaces and entrances.

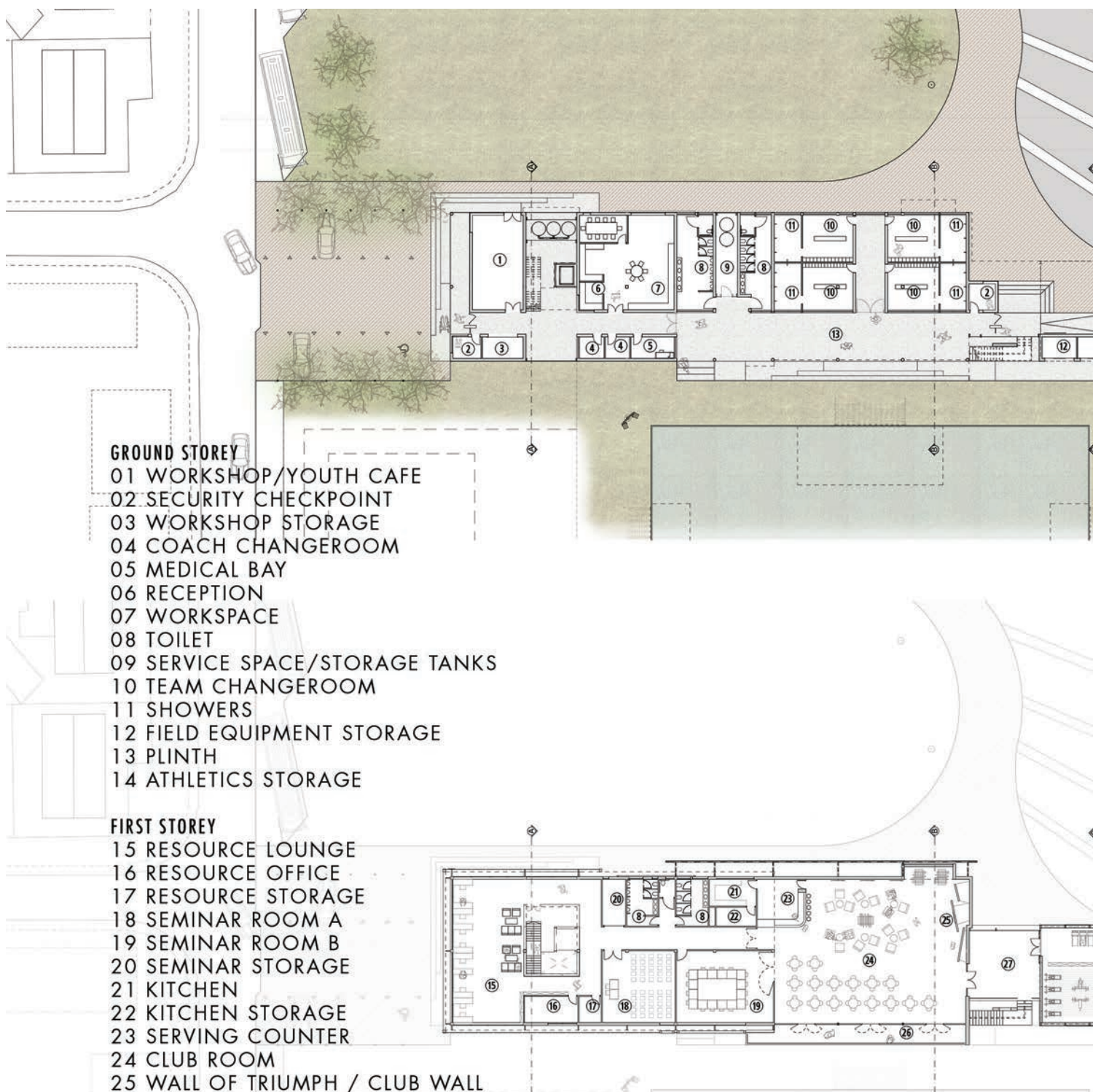
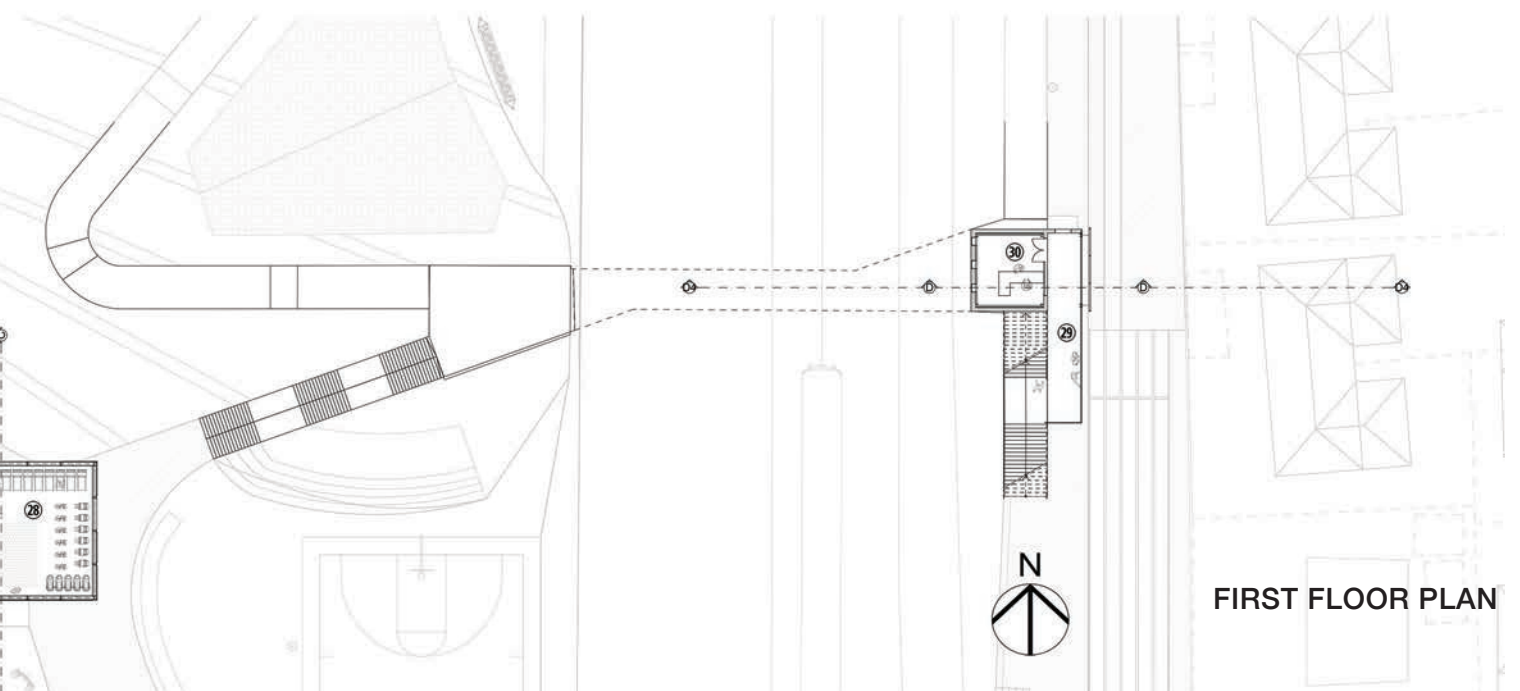
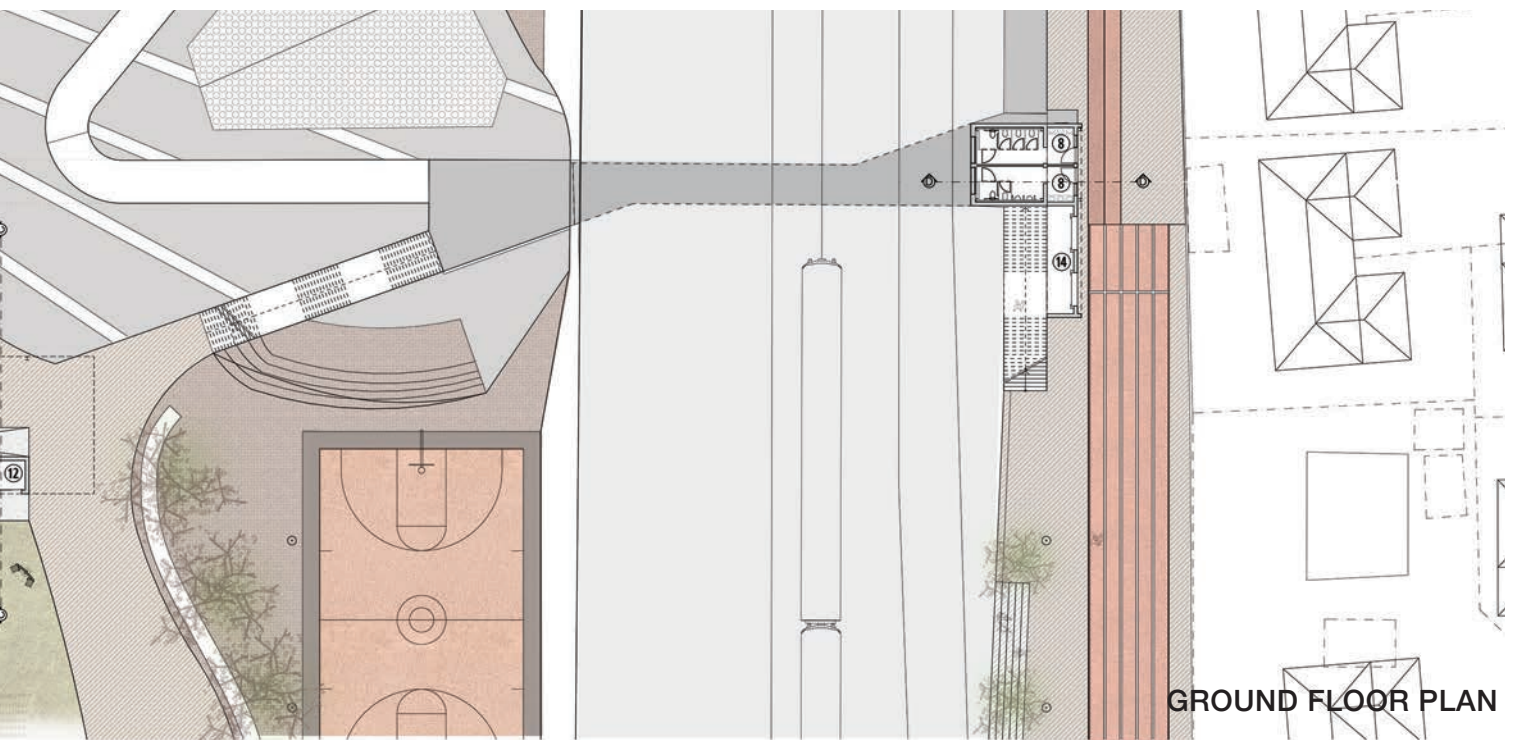


Fig.54 – Final floor plans as presented at the design dissertation examination



INSTITUTIONAL ARRANGEMENTS

URBAN DEVELOPMENT PLAN



CLUBHOUSE+FIELD



+



and/or



PEDESTRIAN PATH

PUBLIC COURT

PUBLIC COURT

PUBLIC COURT



HEIDEVELD
PEDESTRIAN
BRIDGE

RAILWAY
RESERVE

ATHLETICS
KIOSK

PEDESTRIAN PATH



and/or



- 00** FUNDING FROM NATIONAL LOTTERIES COMMISSION *who fund 'sporting bodies and sports clubs' – 'non-profit entities working for the public good'*
- 01** RECREATION & PARKS DEPARTMENT DEVELOPS & MANAGES URBAN PRECINCT *(including 3 public open courts, amphitheatre, pedestrian surfaces, planting & lighting)*
- 02** JOINT VENTURE BETWEEN CLUB & WESTERN CAPE DEPT. OF EDUCATION TO MANAGE PUBLIC BUILDING COMPLEX *(spaces can be timetabled between club + mod centre activities)*

INSTITUTIONAL ACTORS



CITY OF CAPE TOWN
RECREATION & PARKS
DEPARTMENT



Sporting Chance
Coaching Clinics



WESTERN PROVINCE
ATHLETICS

Western Cape
Athletics



NATIONAL LOTTERIES COMMISSION

a member of the dti group

NATIONAL LOTTERIES
COMMISSION
(funding partner)



LOCAL FOOTBALL
CLUB
(Junction Rovers)

INSTITUTIONAL ARRANGEMENTS

Programme development began to suggest the possible operational framework for this project (Fig.55).

The development is considered to be a phased process, with a larger urban framework and catalytic architectural interventions. As such, multiple stakeholders would be involved. The majority of the project is considered public, and would entail support from the City of Cape Town.

The larger urban development plan, comprising the development of the pedestrian path with lighting and paved surfaces, public open sports courts, urban park and athletics facilities would be developed and managed by the City of Cape Town's Recreation & Parks Department. As this is public property, it falls under the city's plans to develop and maintain neighborhoods and essentially forms a large urban park within which the catalytic architectural pieces fit.

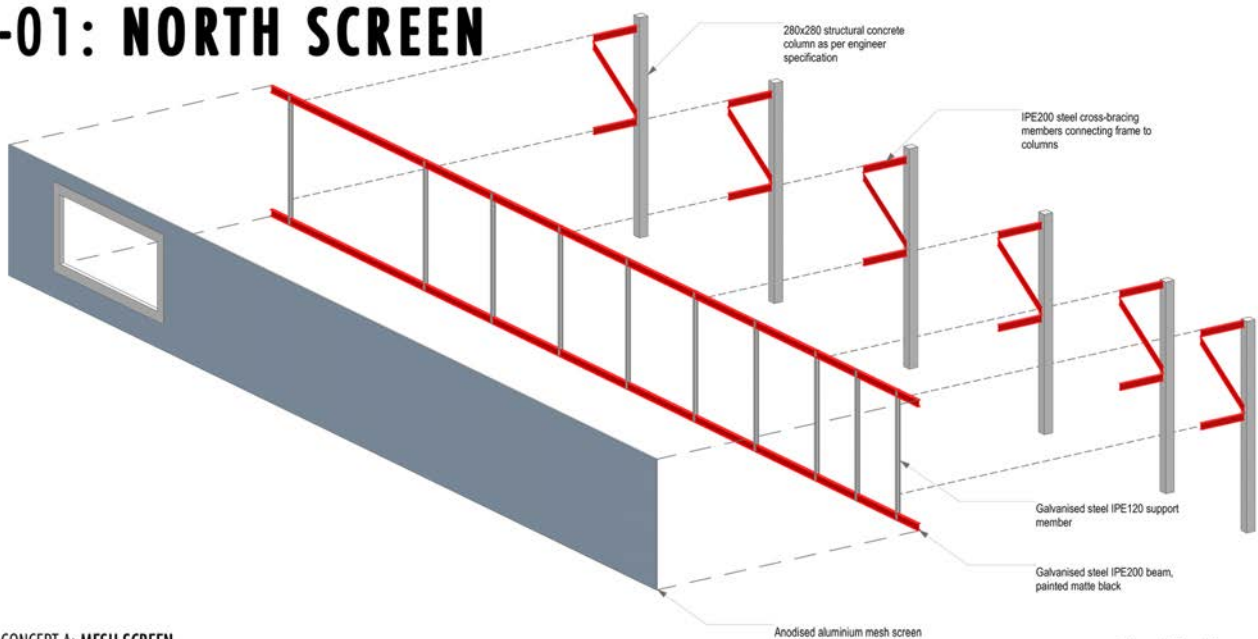
The Heideveld site is currently owned by the city; however, as this design dissertation engages with public urban infrastructure, in the case of this site, the Heideveld Pedestrian Bridge falls under the ownership of the City of Cape Town but crosses PRASA (the Passenger Rail Agency of South Africa) property. Building into the bridge at the Gugulethu side would require an agreement between PRASA and the City.

The clubhouse can potentially be funded by the National Lotteries Commission, which has funding opportunities for organisations that engage in public good, such as sports clubs (National Lotteries Commission, 2017). The building can be financially sustained through the hiring-out of its facilities such as the seminar rooms and practice pitch.

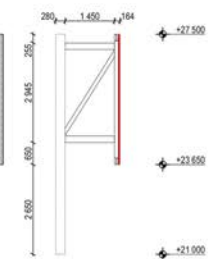
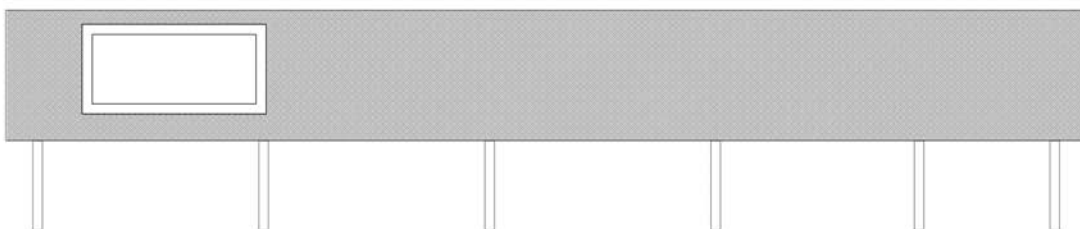
The athletics kiosk, with its playleader office and storage, would be managed by the City's recreation department. It can potentially be used by an NGO or other organisations, such as Western Province Athletics or Sporting Chance.

The clubhouse building would be managed by the local club. There is the possibility that this facility can be shared with other organisations to extend the usability of its facilities, thereby adding to the financial sustainability of the building. For example, a partnership with Sporting Chance enables that organisation to use the clubhouse's seminar facilities and pitch to conduct their coaching clinics.

D-01: NORTH SCREEN



CONCEPT A: MESH SCREEN



CONCEPT B: ADVERTISING



Opportunity for advertising targeting commuters traversing the bridge, and thus potential financing stream for project

CONCEPT C: COMMUNITY MURAL



Screen printed mural designed by school children + local club

Fig.56 – options for the North Screen that acts as a solar mediator on the northern face and provides privacy to the changerooms below

YOUTH SPACE: ARCHITECTURAL IMAGEABILITY THROUGH SURFACES

Architectural imageability is an important consideration for public buildings with expansive social programmes within the context of under-served communities. As observed at the Oliver Kahn Safe Hub, a building with a dynamic youth-focused programme needs appropriate imageability in order to be an inviting venue for youth to retreat to.

The idea of surface architecture thus becomes a compelling point when considering the issue of imageability. If horizontal surfaces are derived from social programme, then their translation to the vertical plane suggests that elevations can convey not only presence, but identity (Fig.56). Through the overarching narrative of returning a decentralised football club to its home ground, embedding it as an icon of youth space and development and a central point in the transcendence of sociotechnical divides, architectural identity is a critical issue.

Phenomenologically, the urban plan is structured to foster the sense of descending onto a landscape of activity (Fig.60). By leveraging the bridge's winding pathway, the site's programme elements slowly reveal themselves to visitors. The public courts and

$\frac{3}{4}$ field, pedestrian route and public open space are held together by the architectural feature of the clubhouse.

At the architectural scale, then, it is within the building's upper storey that social presence is addressed. Programmatically, the spaces are organised as flexible space supported by anchor programmes and fixed supporting space. In plan, this is organised as three distinct areas that are connected by circulation and fixed service space. Two fixed programme spaces anchor the upper floor plan at either end of the building, subsequently addressing two distinct urban conditions through their surface articulation. A resource lounge at the western edge addresses the urban park and residential edge of the site; the cantilevered fitness room makes a substantial gesture to the Heideveld Pedestrian Bridge, soaring over the building's social entrance. Its polycarbonate facade (Fig.59) allows pedestrians to glimpse the dynamic activity occurring within as they descend the bridge's steps, tucking beneath the fitness programme and into the main social entrance (Fig.57, 60).

On the Gugulethu side, a small intervention emerges from the edge of the bridge (Fig.60). A kiosk on the bridge level welcomes youth to the dynamic athletics activity occurring along this linear urban band.



Fig.57 – Entrance to the Clubhouse building off the Heideveld Pedestrian Bridge's staircase, as viewed from a landing on the berm's ramp. Dynamic activity of the fitness room above can be seen through translucent polycarbonate sheeting, and an iteration of the North Screen is visible on the right

The club room, therefore, is an intentionally ambiguous, flexible space with a simple interior geometry that can be rearranged based on different event conditions. This flexibility requires fixed support, which is provided by the recessed service space comprising toilets and furniture storage. This space supports both the club room and two fixed seminar spaces. The seminar rooms, whilst fixed points in plan, can be used to support a function taking place in the club room by means of two large swing doors that enable spatial flow between the club and seminar rooms.

The club room spills out to a large 20m x 5m viewing deck overlooking the practice pitch. This club room can be divided into different zones depending on timetabled activity. For example, on weekdays it can be a lounge and cafe space serviced by the small kiosk at its corner. It provides a space for youth to dwell in after-school and for team mates to wait before practice. On special event days, it can be reconfigured as a banquet space for awards, with additional support from the adjacent seminar space.

The club room addresses two specific edges: the practice pitch through its viewing deck, and the urban park with an urban window overlooking the pedestrian pathway.

A resource lounge, located at the first floor landing, becomes a flowing space that offers a moment of pause as one moves between the quieter institutional spaces of learning (seminar, resource) to the more dynamic club room.

The idea of youth space, however, extends beyond the building. In terms of surface architecture, the clubhouse forms a surface extension of the programmed and flexible sports activity spaces that are arranged in the urban plan. It represents a strategically positioned series of fixed spaces that continue the social surface that begins with the pedestrian path that weaves between the urban park, public courts and $\frac{3}{4}$ practice pitch running north-south. Conversely, the social surfaces of the activated infrastructure running east-west, with the athletics tracks on the Gugulethu side and the pedestrian bridge, continue another series of social surfaces that flow into the building.

Youth space, therefore, comprises a series of sports-related activities translated as horizontal social surfaces. As these surfaces approach the

infrastructure, they begin to activate it through urban elements such as seating that become observation points due to their elevated vantage. As the social surfaces approach the building, they begin to interface with the internal programmatic configurations of club activities. Here, these horizontal surfaces begin to inform the volumetric articulation of internal spaces, particularly at the upper floor where the recreational programme is located.

The roof became an important formal consideration as the idea of architectural imageability was further explored (Fig.58).

Since the clubhouse building sits off-axis from the Heideveld Pedestrian Bridge, visitors coming to the building from this urban infrastructure would be able to see a fifth elevation – the roofscape. Different roof concepts were tested to explore geometric and volumetric possibilities. A continuous curved concrete shell roof (Fig.58, iteration 2) sought to express the major programme (the club room) by lifting in an arc at this point. Environmentally, this would allow natural light into this south-facing elevation.

Another concept, three butterfly roofs, proposed an alternative idea of programmatic expression by sitting atop the three major recreational programmes of the first floor (the resource lounge, club room and fitness room).

However, this concept proved too formal and rigid when considering imageability in terms of youth space. The final iteration is a singular expression of the major space on the first floor (the club room). This concept addresses the structural challenges posed by the concrete curved shell roof (in terms of buildability and practicality) and the architectural expression of the three distinct butterfly roofs (that seemed to fragment the otherwise continuous, linear geometry of this building).

A roof that seemingly floats above the clubroom creates a sense of visual hierarchy suggesting the prominence of the programme below. This is further supported by the long northern screen that intersects the horizontality of this roof and provides solar control and privacy to the changerooms below. This screen has the potential to be a social surface for advertising or a community mural.

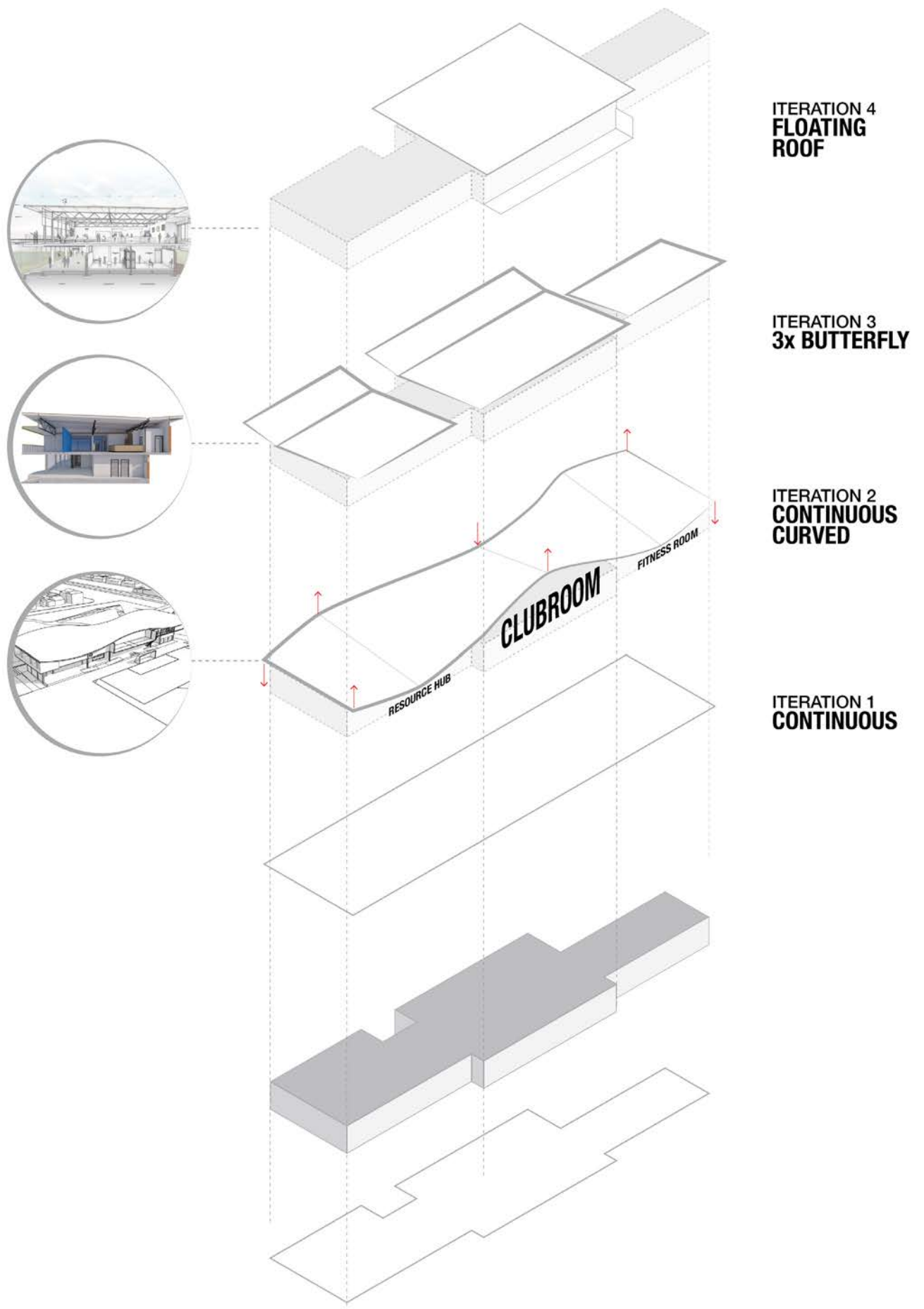


Fig.58 – Roof concept diagrams

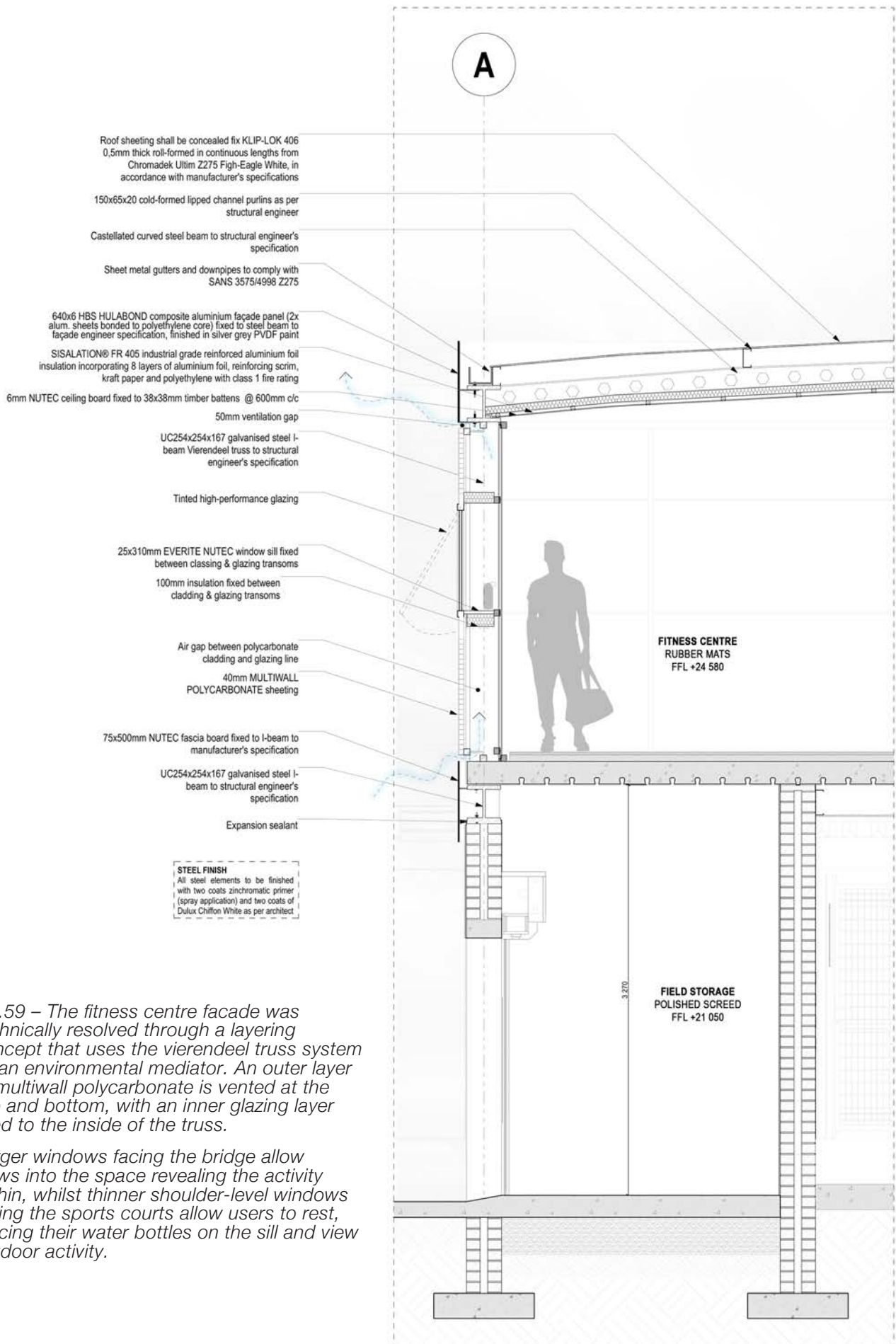


Fig.59 – The fitness centre facade was technically resolved through a layering concept that uses the vierendeel truss system as an environmental mediator. An outer layer of multiwall polycarbonate is vented at the top and bottom, with an inner glazing layer fixed to the inside of the truss.

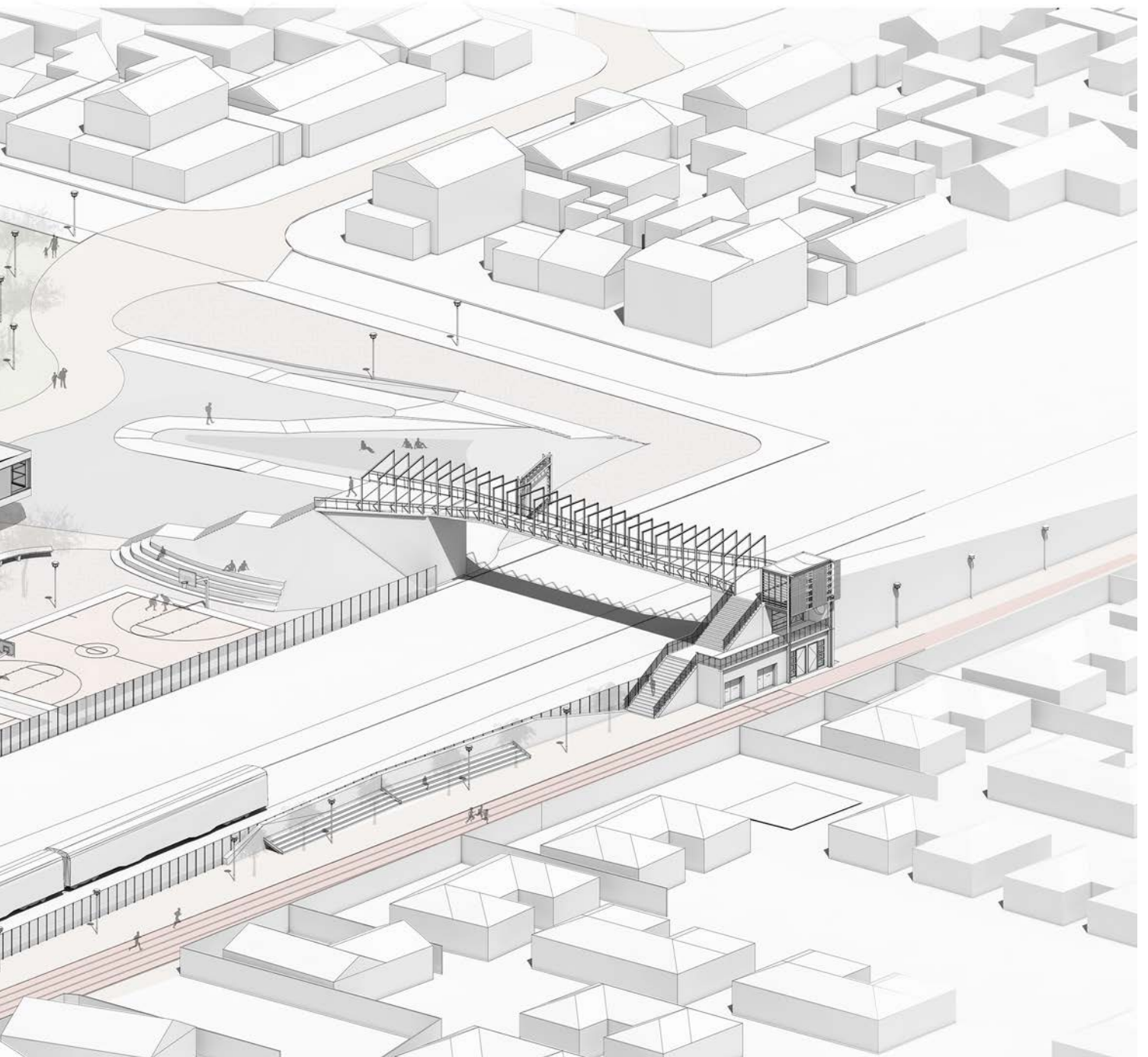
Larger windows facing the bridge allow views into the space revealing the activity within, whilst thinner shoulder-level windows facing the sports courts allow users to rest, placing their water bottles on the sill and view outdoor activity.



D-02: FITNESS CENTRE FAÇADE



Fig.60 – Site axonometric: socialising the spaces around urban infrastructure through social programme & surfaces



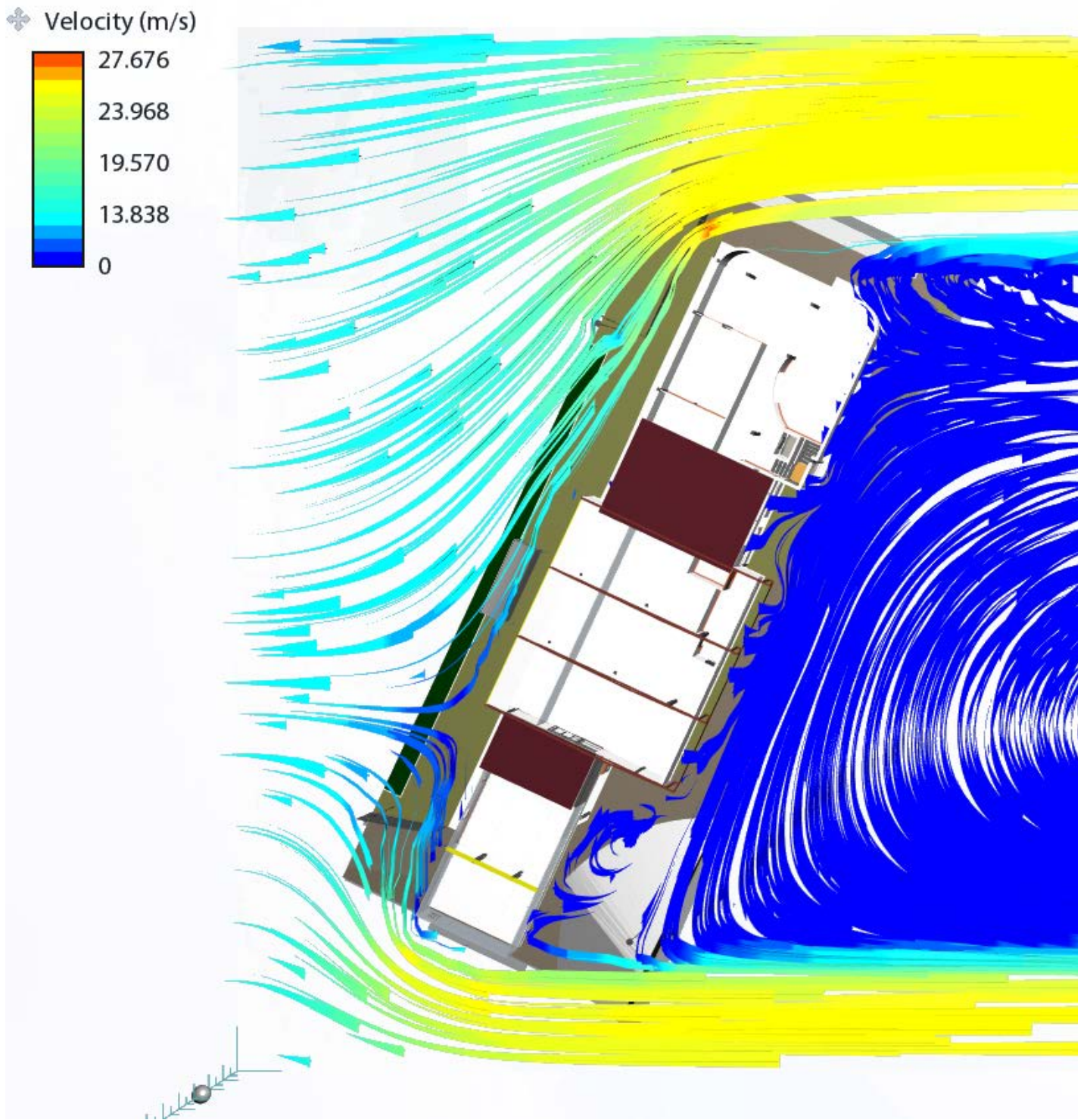
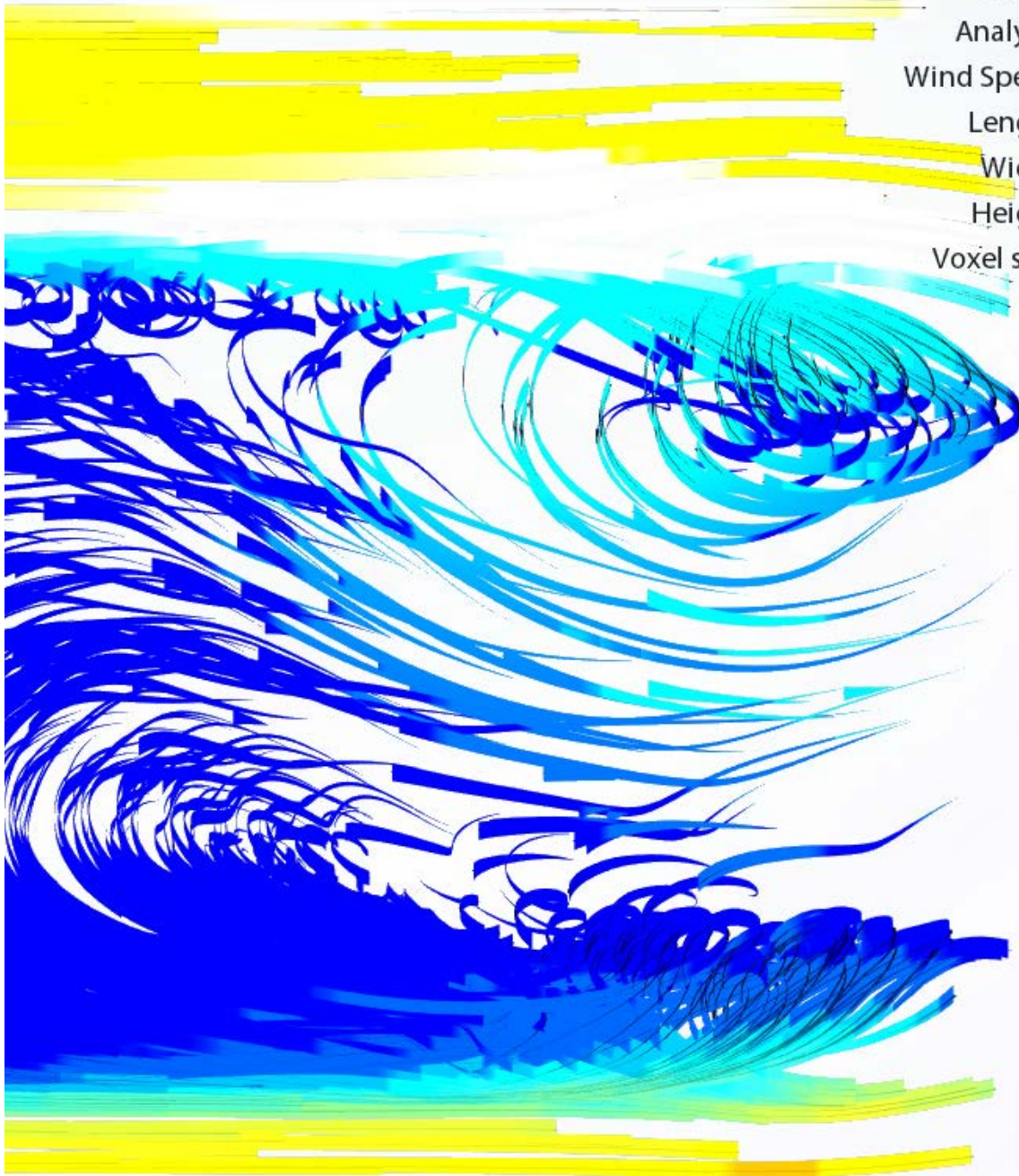


Fig.61 – CFD analysis on a design iteration



Status:	Transient
Analysis:	2D
Wind Speed:	7.000 (m/s)
Length:	0.158 (m)
Width:	0.097 (m)
Height:	0.044 (m)
Voxel size:	0.001 (m)

DESIGN RESEARCH FINDINGS

Process

This design dissertation explores the sociotechnical dynamic in architecture. This is done both theoretically and creatively through design work. The dynamic between digital toolkits and traditional design methods represents a sociotechnical synergy of process.

In *Hot to Cold* by Bjarke Ingels, the architect writes of 'engineering without engines'. He writes that 'The more sophisticated technology we deploy in the design process, the less dependent our designs

will be on corrective technology in their afterlives. To us, this means that buildings are not just informed by the culture of a place, but also by the climate that they are built in.' (Ingels, 2015, p. 9)

This design dissertation integrates digital methods in understanding design intentions through technical systems. The use of the Grasshopper algorithmic environment allowed environmental analysis that gave insight into design decisions. Understanding how the microclimate of flexible event spaces can be affected based on various configurations provided insight into the programmatic placement of fixed space. These analyses confirmed intuitive

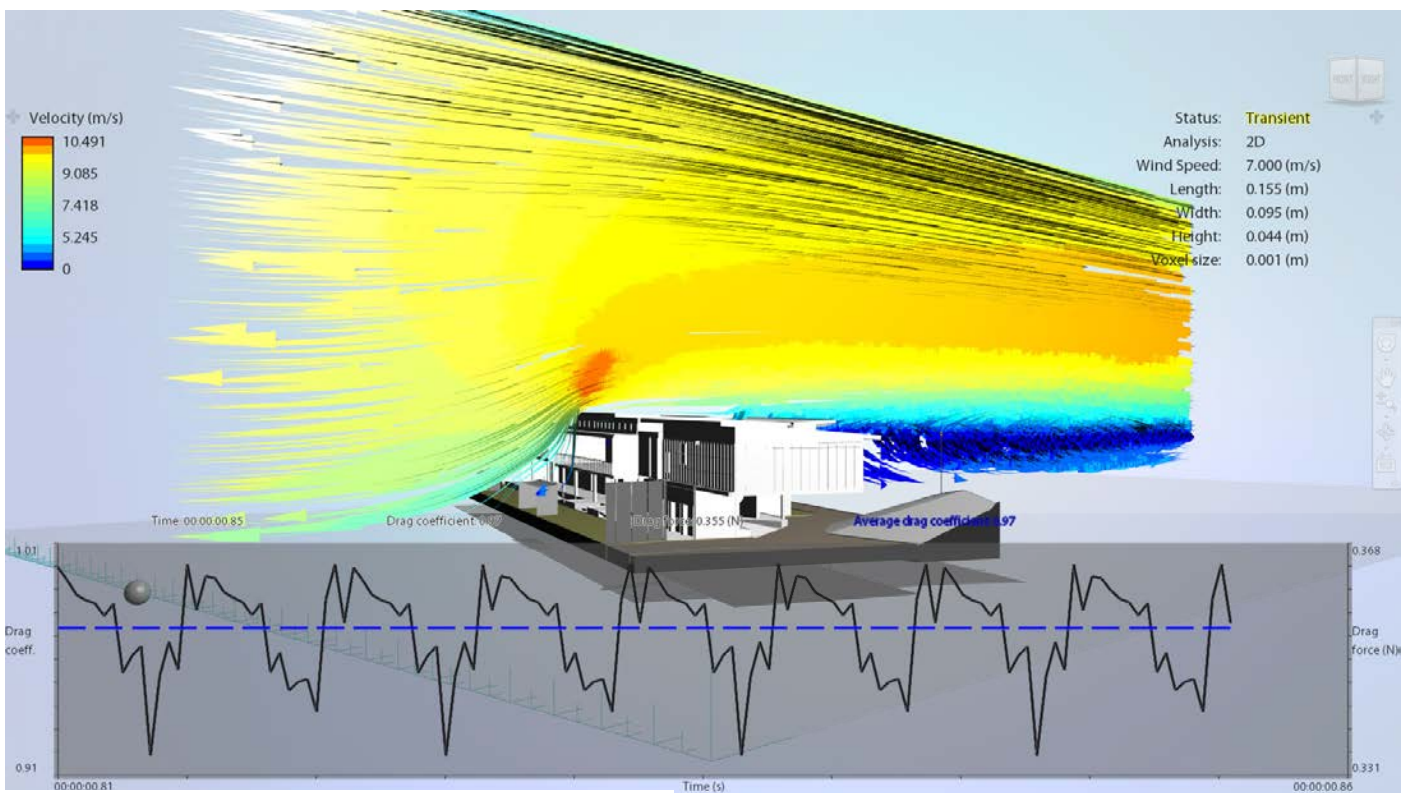


Fig.62 – CFD analysis

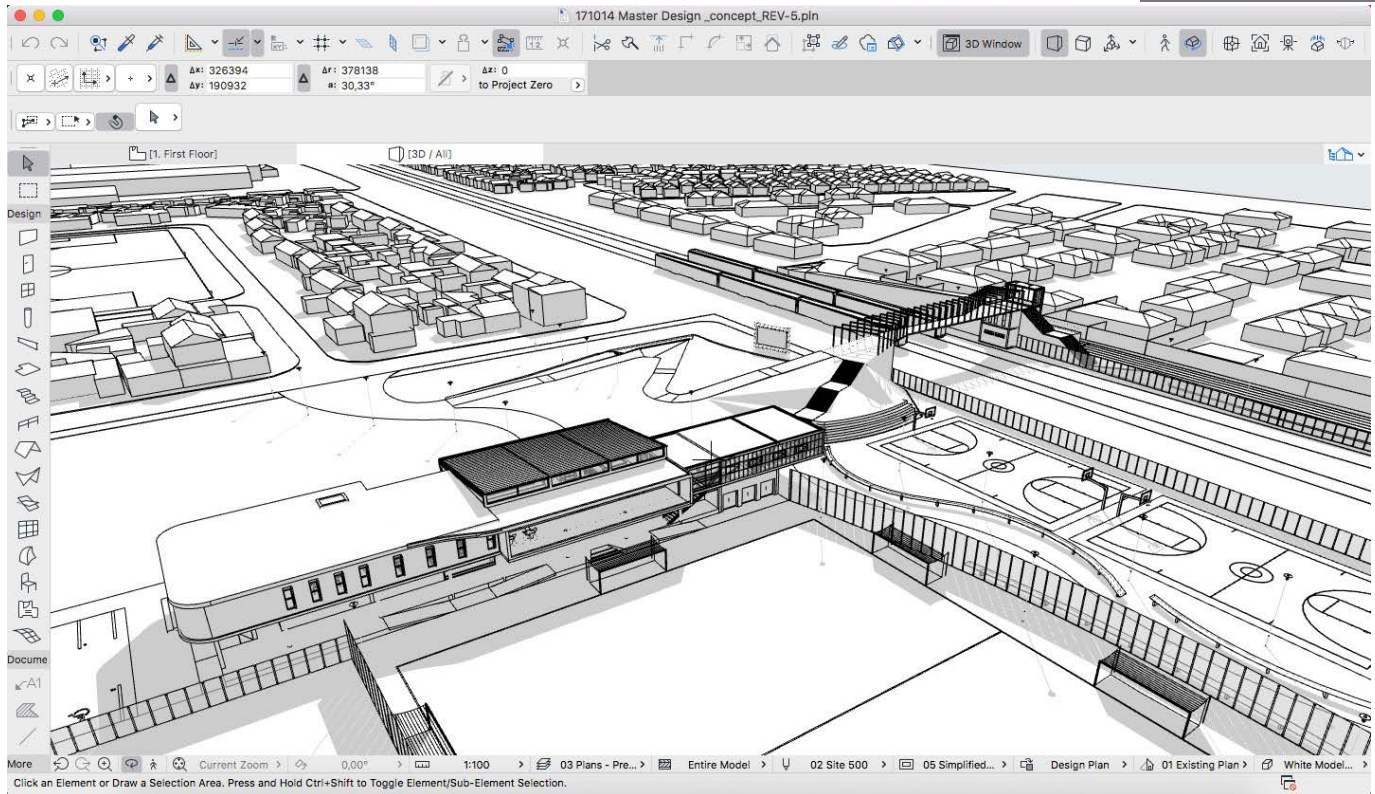


Fig.63 – ARCHICAD BIM environment with the project model open

design decisions and pragmatic responses to programmatic requirements, and provided a level of visualisation which would otherwise be impossible to arrive at without the toolkit (Fig.61 & 62).

The process of moving between a BIM model to the Rhino environment, performing analysis, understanding the results and making subsequent decisions takes considerable time and effort. Therefore, this aspect was limited to specific instances in the design development. Furthermore, the results were based on general weather data for Cape Town, and as the tests were performed in a less rigid, design-outcome-based manner, not intended to be conclusive findings of specific environmental performance characteristics.

As the programme developed rapidly in succession with the architectural synthesis and numerous conceptual changes, environmental analysis was restricted to testing only the characteristics of the more developed design iterations.

In addition to the technical toolkit of environmental testing, the use of a comprehensive 3D building information model provided a significant base from which to perform design tasks (Fig.63). It enabled rapid visualisation and virtual walkthroughs to test spatial experiences.

The process of diagramming became a common design methodology that permeated all instances. From conceptual studies of structure and building placements, to translating environmental results and visualising the design dissertation's narrative arc, diagramming provided a rapid means of understanding and testing design ideas.

Appendix E contains environmental studies undertaken to test the different roof options and wind performance against the fitness centre, north screen and viewing deck. These supplemented design judgements in arriving at the current roof design.



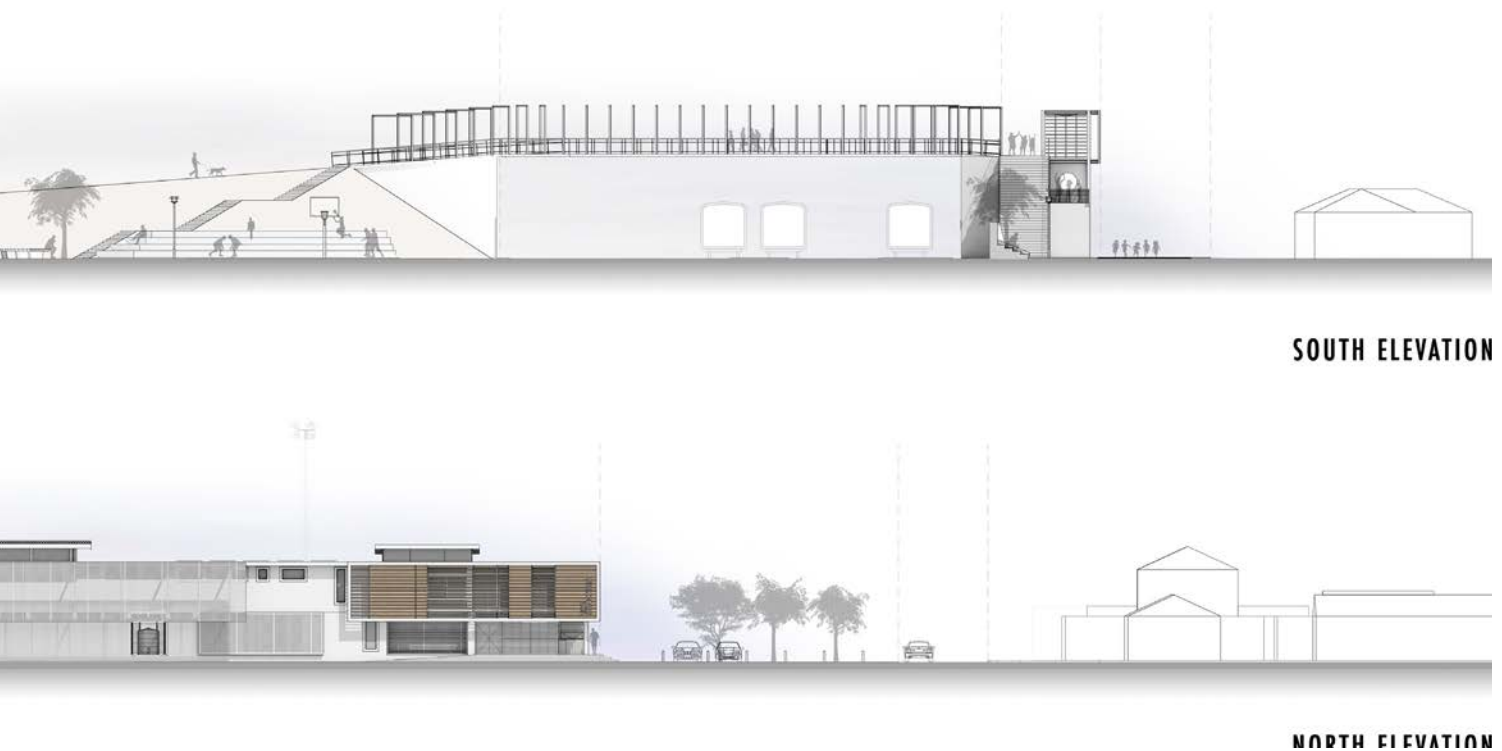
Programme

Within the context of under-serviced communities where infrastructure has historically been used to delineate urban space, social programme was found to be a powerful means of engaging with this division.

Social programme arrives from a deep investigation of the site and its unique narratives. This is achieved through fieldwork that can comprise a series of interviews with key figures in a community. In the case of this project, interviews with a town planner, the school principals and conversations with the sports club provided social context. This was leveraged in constructing a social narrative that began to inform possible activities which would later be translated into specific programmes, and eventually, architectural synthesis.

Programmatically, public buildings in such contexts require specific attention to access control. This sets up a tension between balancing security, circulation, surfaces and structure. I discovered that strategically positioned entrances can extend the sociotechnical interface and also contribute to architectural legibility and imageability.

Entrances can have specific purposes that are derived from their threshold conditions. In this project, two entrances attend to specific urban conditions. One entrance – for the sporting facilities – is designed to continue the movement pattern of the bridge’s staircase, creating a flow that extends onto the plinth. Conversely, a second entrance is located at the opposite end that remains legible by being visible to the residential and park spaces. This entrance is intended mainly for administrative purposes and the upstairs seminar and resource



SOUTH ELEVATION

NORTH ELEVATION

Fig.64 – Site Elevations

lounge spaces. Both entrances are outdoor and covered by fixed programme above. The vertical surface articulation of these first-floor surfaces suggest the dynamic activities that occur in the building and become a means of inviting visitors into the programme (Fig.64).

Creating sports-orientated public buildings requires attention to the organisation of internal programme. Sports programmes suggest certain fixed amenities (storage, change-rooms, toilets) and social spaces (team rooms, meeting spaces, offices). These spaces require an organisational strategy.

Therefore, internal programme can further balance security and circulation by being organised across two stories. This contributes to a building mass that has inherent presence, and enables ground floor spaces to strategically serve their outdoor

programme, freeing the first floor to contain a series of recreational spaces.

Architectural presence can be achieved through simple gestures. The act of raising the entire building onto a plinth (500mm in this case) deals not only with the practicality of the water table in the Cape Flats, but creates a robust social surface that sits as an anchor within a series of dynamic outdoor activities (Fig.65, 66). The plinth becomes a kind of connective tissue that consolidates the various programmatic fixities of the ground floor. It connects both entrances to the field and ground floor amenities. One external staircase, located adjacent to the bridge-connection entrance, connects the plinth to the clubroom and fitness room above.

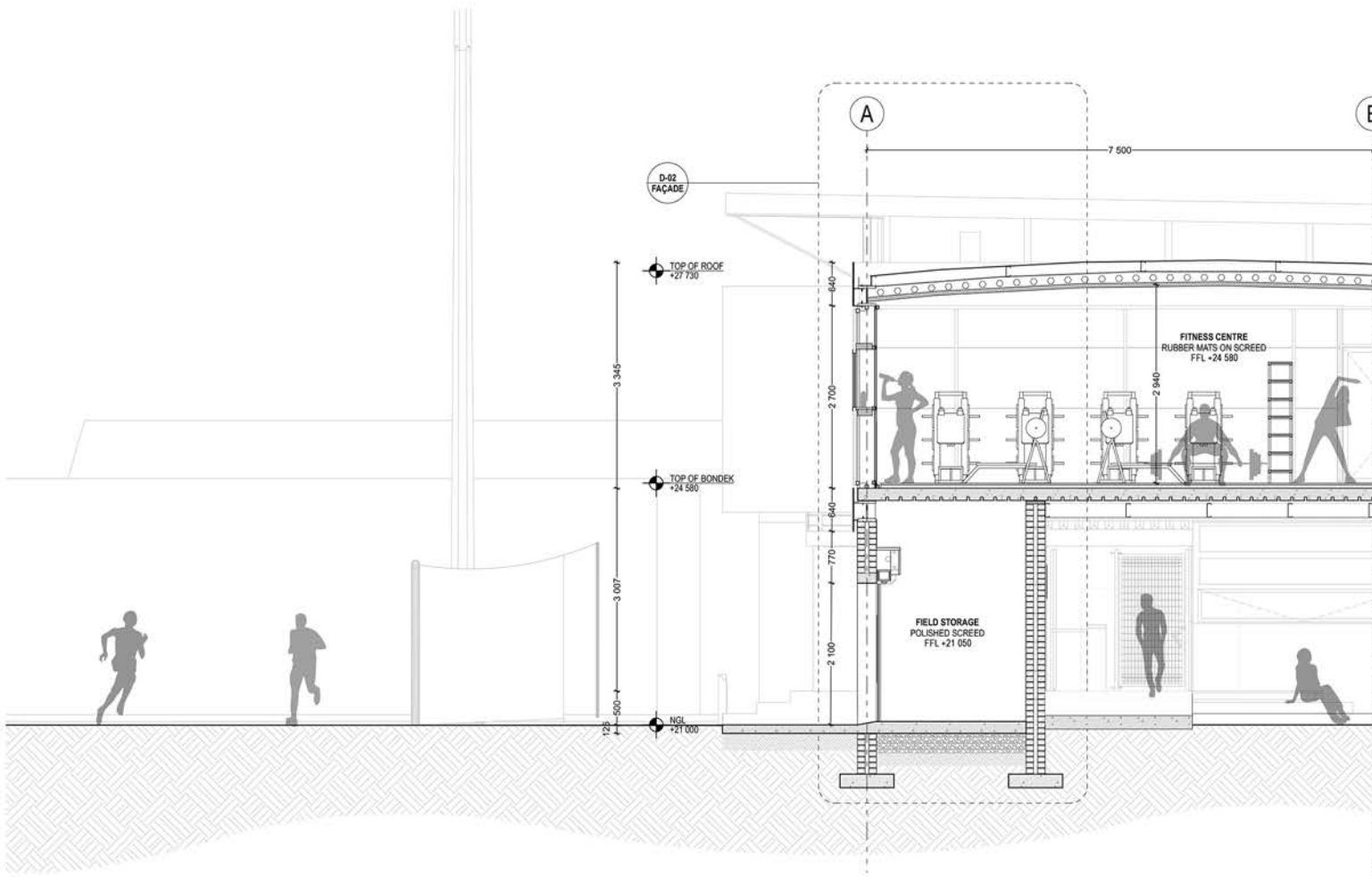
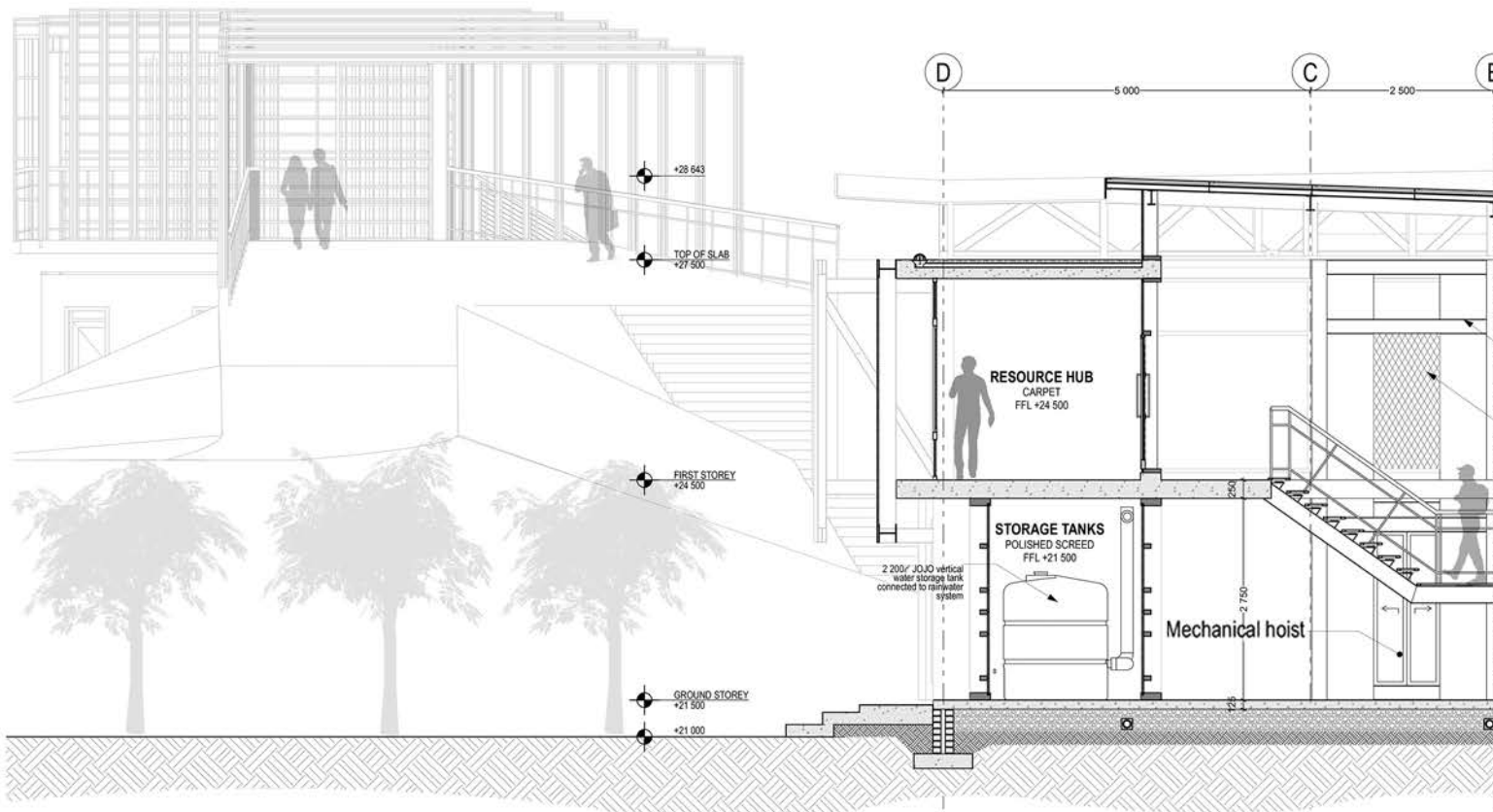


Fig.65 – Sections through the fitness centre and resource atrium, the two fixed programmes that flank the central clubroom space



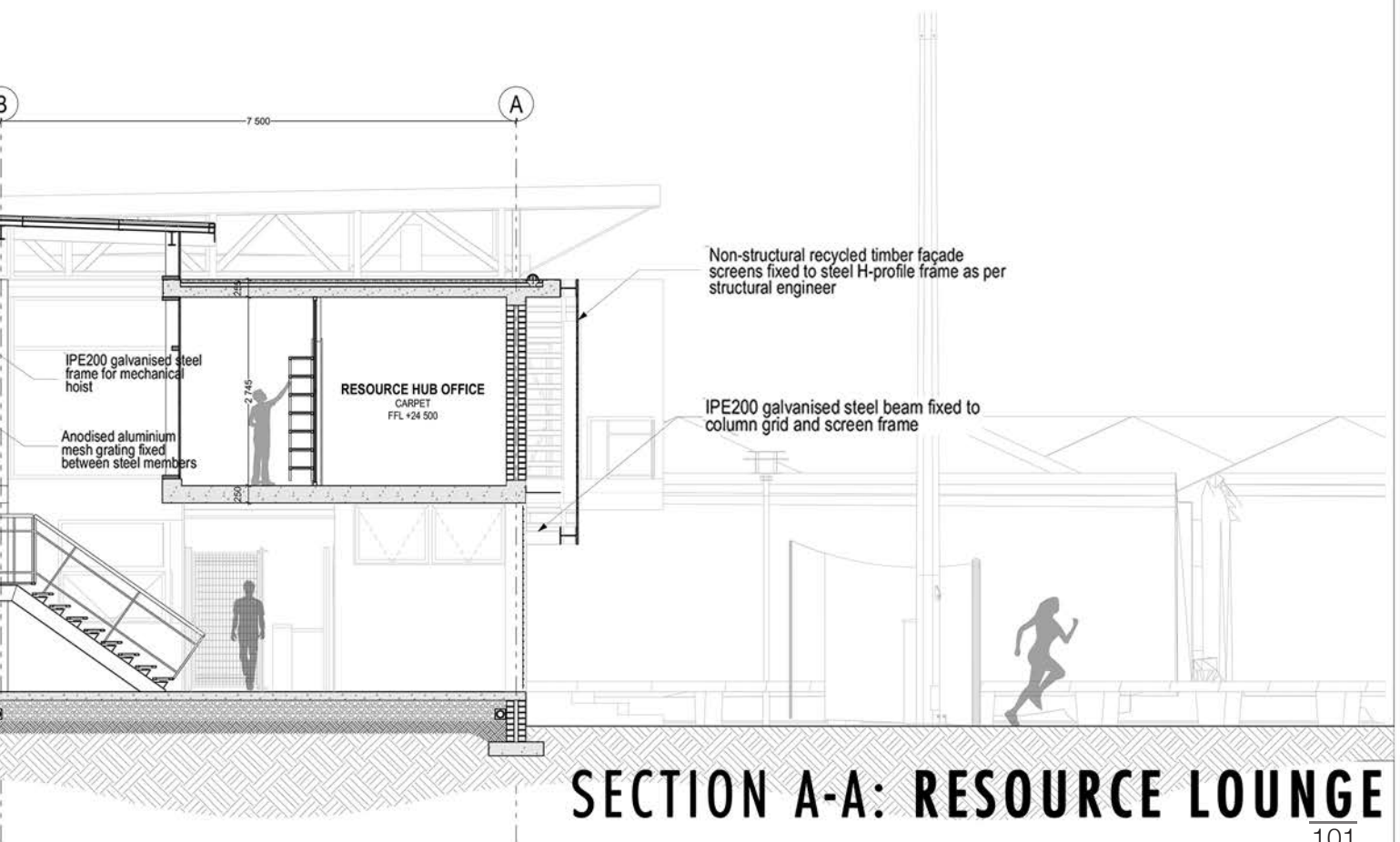
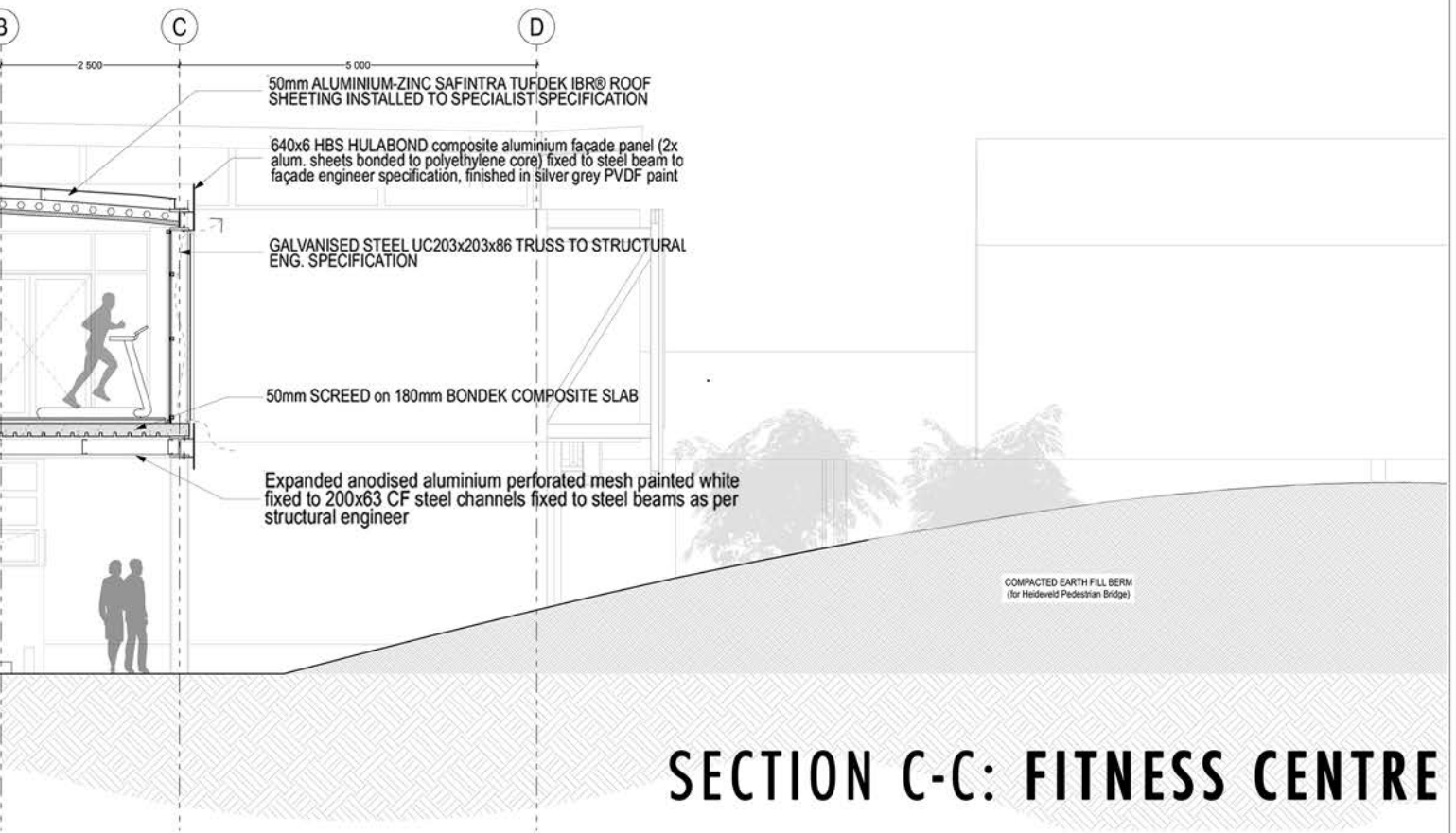
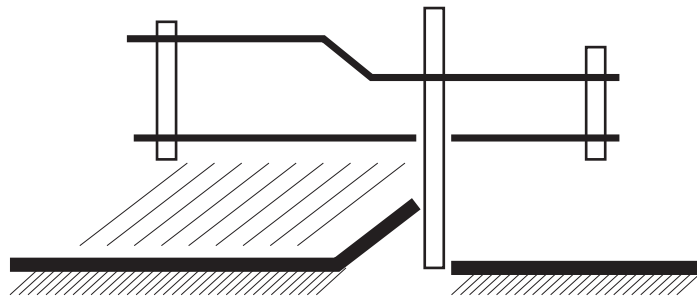


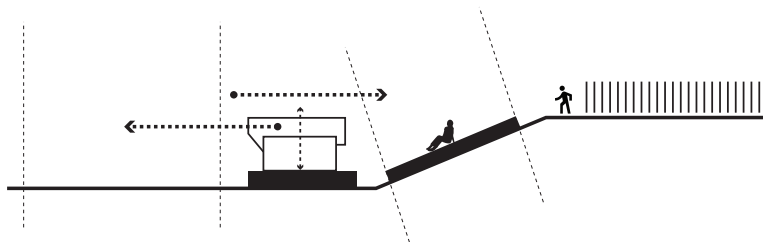




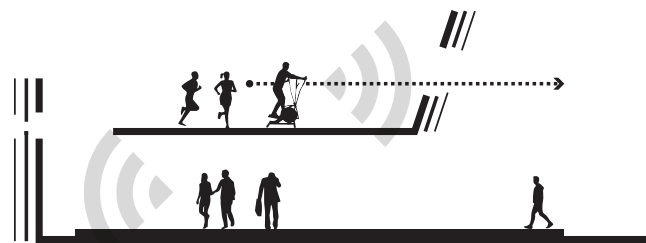
Fig.66 – The clubhouse building from the practice pitch, with the Heideveld Pedestrian Bridge and Gugulethu intervention in the background



SOCIAL SURFACE CONTINUUM



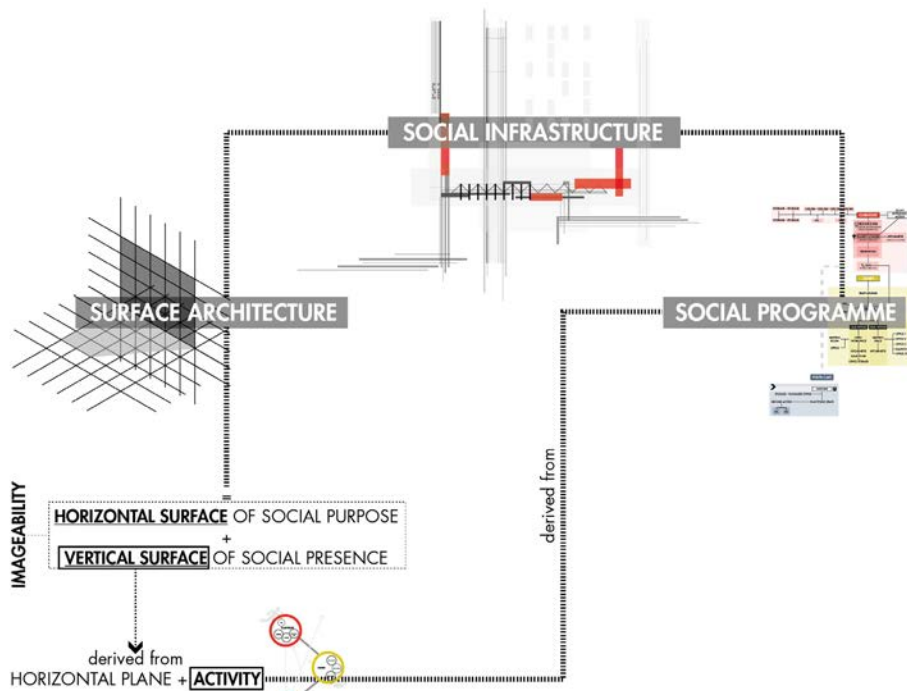
SOCIAL SURFACE DERIVED FROM ACTIVITY
(from social programme)



VERTICAL SURFACE DERIVED FROM SOCIAL SURFACE
(derived from activity)

Fig.67 – Design principles for sociotechnical architecture that engages with social surface and programme

Fig.68 – Theoretical framework developed through design explorations, understanding what 'social infrastructure' means architecturally



Theory to Structure

The making of public buildings within sociotechnical contexts, where architecture seeks to interface with urban infrastructure, requires specific design principles (Fig.67).

As Graham and Marvin write,

...infrastructure networks are thus widely assumed to be integrators of urban spaces. They are believed to bind cities, regions and nations into functioning geographical or political wholes. (Graham & Marvin, 2001, p. 8)

Urban infrastructure that is pedestrian-orientated, such as bridges, have the potential to address social concerns through architectural intervention within contexts where, historically, there has been evidence of splintering urbanism. This requires addressing the infrastructure as an actor within the larger urban network, just as one considers the social aspects of a site: the social patterns of inhabitation, economic activity, cultural landmarks and institutional presence.

Infrastructure becomes a strong spatial presence that can be addressed at the scale of architecture when a social programme is introduced. This can break the infrastructure into a series of surfaces that can be integrated into the architecture in non-direct means. Rather than using literal modes of crafting

social infrastructure, the power of architectural narrative and metaphor can be used to provide a social dimension to urban infrastructure that otherwise serves a purely functional purpose.

Sociotechnical architecture requires two specific aspects: a social programme, and the translation of this programme through surface articulation. It is through these surfaces that architecture begins to respond to a site's urban infrastructure (Fig.68).

Surface architecture therefore comprises the horizontal layer of social purpose, provided by a site's social landscape. Its vertical surface, consequently, are that of social presence. They become a communicable layer that is informed by both social purpose and programme (Fig.68).

Furthermore, constructing sociotechnical architecture requires attention not only to the scale of the building intervention, but the urban scale of site building.

Site building strategies can continue the programme that anchors the catalytic building, but begin to extend that presence into a wider context that can ultimately integrate with the surrounding community. Site building becomes an extension of urban infrastructure and consists of horizontal surface articulation that denotes specific programmed (or unprogrammed) activity.

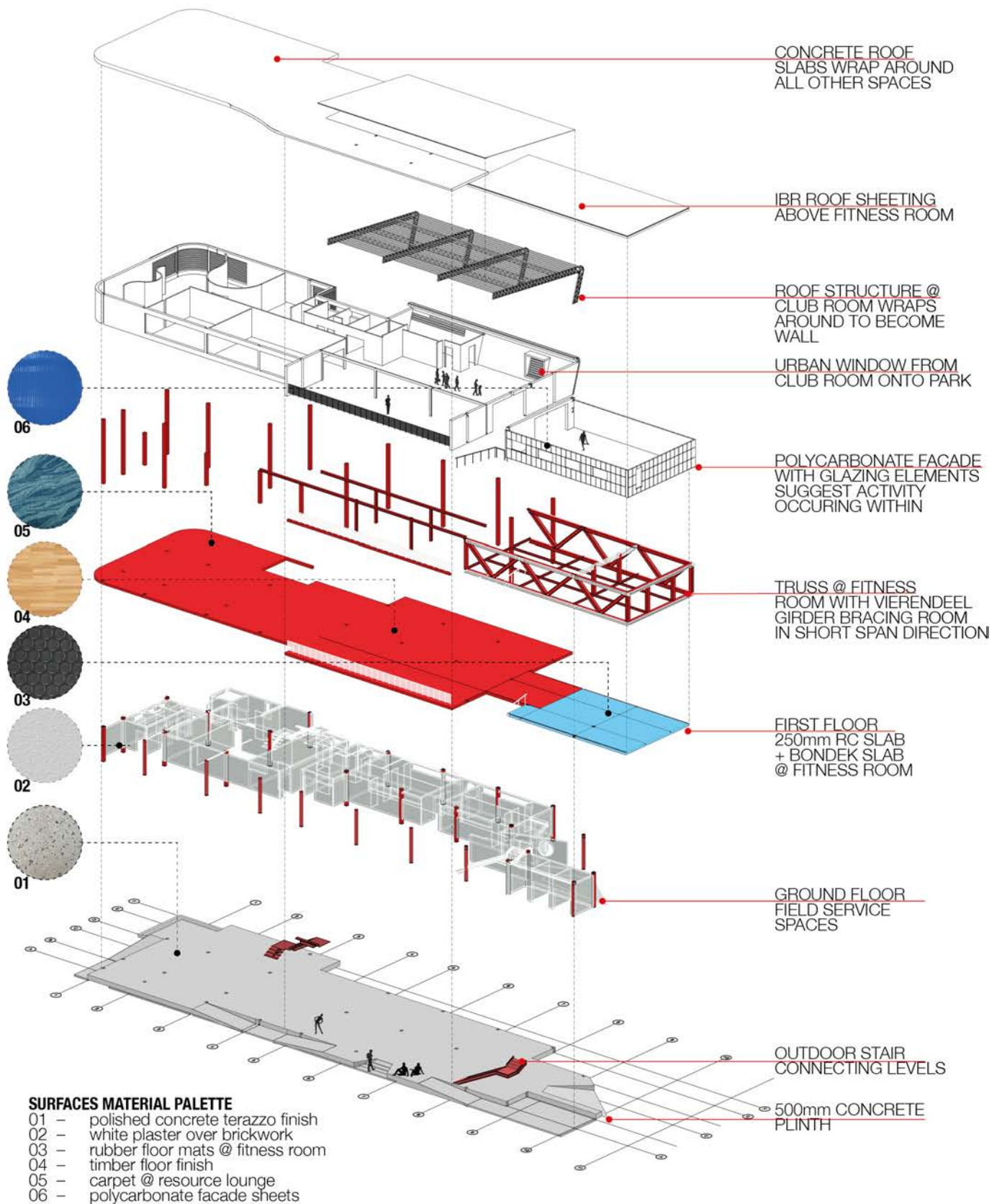


Fig.69 – Structural and material composition of the clubhouse building – based on an early design concept

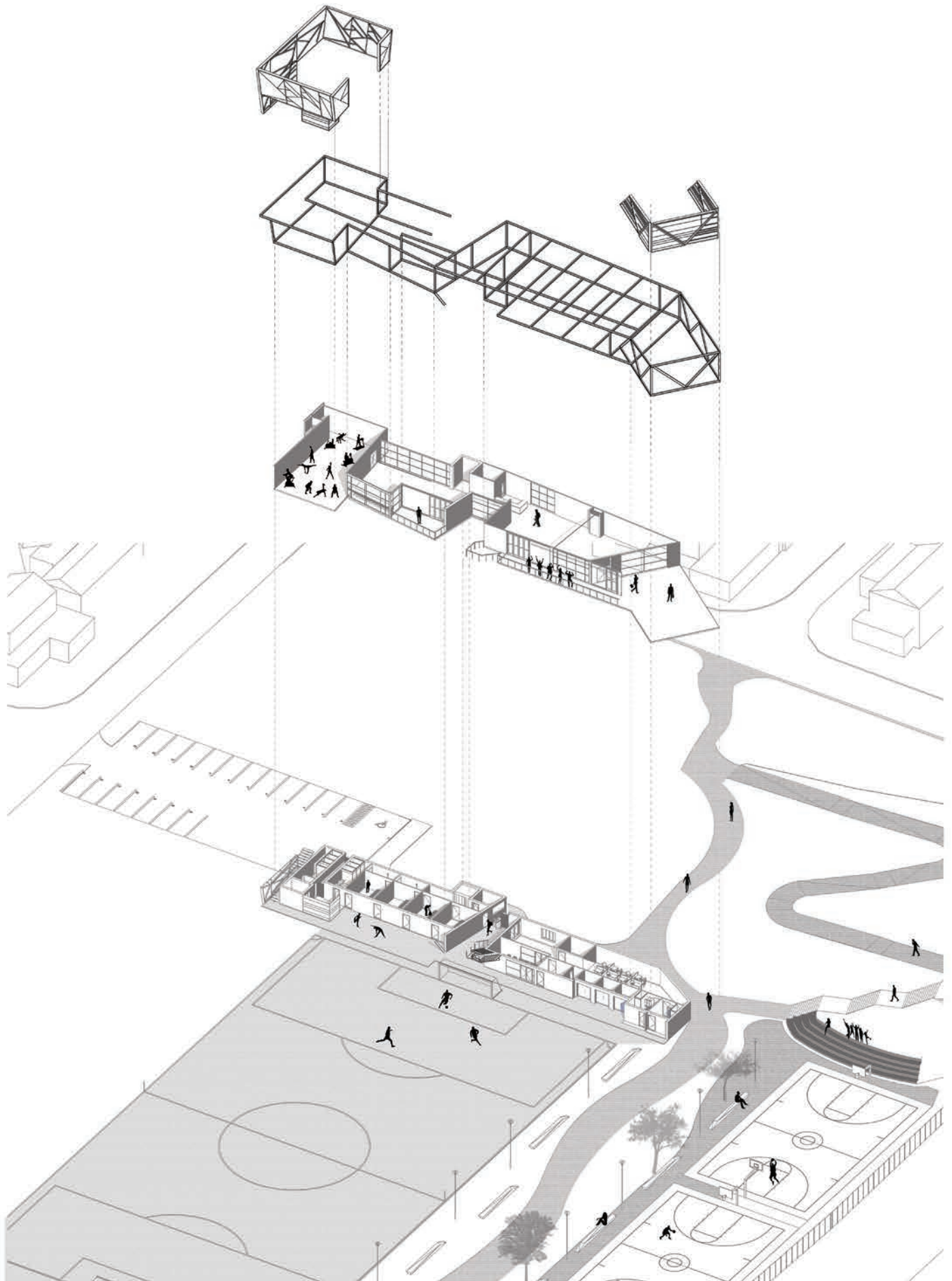


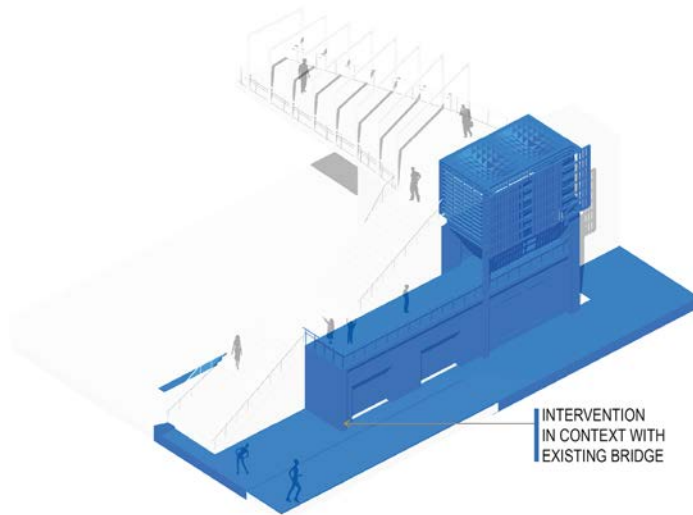
Fig.70 – An early axonometric idea of site activation through social surfaces and structure

Site building can be the simple arrangement of programmes based on a theme (in this case, sports, specifically soccer and athletics – activities derived from site analysis). This becomes an initial urban development step that develops as dominant desire lines suggest the positioning of these surfaces along a route. This route can connect the site to a wider urban context. It can furthermore integrate the site and architectural intervention with pedestrian infrastructure, becoming a key aspect of the site building strategy. This route should run between socially-activated surfaces, ensuring continuous surveillance. It should be well-lit with a line of high-level lighting and a distinct hard surface that continues to specific destinations. In this case, the public safe route is flanked by public open courts and the $\frac{3}{4}$ Astro turf, has a series of street lights along its path, and connects the site to the Heideveld Train Station and Cockscomb Park, the current practice ground of Junction Rovers.

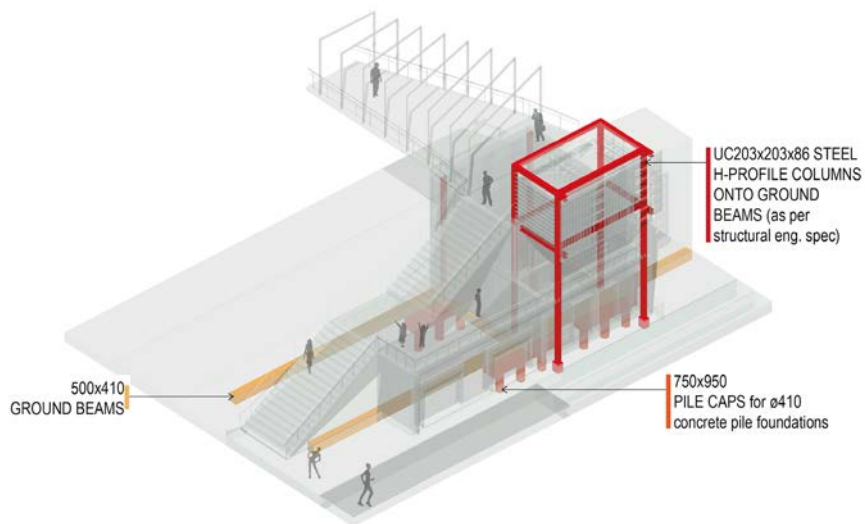


Fig.71 – Looking towards the northern face of the clubhouse building from the urban park, with the Heideveld Pedestrian Bridge in the background



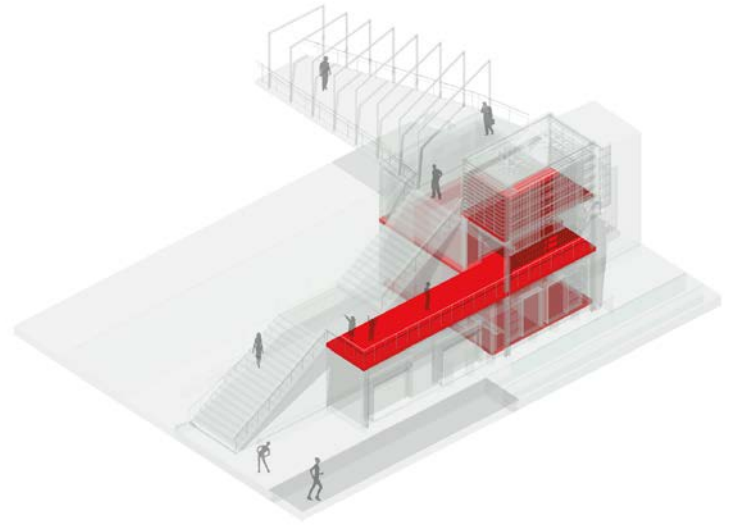


01 ADDITION TO GUGLETHU EDGE OF HEIDEVELD PEDESTRIAN BRIDGE



02 LEVERAGING EXISTING BRIDGE STRUCTURAL SYSTEMS

Fig.72 – Gugulethu athletics hub intervention onto the Heideveld Pedestrian Bridge. These diagrams show how the intervention interfaces with the existing structure.



03 NEW FLOOR SLABS

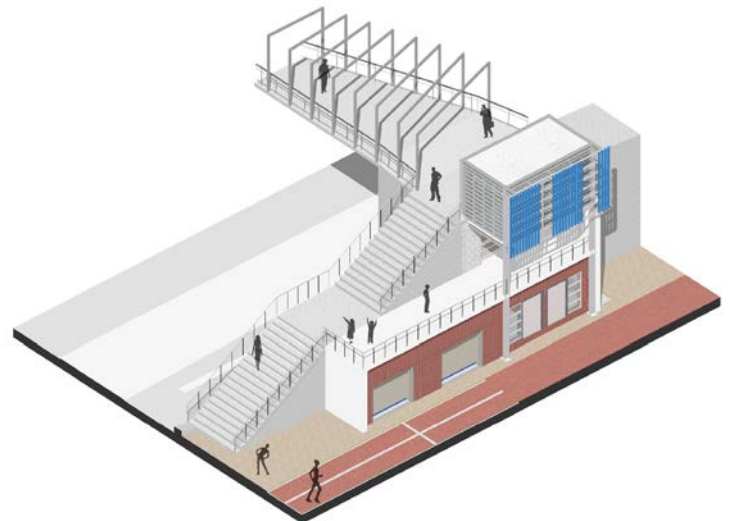
This design dissertation explores two strategies of socialising urban infrastructure. Through design development and experimentation, I discovered that building onto the bridge's structure and berm on the Heideveld site was not feasible economically or structurally. However, on the Gugulethu side, a small intervention could be possible by building into the bridge's structure and piled ground beams.

This small intervention, the Gugulethu Athletics hub, comprises toilets and storage on the ground level, a playleader's office and viewing deck on the first floor, and a kiosk space that sits directly onto the bridge deck (Fig.72).

Structurally, this intervention is seen as a fit-out: using lightweight steel, an interior room is built into the bridge. Cut-outs into the bridge pier's brick walls enable light and ventilation in the toilets and playleader's office (Fig.73).

The kiosk on the bridge deck level is a lightweight steel frame with a canvas roof.

This intervention supports the athletics programme on the Gugulethu side. It is imagined that the Heideveld schools would use this space for their practice; it can also be a flexible event space for informal recreation. The kiosk, being strategically positioned off the bridge level, can serve refreshments to children traversing this urban infrastructure between the Heideveld and Gugulethu programmes (Fig.72, #04).



04 ACTIVATED URBAN INFRASTRUCTURE

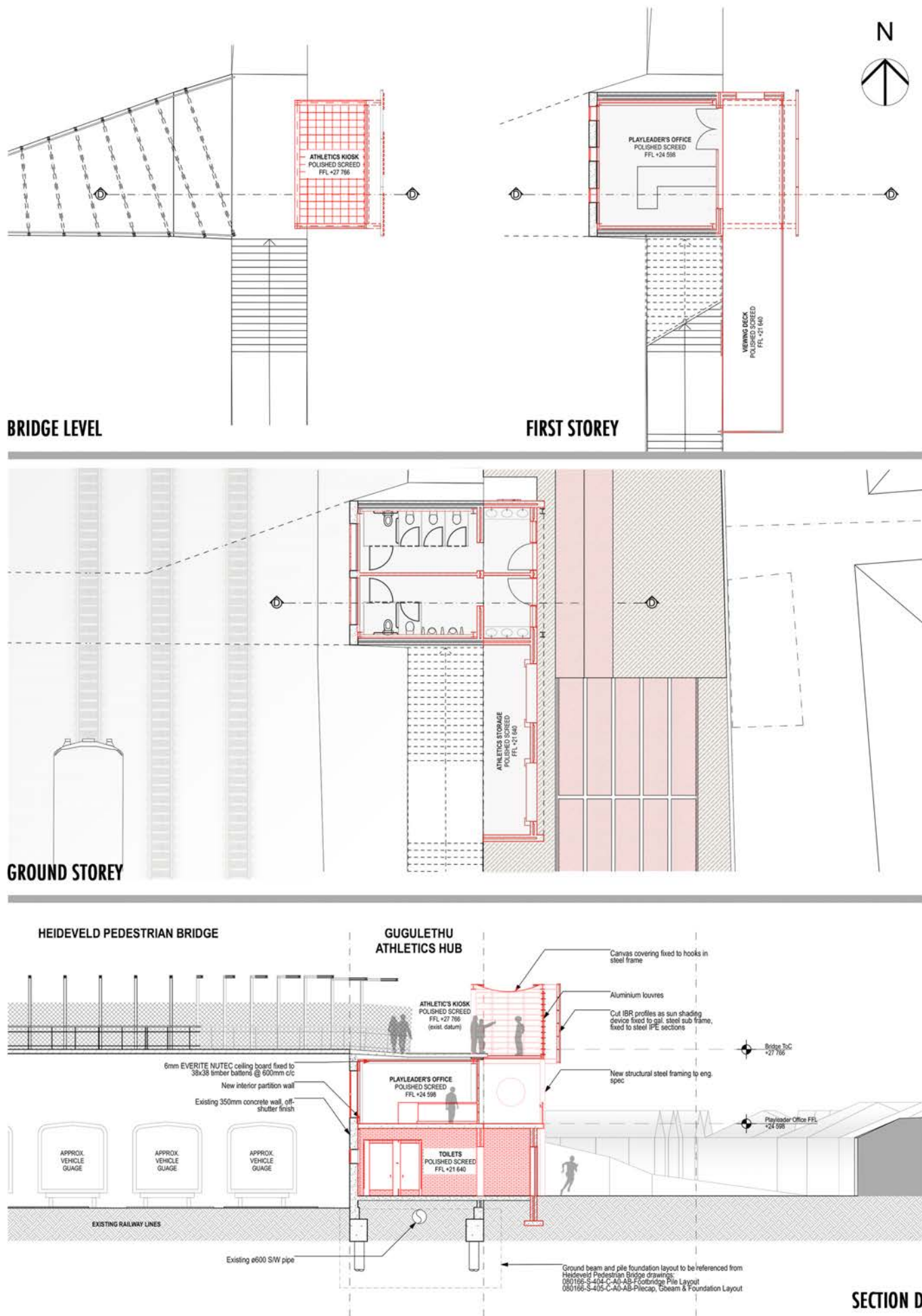
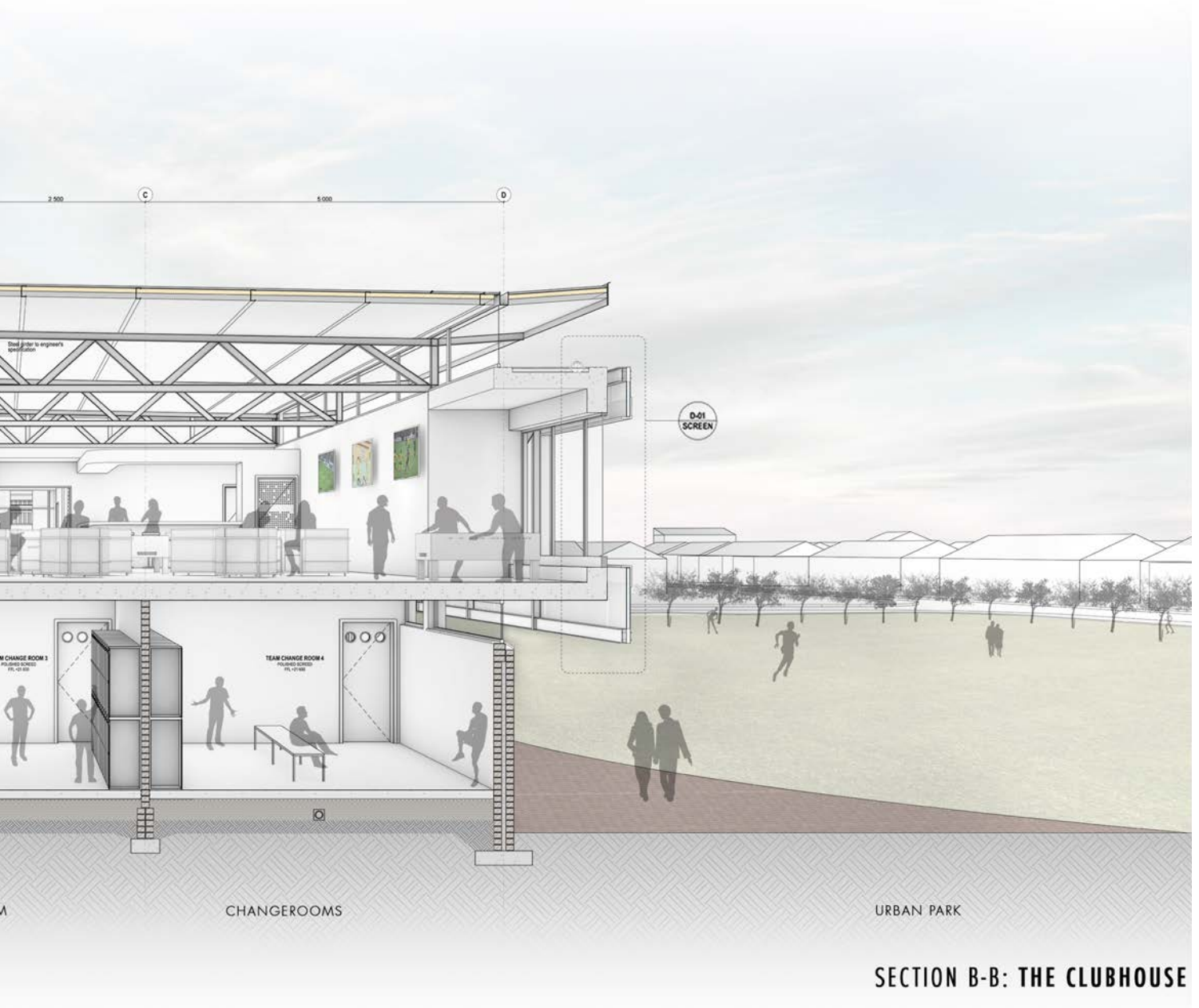


Fig.73 – Plans and sections of the athletics hub intervention, showing the fit-out nature of building into the bridge's structure

Public Sociotechnical Buildings

Public sociotechnically-driven buildings are therefore strategic interventions that fit within a larger urban context. They are place-makers and public markers within vast open space. Within the context of under-served communities, they can communicate their presence through strategic principles such as being raised on a plinth, having imageable vertical services that are driven by internal programme as well as environmental considerations, and seek to organise programme efficiently through the setting-out of specific fixed spaces that service flexible social space (Fig.74). Efficient programme organisation enables these buildings to be the minimal size necessary to support a range of outdoor activities, essentially setting them up as urban armatures that plug into a larger urban framework. Interfacing with urban infrastructure allows the building to be minimal, since its programme extends beyond its built edges by leveraging the infrastructure as part of the wider horizontal social surface.

Fig.74 – The Clubhouse in its final iteration: a dynamic event space soaring above the field, that addresses unique urban conditions and is connected by a robust plinth below



conclusion

This design dissertation interrogates apartheid spatial planning's use of infrastructure to divide communities. By developing an architecture of social infrastructure – comprising social programme and surface articulation – these sociotechnical divides are transcended.

The relationship between the social and technical layers of urban and architectural space has been the impetus behind my design exploration throughout this design dissertation. The preliminary work introduced the concept of the sociotechnical, and this thread has permeated all aspects of my investigation, from theoretical underpinnings to creative design methods and the design focus around architecture and its interface with urban infrastructure.

The project uses the notion of a sports clubhouse to script the social narrative that underpins a compact architectural intervention which nevertheless has a larger urban presence. Perceiving the site as not a singular space, but one that encompasses a region spanning public land, pedestrian transport and train lines across two communities, the design dissertation posits the argument that with the appropriate social programme, and an understanding of the social meaning behind surfaces, such forms of splintering urbanism can be overcome.



Fig.75 – Activating space across urban infrastructure: the Gugulethu athletics facility, with the clubhouse in the background



references

Caletrío, J. (2013). Splintering Urbanism - by Stephen Graham and Simon Marvin (Review). Retrieved from <http://en.forumviesmobiles.org/publication/2013/08/29/book-review-1136>

City of Cape Town. (2011). Allowing inter-community access : Heideveld pedestrian bridge : City of Cape Town. *IMIESA*, 36(1), 45-47.

Cooke, J., Krause, M., Giles, C., Shay, D., Smith, E., Taani, I., et al. (2015). *Violence Prevention through Urban Upgrading - A manual for safety as a public good*. Cape Town: VPUU NPC.

Dowlath, R. (2017). *Studies in Architectural Theory & Technology: Architectural Imageability and the Bioclimatic Approach*.

Eisenman, P. (1999). The Diagram and the Becoming Unmotivated of the Sign. In P. Eisenman (Ed.), *Diagram Diaries* (pp. 286-291). New York: Thames & Hudson.

Graham, S., & Marvin, S. (2001). *Splintering Urbanism*. London: Routledge.

Hillier, B., & Hanson, J. (1984). *The Social Logic of Space*: Cambridge University Press.

Ingels, B. (2015). *Hot to Cold: An Odyssey of Architectural Adaptation*. Spain: Taschen GmbH.

Leatherbarrow, D., & Mostafavi, M. (2002). *Surface Architecture*: The MIT Press.

Moodley, B., Dowlath, R. & Van't Hof, M. (2017). *Lotus Park: The Life of Streets: An Investigation of Trade, Infrastructure and Inhabitation*. University of Cape Town, Architecture Planning + Geomatics, Cape Town: University of Cape Town.

National Lotteries Commission. (2017). National Lotteries Commission | What Organisations Are Funded. Retrieved from <http://www.nlcsa.org.za/what-organisations-are-funded/>

Norberg-Schulz, C. (1971). *Existence, Space & Architecture*. New York City: Praeger Publishers.

Statistics South Africa. (2011). South African National Census of 2011. Retrieved from <http://www.statssa.gov.za/>

Western Cape Government. (2017). MOD Programme. Retrieved from <https://www.westerncape.gov.za/general-publication/mod-programme>

image credits

FIG.01	p.4	By author	FIG.41	p.67	By author
FIG.02	p.10	By author	FIG.42	p.68	By author
FIG.03	p.12	By author	FIG.43	p.69	By author
FIG.04	p.20-21	By author	FIG.44	p.70	By author
FIG.05	p.22	By author	FIG.45	p.73	By author
FIG.06	p.24	By author	FIG.46	p.74	By author
FIG.07	p.26-27	By author	FIG.47	p.75	By author
FIG.08	p.26	Photo by author	FIG.48	p.76	By author
FIG.09	p.26	Photo by author	FIG.49	p.77	By author
FIG.10	p.29	By author	FIG.50	p.78	By author
FIG.11	p.30	Photo by author	FIG.51	p.79	By author
FIG.12	p.30	Photo by author	FIG.52	p.80	By author
FIG.13	p.30	Photo by author	FIG.53	p.81	By author
FIG.14	p.31	Photo by author	FIG.54	p.82-83	By author
FIG.15	p.32	By author	FIG.55	p.84	By author
FIG.16	p.33	Photo by author	FIG.56	p.86	By author
FIG.17	p.33	Photo by author	FIG.57	p.87	By author
FIG.18	p.33	Photo by author	FIG.58	p.89	By author
FIG.19	p.34	By author	FIG.59	p.90-91	By author
FIG.20	p.37	By author	FIG.60	p.92-93	By author
FIG.21	p.39	Photo by author	FIG.61	p.94	By author
FIG.22	p.39	Photo by author	FIG.62	p.96	By author
FIG.23	p.39	Photo by author	FIG.63	p.97	By author
FIG.24	p.40	(Graham & Marvin, 2001, p. 39)	FIG.64	p.98-99	By author
FIG.25	p.42	By author	FIG.65	p.100-101	By author
FIG.26	p.44-45	By author	FIG.66	p.102-103	By author
FIG.27	p.46	By author	FIG.67	p.104	By author
FIG.28	p.48	By author	FIG.68	p.105	By author
FIG.29	p.48	By author	FIG.69	p.106	By author
FIG.30	p.49	By author	FIG.70	p.107	By author
FIG.31	p.50-51	By author	FIG.71	p.108	By author
FIG.32	p.54-55	By author	FIG.72	p.110-111	By author
FIG.33	p.56	By author	FIG.73	p.112	By author
FIG.34	p.58	By author	FIG.74	p.114-115	By author
FIG.35	p.59	By author	FIG.75	p.116-117	By author
FIG.36	p.59	By author			
FIG.37	p.60-61	By author			
FIG.38	p.62-61	By author			
FIG.39	p.65	By author			
FIG.40	p.66	By author			

Application for Approval of Ethics in Research (EiR) Projects
 Faculty of Engineering and the Built Environment, University of Cape Town

APPLICATION FORM

Please Note:

Any person planning to undertake research in the Faculty of Engineering and the Built Environment (EBE) at the University of Cape Town is required to complete this form **before** collecting or analysing data. The objective of submitting this application *prior* to embarking on research is to ensure that the highest ethical standards in research, conducted under the auspices of the EBE Faculty, are met. Please ensure that you have read, and understood the **EBE Ethics in Research Handbook** (available from the UCT EBE, Research Ethics website) prior to completing this application form: <http://www.ebe.uct.ac.za/usr/ebe/research/ethics.pdf>

APPLICANT'S DETAILS		
Name of principal researcher, <u>student</u> or external applicant	RAHUL DOWLATH	
Department	ARCHITECTURE, PLANNING & GEOMATICS	
Preferred email address of applicant:	dwlrah001@myuct.ac.za	
If a Student	Your Degree: e.g., MSc, PhD, etc.,	M.Arch(Prof)
	Name of Supervisor (if supervised):	Supervisor: F. CARTER, for UCT Co-Supervisor: T. Brunette, for ARUP Cape Town
If this is a research contract, indicate the source of funding/sponsorship	-	
Project Title	(Re)Scripting Space: A Bioclimatic Approach to Social and Environmental Performance in Architecture	

I hereby undertake to carry out my research in such a way that:

- there is no apparent legal objection to the nature or the method of research; and
- the research will not compromise staff or students or the other responsibilities of the University;
- the stated objective will be achieved, and the findings will have a high degree of validity;
- limitations and alternative interpretations will be considered;
- the findings could be subject to peer review and publicly available; and
- I will comply with the conventions of copyright and avoid any practice that would constitute plagiarism.

SIGNED BY	Full name	Signature	Date
Principal Researcher/ Student/External applicant	Rahul Aneel Dowlath		10 Apr 2017

APPLICATION APPROVED BY	Full name	Signature	Date
Supervisor (where applicable)	Francis Carter		10 Apr 2017
HOD (or delegated nominee) Final authority for all applicants who have answered NO to all questions in Section 1; and for all Undergraduate research (Including Honours).	Prof. T. Berlanda		10 Apr 2017
Chair : Faculty EIR Committee For applicants other than undergraduate students who have answered YES to any of the above questions.			

Application for Approval of Ethics in Research (EiR) Projects
Faculty of Engineering and the Built Environment, University of Cape Town

APPLICATION FORM

Please Note:

Any person planning to undertake research in the Faculty of Engineering and the Built Environment (EBE) at the University of Cape Town is required to complete this form **before** collecting or analysing data. The objective of submitting this application *prior* to embarking on research is to ensure that the highest ethical standards in research, conducted under the auspices of the EBE Faculty, are met. Please ensure that you have read, and understood the **EBE Ethics in Research Handbook** (available from the UCT EBE, Research Ethics website) prior to completing this application form: <http://www.ebe.uct.ac.za/usr/ebe/research/ethics.pdf>

APPLICANT'S DETAILS	
Name of principal researcher, student or external applicant	Francis Carter
Department	Architecture Planning + Geomatics
Preferred email address of applicant:	francis.carter@uct.ac.za
If a Student	Your Degree: e.g., MSc, PhD, etc.,
	Name of Supervisor (if supervised):
If this is a research contract, indicate the source of funding/sponsorship	
Project Title	Gugulethu streets and community buildings spatial and social survey

I hereby undertake to carry out my research in such a way that:

- there is no apparent legal objection to the nature or the method of research; and
- the research will not compromise staff or students or the other responsibilities of the University;
- the stated objective will be achieved, and the findings will have a high degree of validity;
- limitations and alternative interpretations will be considered;
- the findings could be subject to peer review and publicly available; and
- I will comply with the conventions of copyright and avoid any practice that would constitute plagiarism.

SIGNED BY	Full name	Signature	Date
Principal Researcher/ Student/External applicant	Francis Carter		20 Apr 2017

APPLICATION APPROVED BY	Full name	Signature	Date
Supervisor (where applicable)	Francis Carter		20 Apr 2017
HOD (or delegated nominee) Final authority for all applicants who have answered NO to all questions in Section 1; and for all Undergraduate research (Including Honours).	Vanessa Watson Click here to enter text.		Click here to enter a date.
Chair : Faculty EIR Committee For applicants other than undergraduate students who have answered YES to any of the above questions.	G. Sithole		2 May 2017 Click here to enter a date.

APPENDIX B: PLAGIARISM DECLARATION

The Junction: Transcending Sociotechnical Divides through Youth Space

Rahul Dowlath (DWLRAH001)

Supervisor: Francis Carter, for UCT

Co-supervisor: Tessa Brunette, for ARUP Cape Town

Course Code: APG5079W

Design Dissertation report presented as part fulfilment of the degree of Master of Architecture (Professional) in the School of Architecture Planning and Geomatics, University of Cape Town.

11 December 2017

I hereby grant the University free license to reproduce the above design dissertation in whole or in part, for the purpose of research.

I declare that:

(i) The above design dissertation is my own unaided work, both in conception and execution, and that apart from the normal guidance of my supervisors I have received no assistance apart from that stated below:

...n/a.....

(ii) Except as stated below, neither the substance or any part of the design dissertation has been submitted for a degree in this university or any other university:

...n/a.....

(iii) I am now presenting the design dissertation for examination for the degree of Master of Architecture (Professional).

Plagiarism declaration:

1. I know that plagiarism - to use another's work and pretend that it is one's own – is wrong.
2. I have used the Harvard convention for citation and referencing. Each contribution to, and quotation in, this report from the work(s) of other people has been attributed, and has been cited and referenced.
3. This report is my own work.
4. I have not allowed, and will not allow, anyone to copy my work with the intention of passing it off as his or her own work.

Signature.....

Signed by candidate

Date **11 DECEMBER 2017**

APPENDIX C: STRUCTURED INTERVIEW QUESTIONS



School of Architecture, Planning and Geomatics
University of Cape Town, Private Bag X3, Rondebosch 7701
Room 4.13, Centlivres Building, University Avenue, Upper Campus
Tel: +27 (0) 21 650 2375 Fax: +27 (0) 21 650 2383
E-mail: francis.carter@uct.ac.za
Internet: www.apg.uct.ac.za

UCT Postgraduate programme in professional studies of architecture: M.Arch(Prof)
Fields of Play Design Studio - research for design:
Manifesting the Invisible: A Bioclimatic Approach to Sociospatial Performance for Youth-Centred Architecture

Student: Rahul Dowlath (060 526 77 27 / dwlrah001@myuct.ac.za)
Supervisor: Francis Carter (021 650 2375 / francis.carter@uct.ac.za)

*Statement to be read out to an interviewee by a student about to undertake an interview for research in the Prof Masters Design Studio 'Fields of Play'.
A copy of the form should be given to respondents if they request it.*

April - September 2017

CONSENT FOR AN ADULT TO BE INTERVIEWED FOR THE PURPOSE OF RESEARCH

My name is **Rahul Dowlath** and I am studying the design of buildings, at the University of Cape Town.

As part of my postgraduate studies to become a professional architect I am doing research on public buildings and space, youth development agencies and sports and recreation facilities. I would like to ask you some questions about this to help me with my research.

The questions I ask are only for education and research and do not directly benefit you or your community; you will not be compensated for your participation.

I must be careful not to raise expectations, as no improvement to any facilities will result from the interview.

The information which I am gathering will be used in my course and exams, and may also be published in academic journals or exhibitions.

I would like to record the interview, if you agree.

You have a right to refuse to answer any questions. If you want to end the interview at any point you are free to do so.

Permissions:

Do you agree to be interviewed, to contribute to this research?

Yes I do: No I do not:

Do you agree to the interview being recorded?

Yes I do: No I do not:

Do you give permission for your name, title and photo to be used as a source of information in our research?

Yes I do: No I do not:

Participant: name:

signature:

Student: signature:

date:

INTERVIEW WITH TOWN-PLANNER:

- » *When was Heideveld formed? / What was it like growing up in the area?*
- » *How was it planned? What planning strategies were used?*
- » *How has it grown or developed over time?*
- » *What is the relationship with other surrounding suburbs (Gugulethu/Phillipi/Mannenberg...) / tensions, networks?*
- » *Youth development: are there any after-school programmes?*
- » *Schools: how does the community interact with them? are they used as spaces for hired activity in downtime (evenings/weekends/holidays)?*
- » *Presence of schools in neighborhood: safety, lockdown? vandalism?*
- » *Where do kids go after-school?*

Gangsterism

- » *What is the spatial effect of gangs are operating in the area? Do they create controlled territories that prevent people from freely moving about the suburb?*
- » *Tensions with law enforcement? Have there been any major incidents?*
- » *How do these gangs affect schools / youth? Are youth succumbing to joining them, and do afterschool/lack of afterschool programmes have anything to do with this?*
- » *Community development: is there a top-down approach from the city towards development (long term growth plans etc), or is there a drive from the community towards community building/development?*
- » *New bridge across train lines: any background to this? Reasons for it being placed across from large piece of abandoned land?*
- » *Site: reason behind the empty pockets of land? Are they a relic of apartheid planning strategies?*

- » *Site: is there any plan for this area? For the pockets of empty space?*
- » *Site: roads built to suggest some sort of stalled development? What was intended for that space?*
- » *Are there any future plans for the suburb? Urban plans?*
- » *Have you worked on any planning strategies for the suburb?*

+ closing comments?

+ Walkabout to site / schools HEIDEVELD SECONDARY, WILLOWS PRIMARY

+ And data pertaining to area that might be helpful

+ Thank you

INTERVIEW WITH SCHOOL PRINCIPALS:

» *Where do your students come from? (Heideveld/Gugulethu...?)*

» *When does school open and close? What time do kids start arriving?*

» *How do kids get to school? (Walk/public transport?)*

» *How is security managed at the school – what kinds of barriers/boundaries are used? Is there any kind of surveillance?*

» *Are there any afterschool activities run by the school?*

» *Are there any afterschool activities run by third-parties that make use of the school's facilities? (E.g. does MOD-C operate here?)*

» *What are the main sports played?*

» *Are there any inter-school connections with sport (inter-school matches?) And if so, with which schools?*

» *Have there been any safety incidents? Issues of crime?*

» *Are the school's facilities hired-out/used during off-peak times by the community for functions/events?*

» *Do you have sports days?*

- Where are they held?
- What kinds of sports are played?
- How is it funded?

» *What is the state of sporting facilities/equipment in this school?*

» *Does the school have a physical education curriculum? If so, at what times is this held?*

» *Are any facilities/spaces shared between this school and Willows/Heideveld High?*

» *What is the relationship between this school and the local club (Junction Rovers)*

» *Does the club run programmes that link with the school*

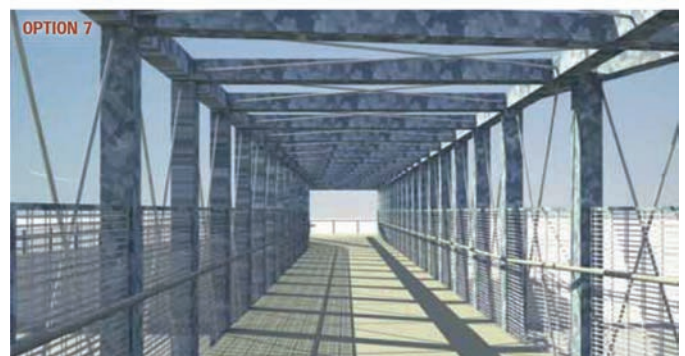
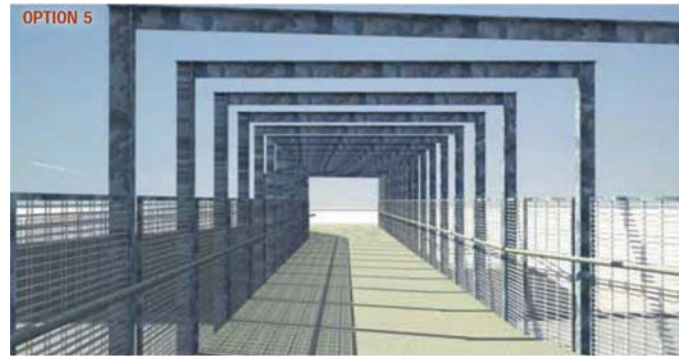
» *Do some of the students from this school go on to join the club and move through its ranks?*

The following images are from the journal IMIESA by the City of Cape Town that shows the various design options explored by the engineers who designed the Heideveld Pedestrian Bridge.

The bridge was built on an existing desire line that cut across the train lines. According to the article, 'previously, there was no pedestrian bridge north of Heideveld Station that the public could use without a railway ticket.' (City of Cape Town, 2011)

Furthermore, many school children make this crossing daily from New Rest in Gugulethu to the two schools in the Heideveld precinct (Willows Primary and Heideveld High). The woonerf concept guided the design, which includes a large mound (or berm) that rises on the Heideveld site to meet the height of the steel pedestrian bridge.

Image source: City of Cape Town. (2011). Allowing inter-community access : Heideveld pedestrian bridge : City of Cape Town. *IMIESA*, 36(1), 45-47.



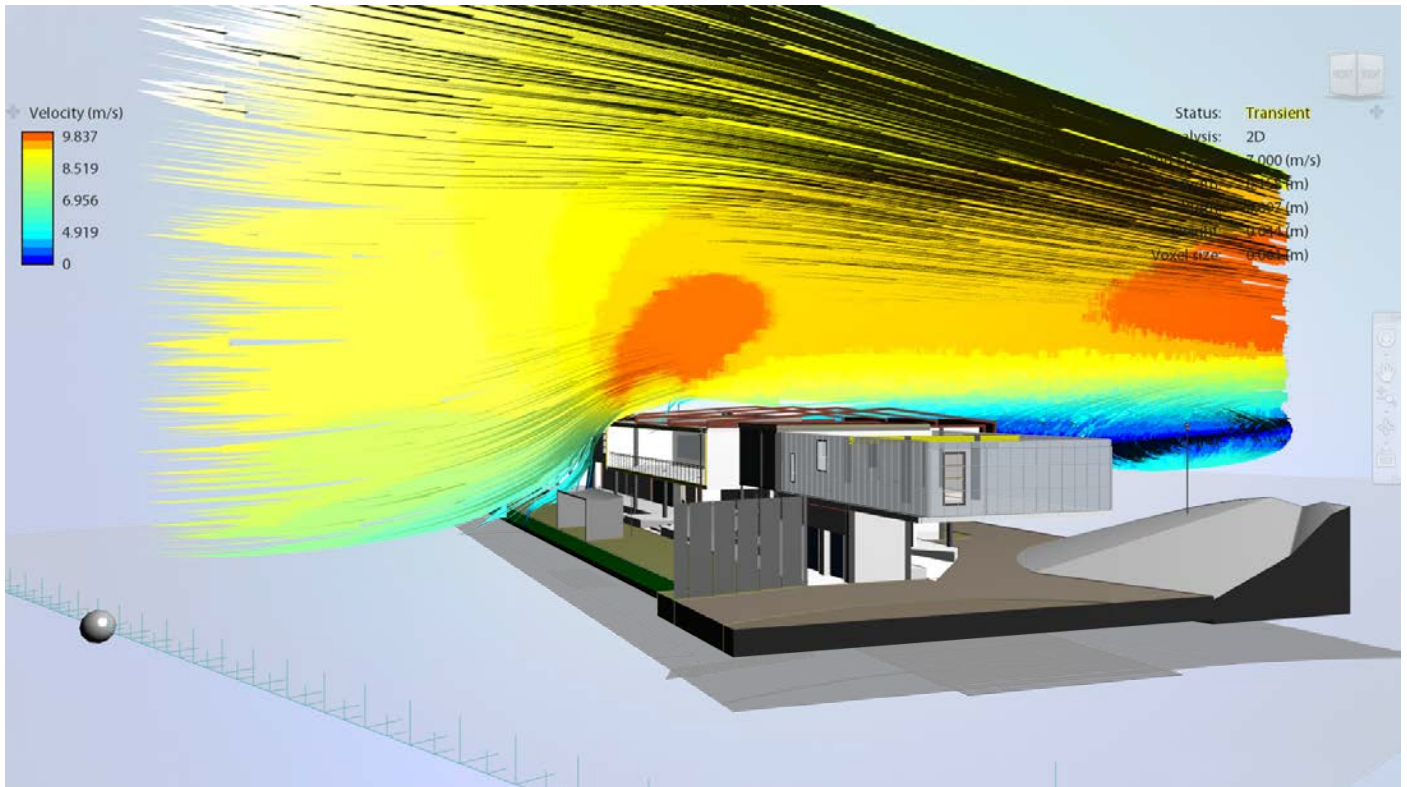
Mound/berm rising to meet the bridge

APPENDIX E: ENVIRONMENTAL + STRUCTURAL ANALYSIS

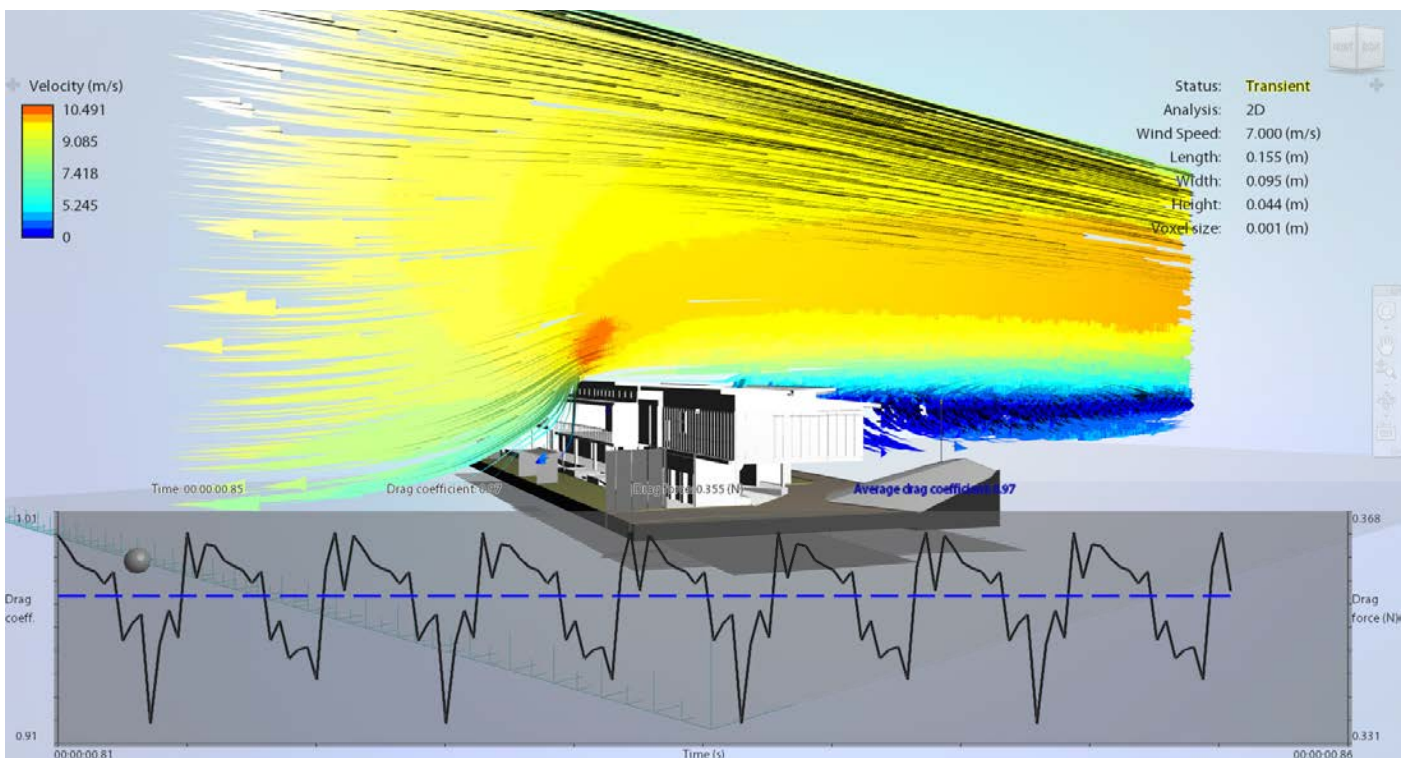
The following are preliminary technical analysis on the various design iterations. They explore issues of solar radiation on the proposed roof geometries, and basic CFD wind simulation using the Autodesk Flow Design environment to understand how wind moves through and around the building.

Wind speeds for the CFD tests were obtained from local weather data for Cape Town and were set to $7\text{m}\cdot\text{s}^{-1}$

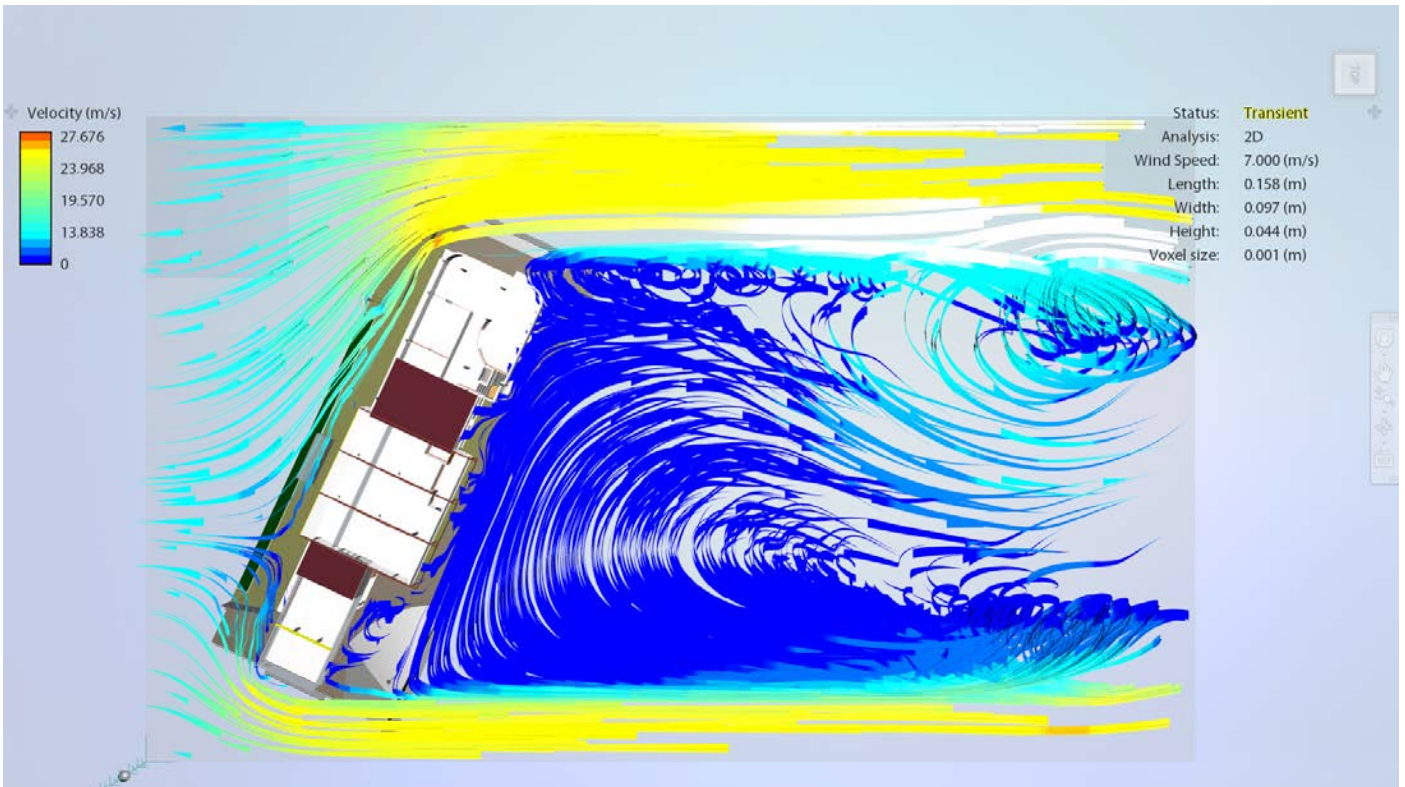
Solar radiation used the local EPW weather file from Ladybug, the environmental analysis tool in the Grasshopper environment where the solar analysis took place.



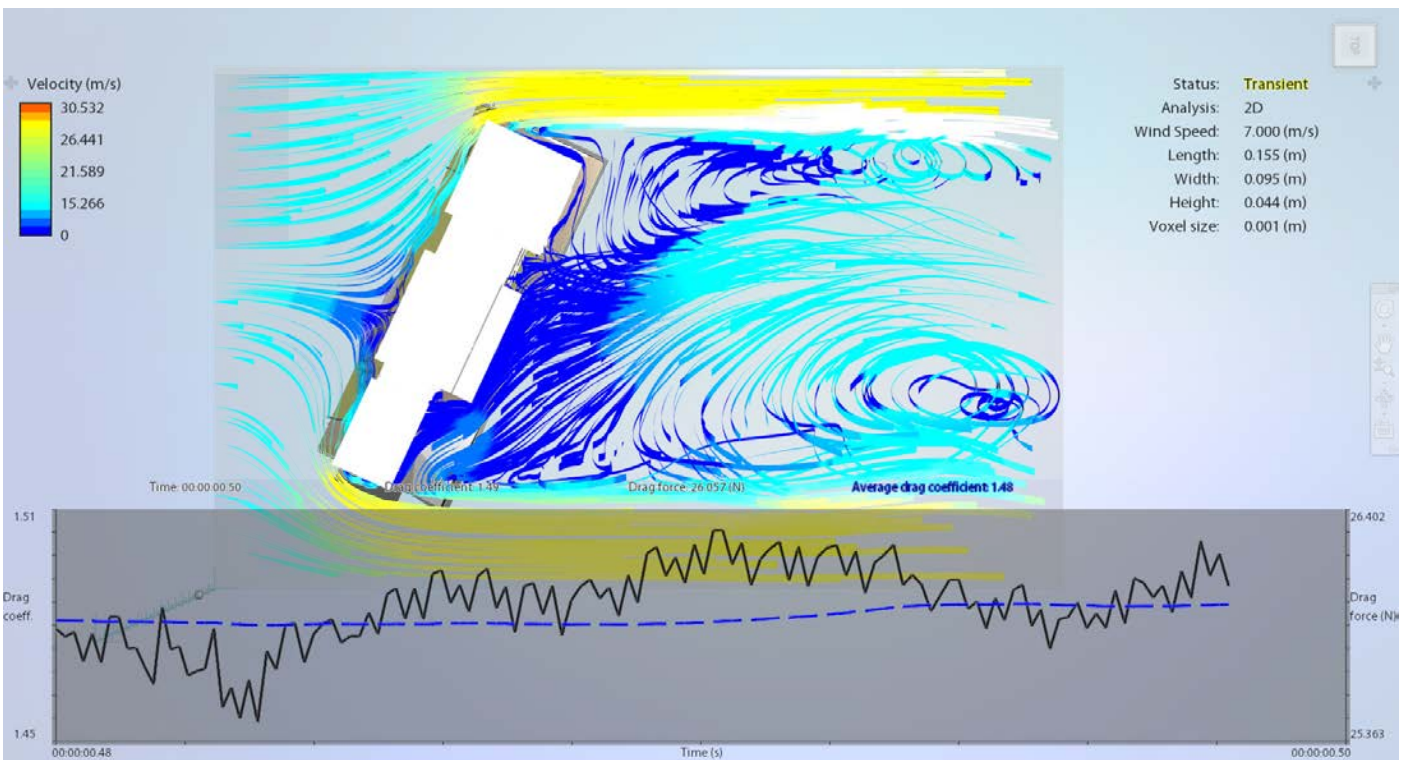
CFD test on an early concept of the current wrap-around roof design (iteration 4 on p89). Orange indicates an increase in velocity around the top southern edge of the roof.



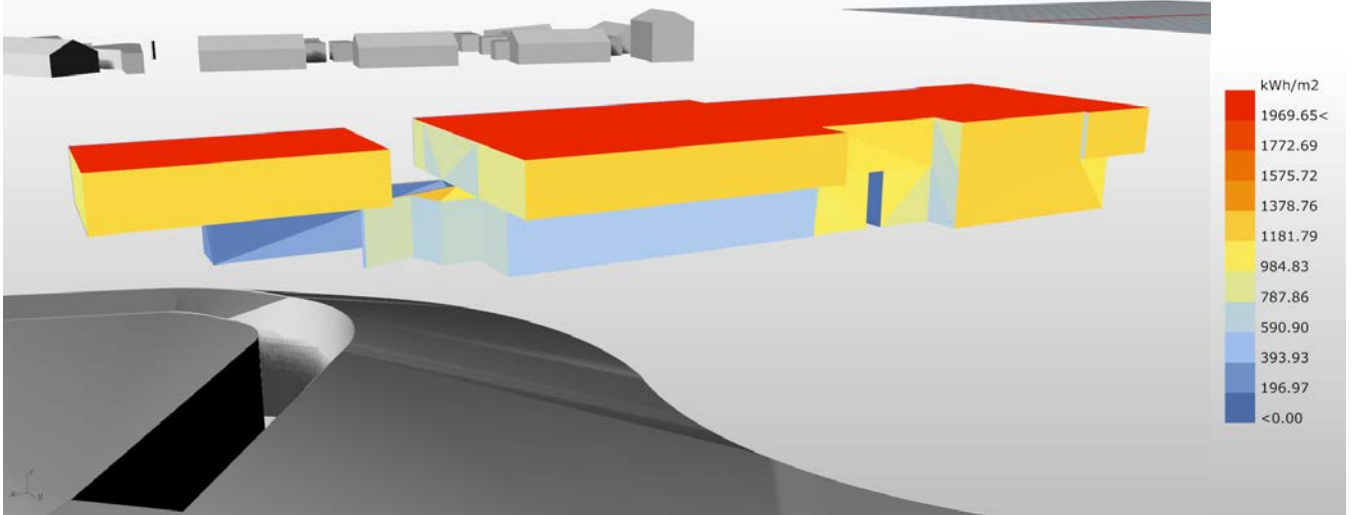
CFD test on an early concept of the separate butterfly roof design (iteration 3 on p89)



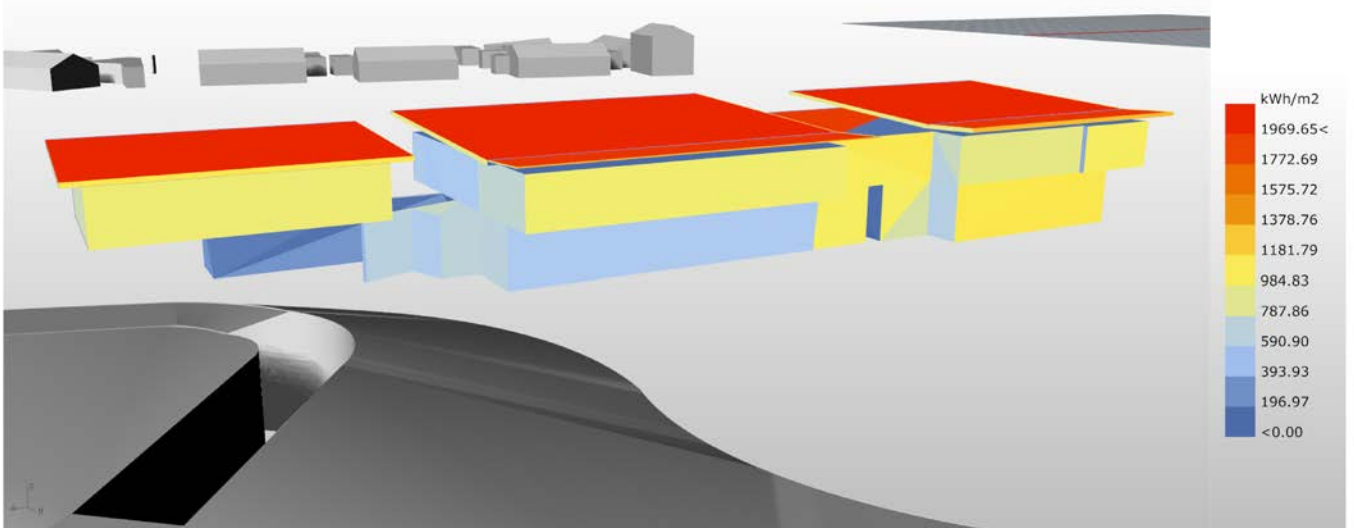
Top view of the CFD test on an early concept of the current wrap-around roof design (iteration 4 on p89).



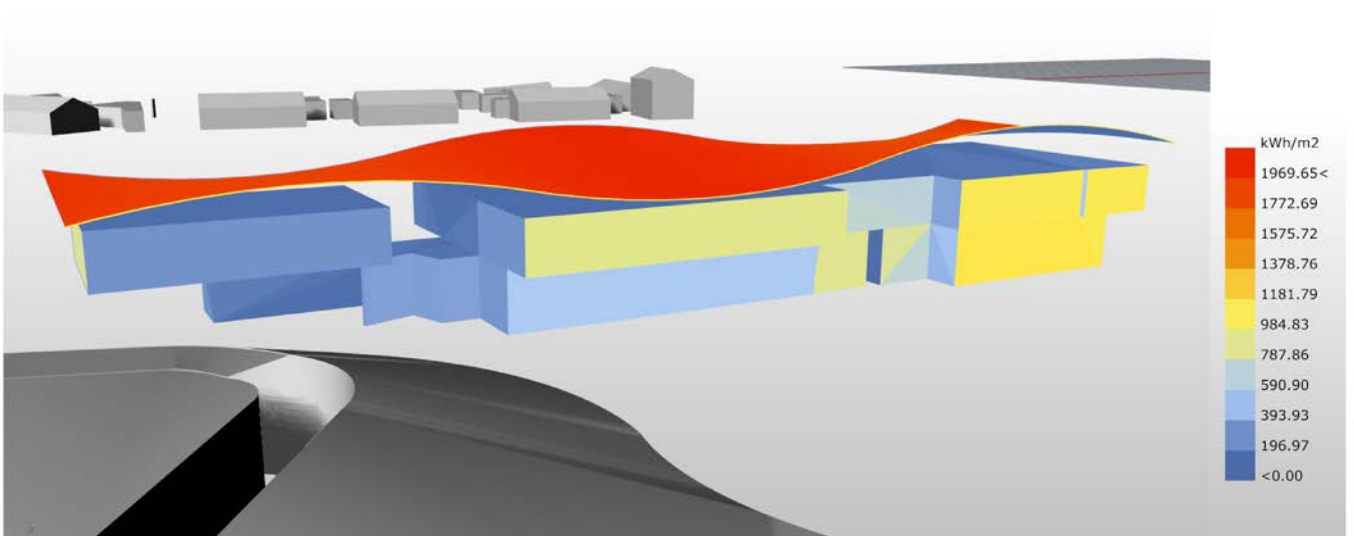
Top view of the CFD test on an early concept of the separate butterfly roof design (iteration 3 on p89)



Solar radiation analysis on test geometry (01 – with no roof)



Solar radiation analysis on test geometry (02 – with multiple butterfly roofs)



Solar radiation analysis on test geometry (03 – with concrete shell roof)

Solar radiation analysis was mainly used to visualise the effect of solar radiation on the building's northern face, and to see how different roof options affected solar radiation based on their overhangs and geometries.



CLUB POPULATION

Juniors	80
Seniors	40
TOTAL	120

U6 → U18 teams with 3 senior teams



SPATIAL ANALYSIS: CHANGEROOMS

SPACE	SHWR. AREA	LOCKER RM.	TOTAL AREA (m ²)	DESIGN POPULATION
TC 1	13,12	24,56	37,68	12
TC 2	13,12	24,56	37,68	12
TC 3	13,12	24,56	37,68	12
TC 4	13,12	24,56	37,68	12
CHANGEROOMS			150,72	48

Design population is for a snapshot of the use at one single time (i.e. the maximum capacity of the TCs)



TIMETABLED USE

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
16:30					
17:30					
18:30					
19:30					
20:30					

Activity timetabling derived from current Junction Rovers practice schedule. No ending times were given, so ending times were assumed for this exercise



HOT WATER CONSUMPTION

	PEOPLE USING	TIME USED (mins)	ℓ/min	AMOUNT OF HOT WATER CONSUMED (ℓ)
MONDAY / WEDNESDAY	80	160	7,75	1240
TUESDAY / THURSDAY	40	80	7,75	620

During the peak usage times (see table above), how much water is being used by the changerooms? Based on a ±2min shower per person, with the general average consumption of 7,75ℓ/min



ENERGY

Water storage required = 1240ℓ

Therefore, how many kWh are required to heat this stored water? (through 10°C?)

$$\begin{aligned}
 E &= m \times \text{specific heat capacity} \times \Delta\text{temperature} && (\text{shc of water} = 4187/\text{kg}^\circ\text{C}) \\
 &= 1240 \times 4187 \times 10^\circ\text{C} \\
 &= 51\,918\,800 \text{ J} \\
 &= 14,42 \text{ kWh}
 \end{aligned}$$

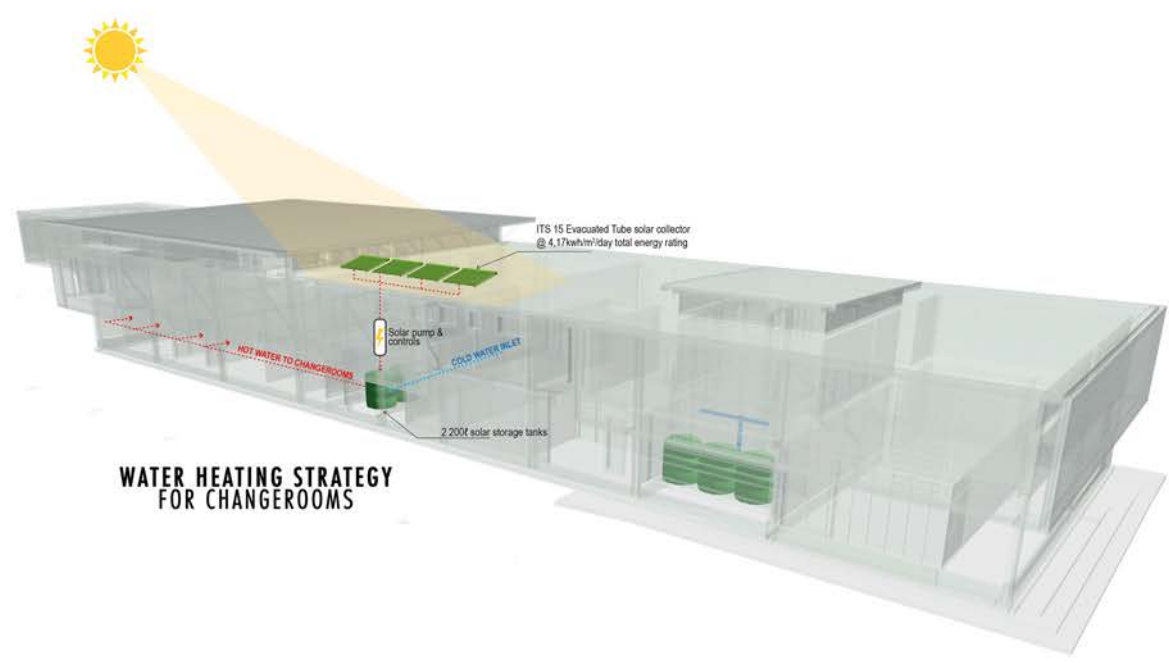
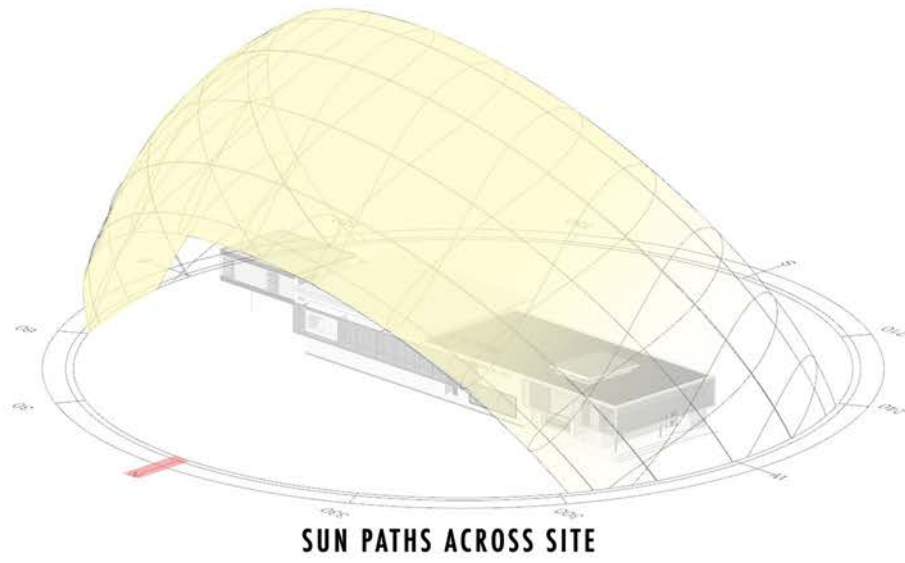
Therefore, a solar geyser system with heating capacity for 14,42 kWh is required to heat 1240ℓ for use in the change rooms.

A low-flow system can use 9ℓ/min. This chart indicates the water savings if all showerheads in the changerooms use the specified low-flow system

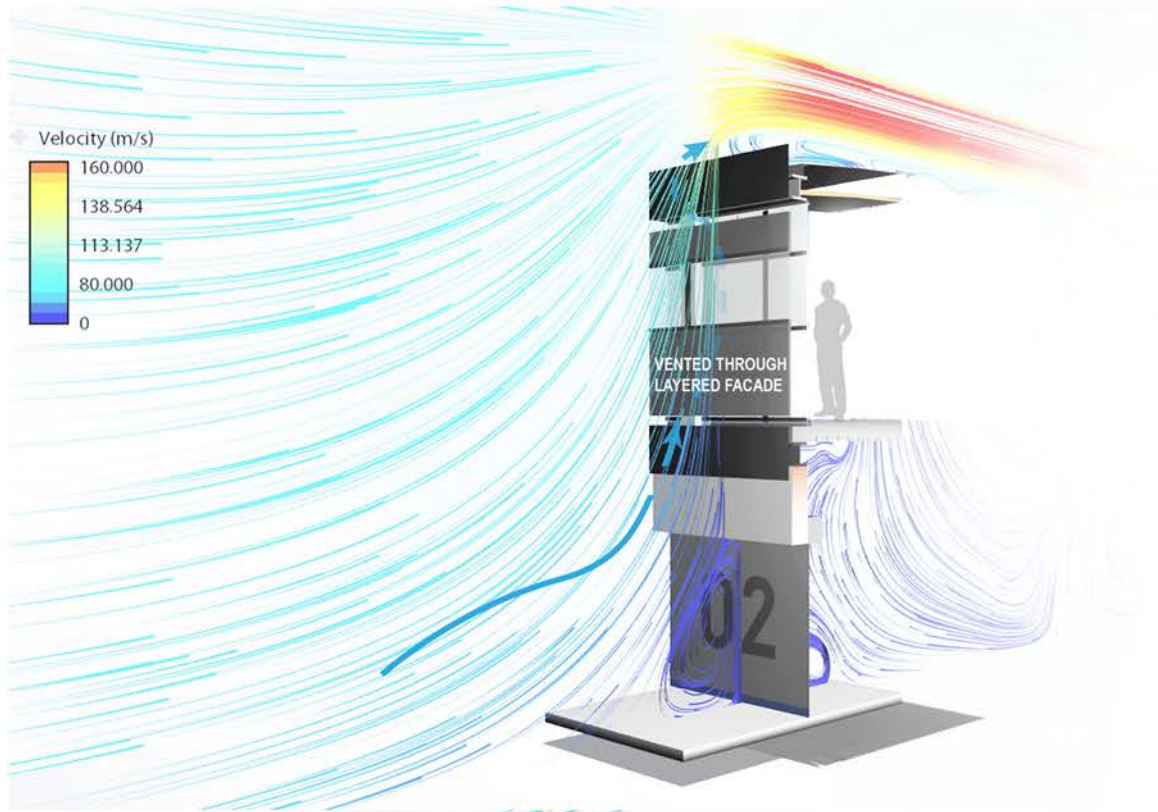
In responding to the current water & energy crisis facing the City of Cape Town, this sustainability analysis guided the water and energy strategy for the project.

It is reasoned that the club's change-rooms & showers will be the biggest consumer of water

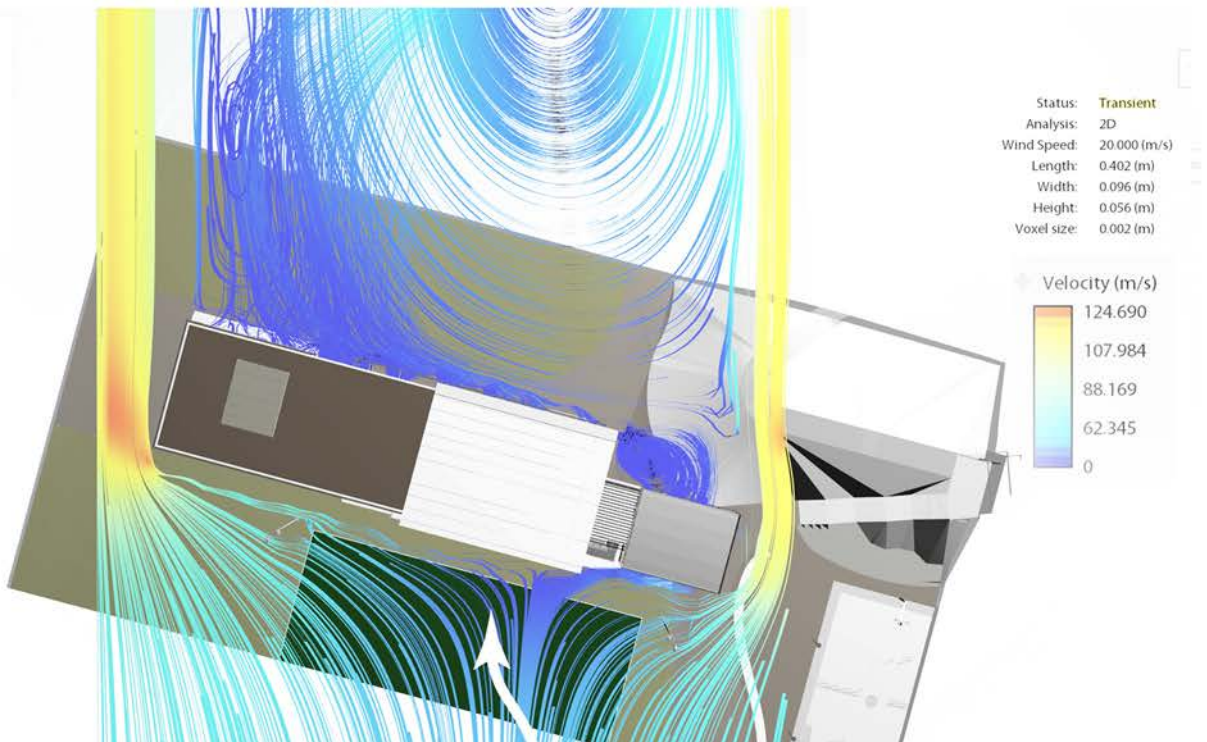
and energy; this calculation determines how much water & energy would be consumed, indicating the possible sizing of evacuated tube solar collectors and storage tanks required to take this system off-grid.



WIND FLOW VISUALISATION: GYM @ 20m.s⁻¹

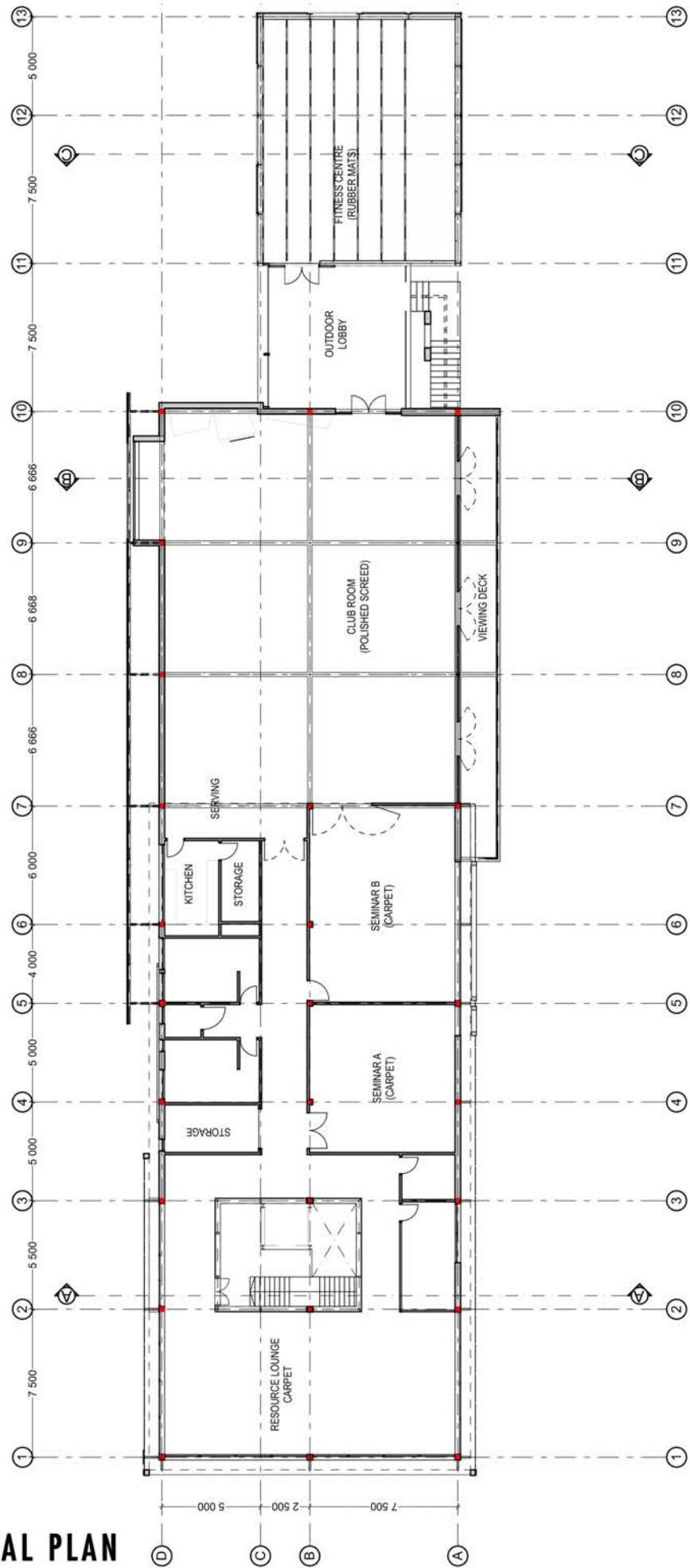


WIND FLOW VISUALISATION: SE @ 20m.s⁻¹



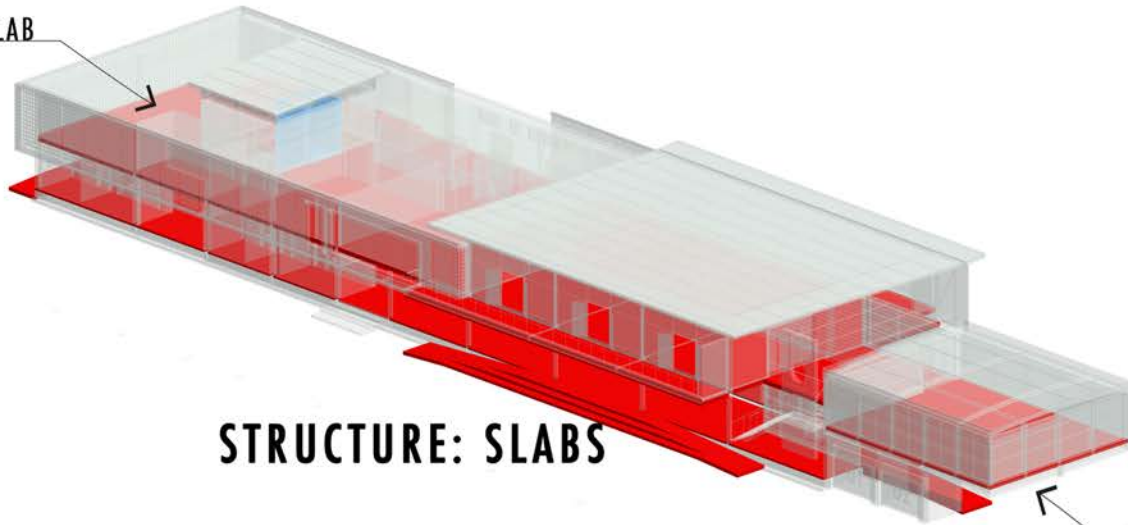


GROUND STOREY STRUCTURAL PLAN



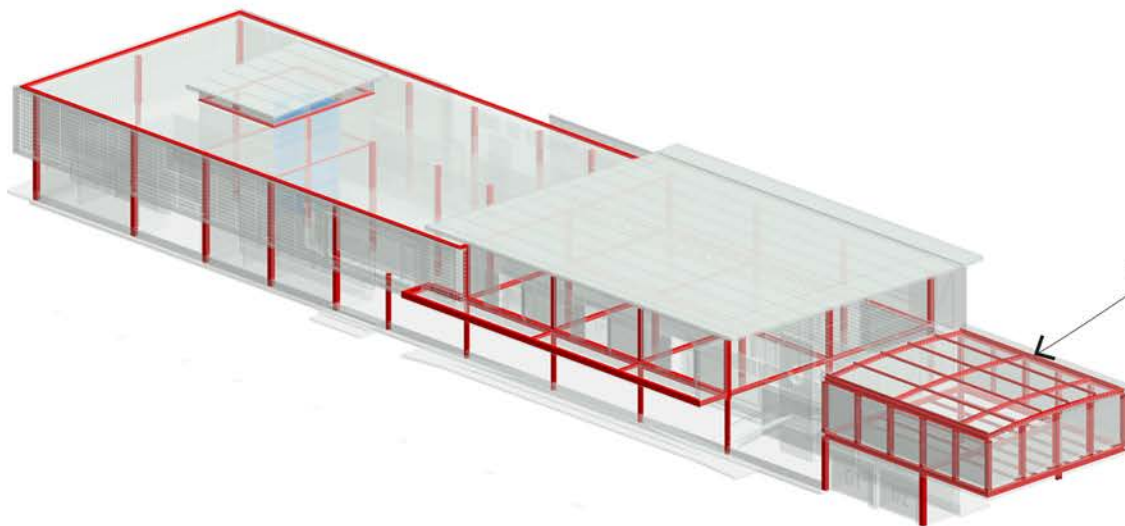
FIRST STOREY STRUCTURAL PLAN

250mm RC SLAB



STRUCTURE: SLABS

BONDEK SLAB



STRUCTURE: FRAMING

VIERENDEEL TRUSS