

BELLVILLE PUBLIC TRANSPORT INTERCHANGE

IMPROVING RELATIONSHIPS THROUGH ARCHITECTURAL LAYERING

STEPHAN DE KLERK – M ARCH [PROF]

DESIGN DISSERTATION

University of Cape Town

This dissertation is presented as part fulfilment of the degree

of Master of Architecture (Professional)

in the School of Architecture, Planning and Geomatics,

University of Cape Town

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This dissertation is presented as part fulfilment of the degree of Master of Architecture (Professional) in the School of Architecture, Planning and Geomatics, University of Cape Town

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I would like to thank my heavenly father,
for giving me the talent and endurance to do what I love

I would like to thank my parents,
for their support, love and patience throughout the years

I would like to thank my brother, family and friends
for the support and prayers

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PREFACE

Public Transport has played a fundamental part in my personal life as it was the mode of transport used to get to friends, part-time work and ultimately university campus over the span of eleven years. Using the South African public railway service on a daily basis for the past six years, it has made me aware of many fundamental architectural problems within this arena, with the biggest concern lying within the public transport interchange precinct; at the coming together of the different modes of public transport.

Staying in the Northern Suburbs my entire life, attending Bellville High school and later the University of Cape Town, meant that the Bellville Public Transport Interchange has had a big impact on my idea and conceptions on the functioning of a public transport interchange. Subconsciously studying the Bellville Public Transport Interchange and understanding its functioning over the past eleven years has made me aware of the absence of architectural contribution within its current operational system and has lead me to the investigation of the relationship between architecture and the Bellville public Transport Interchange.

The dissertation document that follows seeks to improve the current relationship between architecture and the Bellville Public Transport Interchange through the use of vertical and horizontal architectural layering systems.



1. BELLVILLE TAXI RANK

INTRODUCTION

Public transport has been at the centre point of discussion for Cape Town development over the last couple of years as major investment is currently being made into this growing sector, which along with extreme personal interest has sparked an investigation into the relationship between architecture and the Bellville Public Transport Interchange (BPTI). With the City of Cape Town currently managing over 200 Public Transport Interchanges (Pollack 2012), this document argues the importance of architecture to the success of these systems. The question that emerges is how does architecture respond and contribute to such a complex system at the point of exchange between all these different modes of transport in a Public Transport Interchange (PTI) precinct which functions at different levels, speeds and programmes?

Because of its complex nature, it requires a complex response; architecture which is able to navigate positive relationships through various architectural layering methods. The document will investigate ways in which architecture is used to address fundamental problems which runs parallel within the BPTI by proposing an architectural response which serves as separator and connector through vertical and horizontal layering methods for relationship improvement.

The structure of this document will be conducted through the theory on different building layers described by Julian Ross in his book *'Railway Station: Planning, Design and management'*, which aims to assist an understanding of Site, Layout, Structure, Skin. With the addition of Programme and Circulation, this document uses this theory as an ordering tool to come to grips with the complexity of the relationship between architecture and the BPTI. Each layer will be analysed in terms of its functioning role accompanied by the conceptual approach in creating an intricate connection between architecture and the BPTI.

- 1) Site- attaining an understanding of the context in which the investigation takes place, along with a proposed urban framework
- 2) Programme – site influences on programme dynamics
- 3) Layout- planning to programme relationship and functioning of the site
- 4) Structure- the main structural form complimenting the planning and responding to PTI challenges
- 5) Circulation - reinforcing architectural planning and resulting from site functioning while acting as mediator between Transport, Interchange and Building.
- 6) Skin- the architectural interface acting as mediator between transport and building, connecting and separating relationships

TRANSIT-ORIENTED DEVELOPMENT

Transit-Oriented Development (TOD) is a term which originated in North America in the late 1970's and early 1980's and gained great popularity at the turn of the century and has had worldwide success. Although the ideas surrounding the concept of TOD has evolved quite a bit over the last forty years, there are certain generally accepted principles associated with this theory and served as the basis for the envisaged urban development strategy for the Bellville Public Transport Interchange precinct.

The five D's of TOD (Lee & Cervero 2007) are:

- Density
- Diversity (in land-use)
- Design (urban design)
- Distance to Transit
- Destination accessibility

The idea is based around the densification of relatively high-density mixed-used development, usually consisting of retail, commercial and residential components around a public transit stop or interchange within an easy walking distance radius of 400-800m. According to TSTC (n.d.) its aim is to increase the use of public transport and increase property value in both residential and commercial property markets, broaden employment opportunities for low-income workers and workers without access to an automobile and also broaden employers' workforce pool while promoting healthier lifestyles through walking and cycling due to the close proximity of the public transport interchange (Wilkinson 2006). This document challenges the exclusion of Architecture within the 5 D's principle and sees this as an opportunity for creating positive new relationships.

It's important to understand that although this theory is positive in its objective, it does open up discussion surrounding two big challenges. The first is that of architectural privacy, the second is the practical implication of building next to an active railway line.

ARCHITECTURAL PRIVACY

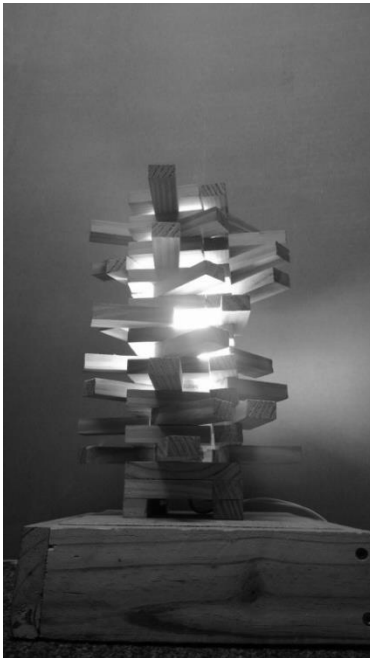
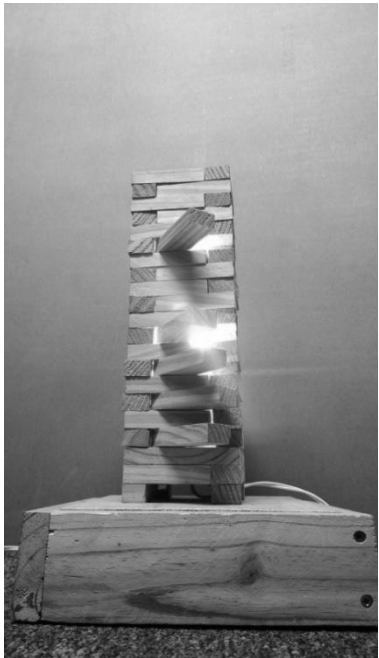
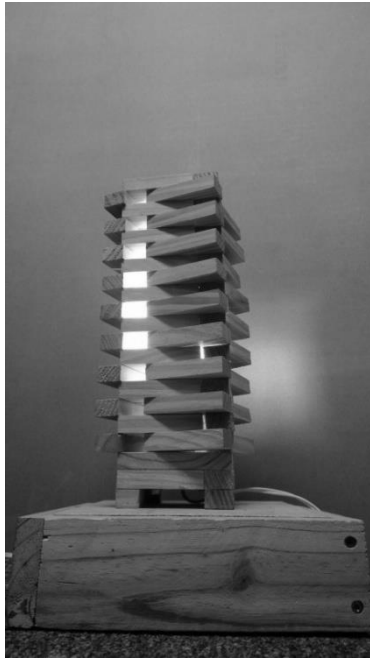
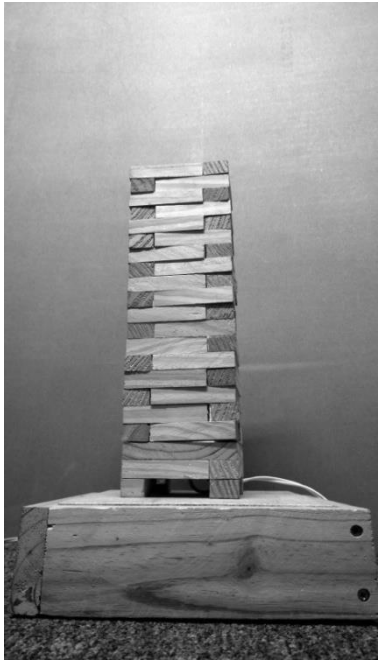
While the idea of architectural privacy and the regulation thereof is almost a prerequisite in contemporary architectural practice, examples within PTI's suggest that it might not meet the current requirements for positive relationships in an environment which supports the users need for privacy.

Although many theories have been established on this topic in architectural discourse, the following document argues the value of a collaborative approach between two key opposing theories on architectural privacy. The first, stated most clearly by Nathan Witte, is a position on privacy being an implicit **Dynamic** property with the individual having a sense of control over his privacy condition. *"The environment must allow for one's dynamic closed and open permeability, creating options or places of release from contact and observation"* (Witte, 2003, p. 31), with the second opposing theory by Julia W. Robinson presented in her paper *'Institutional Space, Domestic Space, and Power Relations: Revisiting territoriality with space syntax'* with her position on privacy being a **Static**, inherent property with different kind of fixed spaces.

Thus it argues for an architectural approach which has strict categorisation of fixed spaces of public and private nature which is responsive to a specific environment (vertical layering) as well as providing a degree of control in this system where privacy regulators could increase and decrease privacy according to social need (horizontal layering). In the light of this, these elements can be argued to then either *Connect* or *Separate*. The extent of the connection and separation of these spaces are determined by what Michael Georgiou calls the five parameters (Georgiou 2006) of:

- Visibility
- Vocals
- Olfactory
- Accessibility
- Proximity

The relationship between two spaces might realize some of the parameters while others might be constrained, which leads to the justification of a space's privacy in relation to another. The importance of this theoretical investigation is due to the nature of a TOD's implementation into a precinct like the BPTI as extreme public entities are in close proximity to private spaces and in result needs different treatments as Herman Hertzberger explicitly states that the inconsistency of private and public is equally wrong as the antithesis of general and specific (Hertzberger 2005, p. 12). The interface between architecture and public transport as well as the interface between different architectural elements **will be conducted through this trope as it goes in search of new relationship manifestations.**



2. DYNAMIC LAMP DESIGN

BUILDING NEXT TO THE RAILWAY

The following chapter will be an investigation into the general challenges that accompany the action of building next to an active railway line in the context of South Africa through the lenses of Technology, Materiality and Design. Within recent times in RSA, with railway design entering a new era due to modern approaches and technologically advanced materials and construction methods along with major investment being made into public transport systems, major concerning factors for buildings neighbouring railway lines have started to emerge.

Investigations will follow into different methods of addressing the emerging problems through innovative design and technological methods and principles relevant within the current context of RSA. As my dissertation project forms an integral part of the BPTI, the following investigation will be seen as research into general potential systems for better personal understanding when dealing with a project of this nature and could serve as a handbook covering the basics of neighbouring railway design in South Africa. The investigation will be making use of various precedents, not only related to the field of architecture, in finding ways of successfully addressing problems on neighbouring railway buildings.

The following chapter investigates the two biggest problems of building next to an active railway system in South Africa: 1) noise emission and 2) vibration produced by the active railway systems.

Site:

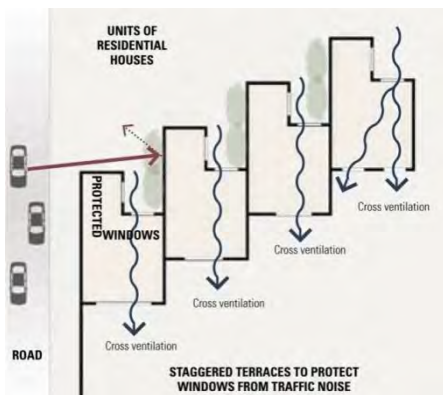
There is evidence that suggest that intrusive external noise is harmful to individuals within the work and home environment, both from personal perceptions of influenced individuals as well as the burden of disease analysis by the World Health Organisation (ABCB 2012). The types of noise which this chapter will try to address are restricted to the railway origin of 1) the pass-by situation (trains at a constant speed), 2) acceleration and deceleration, 3) stationary noise, and 4) shunting noise (rail car coupling), which can all be classified as Airborne Noise, which is noise transmitted through the air (EC 2003). When sound strikes the surface of a boundary part of the sound is reflected back, part is transmitted through and part is absorbed by conversion to heat within the material. For this investigation noise pollution shall be carefully investigated through the three methods of 1) Absorption, 2) Reflection and 3) Transmission (Pohl 2011).

The vibration which will be discussed comes in the form of Rayleigh vibration waves which is connected with surface railway lines, such as the tracks being encountered in South Africa,

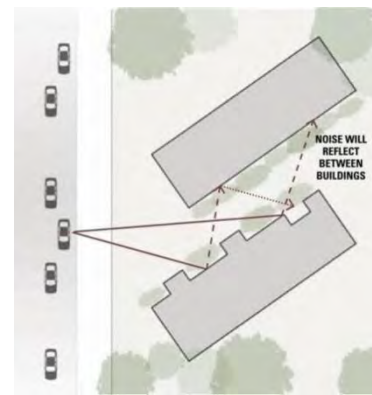
which not only creates structural dilemmas for neighbouring buildings but commonly result in Ground-Borne Noise; a noise in a building's structure caused via vibration in the ground (Eade 1999).

Layout:

The diagrams below illustrate how the layout could be used to manipulate sound waves.



3. BUILDING STACKING



4. BUILDING ORIENTATION

Figure 3 depicts how, by means of stacking, sound could be reflected away from zones that benefits from quiet space. Hard edges and soft edges play a fundamental role when looking at deflecting noise. This deflection could also take place between building facades as they could be placed to complement each other in terms of noise deflection (figure 4).

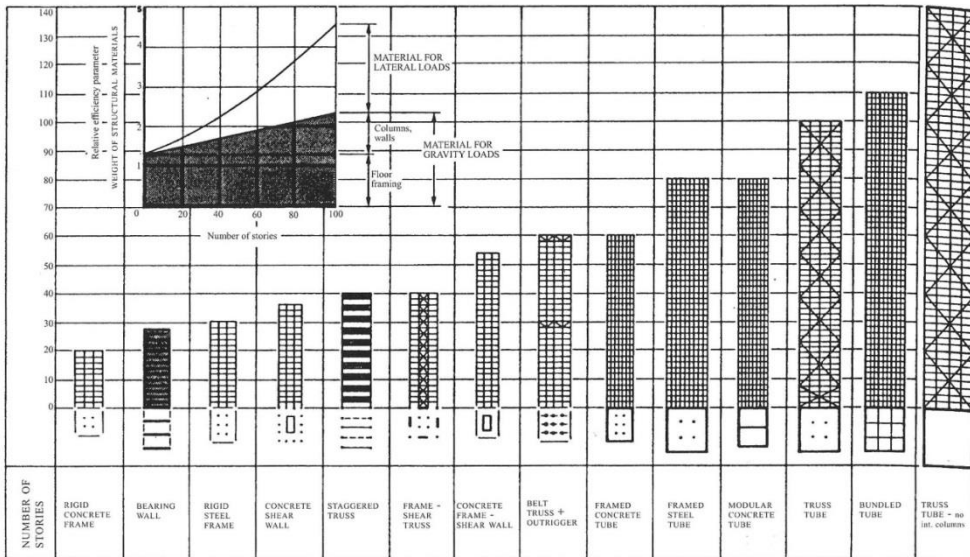
Structure:

This part of the investigation will mostly be concerned with vibration, will be divided into two main categories: The first is that of resilience and the second being flexibility. Overall structural systems, foundations and flooring would be discussed under structure while walls and roofing would be categorised under the skin of the building.

The structural systems which can be drawn to the current South African context (Chewe 2009) with specific regards to Cape Town are (maximum height of 60 meters):

- Rigid concrete frame (resilience)
- Bearing wall (resilience)
- Rigid steel frame (flexible)
- Concrete shear wall (resilience)
- Staggered truss (flexible)

- Frame – shear truss (flexible)
- Concrete frame – shear wall (resilience)
- Belt truss + outriggers (flexible)
- Framed concrete tube (resilience)



5. STRUCTURAL SYSTEMS: Applicable in South Africa

Modern railway stations have been experiencing the revival of new technologies and the structural engineer with structures dealing with vibrations successfully through steel and glass construction. This flexible approach, which is generally through steel construction, is successful when responding to vibrations impacting the structure, as it gives opportunity for the structure to adapt to shear and lateral forces caused by vibration, however is regarded to be less successful when dealing with Ground-Borne noise, as the rattling of metals could be a disturbance to residential and commercial office spaces if the joints and connections aren't constructed at a high quality.

The most appropriate acoustical construction solution is believed to be *discontinuous construction*. This requires the construction of two building shells, one inside the other (Pohl 2011). This multi layered system is to be applied to wall, floor and roof and would be discussed throughout the investigation.

Skin:

Arguably the most influential factor when addressing noise and vibrations influencing a project; the skin of a building is not only designed to be an aesthetical feature, but also becomes a tool for addressing these problematic influences created by railway systems. Investigation will be categorized into 1) Absorption, 2) Reflection and 3) Transmission.

Absorption:

Different skin applications can be used in order to deal with noise and vibration absorption. There are three main types of sound absorbers:

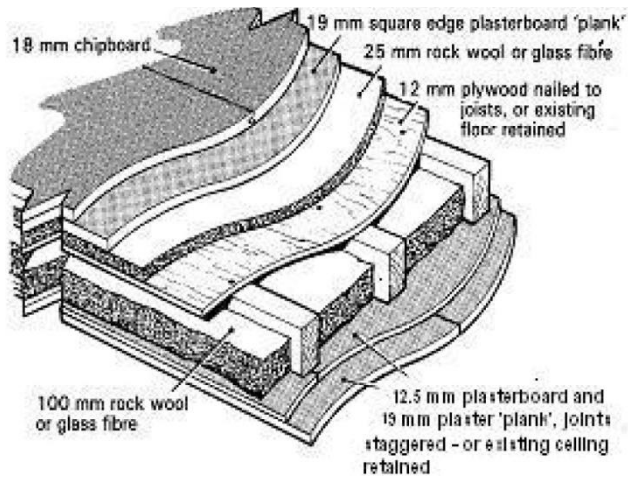
- 1) The cavity absorber
- 2) The membrane absorber
- 3) The porous or dissipative absorber

Each of these absorbs sound energy by converting it to heat, although the method is different in each case (Fry 1988). A practical approach which might be the most successful is based on the idea of multiple layering and constitutes both 1) cavity absorber and 2) membrane absorbers as these two only have slight scientific distinctions. Also known as a sandwich barrier; both these approaches consists of two skins of relatively high stiffness and strength. An air gap is provided in-between these two panels which potentially offers the greatest scope for large noise reduction in building construction (Pohl 2011).

More commonly encountered efficient systems are standard residential cavity masonry wall construction as well as moveable shuttering systems. The shuttering system provides some form of control as the shutters could be adjusted in order to facilitate desired acoustic needs however joints might be less sound when comparing with cavity masonry walls.

When the danger of cavity resonance arises, it could be overcome through the use of a sound absorbent material within the cavity, which brings forth the next point of insulation. The most commonly encountered method in dealing with sound intrusion in RSA is through insulation as it is a practical and cost efficient method in dealing with the problem and is not only restricted to the facade but can be applied to the whole outer skin of a building. Insulation can be provided for the wall, floor and roof and thus becomes an extremely cost effective and practical tool for buildings adjacent to railway lines.

Categorised under 3) porous or dissipative absorber, this system works by allowing the air movement or fluctuations into the fabric of the material (Fry 1988). It is however necessary that the insulation chosen must be an open pore material; typical examples of these are glass fibre, rock wool, open foam, mineral plaster and hair mat. Distinction must also be made between materials which are good for thermal insulation and those good for sound absorption, such as polystyrene and foam glass being good for thermal insulation however poor sound absorbers.



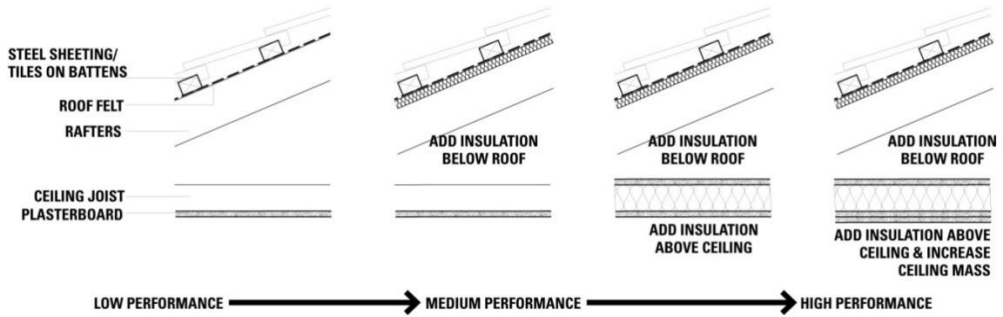
6. TIMBER FLOORING INSULATION

By providing insulation between battens in timber flooring or as a complete flooring layer on a concrete floor, noise intrusion will be successfully dealt with



7. WALL INSULATIONS

Two types of insulation could be used with regards to wall construction, 1) with insulation being placed on the outside of the single skin, and 2) where the insulation is placed between the two skins as shown in figure 12.

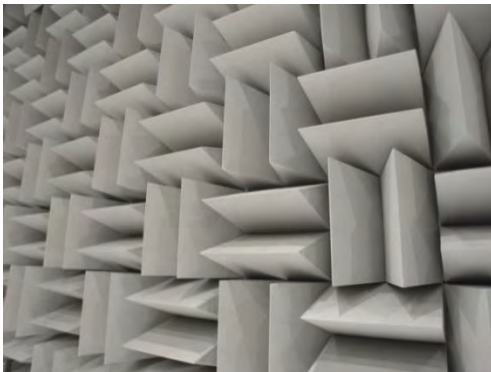


8. ROOFING INSULATION

Reflection:

The previously mentioned methods of multiple layering could well be categorised under reflection, as this is a form of sound reflection which takes place in the process of keeping out noise pollution, however for this topic I will specifically look at strategies in which building skins can be technologically driven to actively reflect sound off the skin through methods of angled facade systems.

The most effective precedent in theory for this system would be the Orfield Laboratory, where the walls are lined with 335mm fibre glass acoustic wedges, all angled to reflect sound to create a space of sound energy absorption of 99.9% (Thornhill 2012).



9. ANGLED PANELS: Orfield Laboratory

10. INTERIOR VIEW: Orfield Laboratory

Transmission:

Different types of materials and its transmission coefficient value will be the focus point when discussing the idea of the transmission of sound. Here the density, mass and stiffness

are once again a determining factor when deciding on material choice for a project. Sound is a physical force that generates pressure; therefore the transmission of sound from one side of a material to the other requires the actual movement of the material. The pressure created by the sound waves causes the material to deflect slightly, which causes the material to vibrate (Ground-Borne material). Material choice is thus important as the heavier material will set more sound energy into vibration (Pohl 2011).

Dense material however is less porous, which reduces the ability of sound waves to enter the material, which means that sound will not easily penetrate the material, and in effect will be less transmittable; which is ideal for blocking out unwanted sound, less ideal though for vibration; the opposite accounts for materials which is less dense.

Material	f(Hz)					
	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz
Brick, 4"	30	36	37	37	37	43
Block, 7 5/8" hollow cinder	33	33	33	39	45	51
Block, 6" concrete lightweight painted	38	36	40	45	50	56
Curtains, lead/vinyl 1.5 lb/ft ²	22	23	25	31	35	42
Door 2 5/8" hardwood	26	33	40	43	48	51
Fiber Tile, filled mineral 5/8"	30	32	39	43	53	60
Glass plate, 1/4"	25	29	33	36	26	35
Glass laminated, 1/2"	23	31	38	40	47	52
Panels, perforated metal with mineral 4"	28	34	40	48	56	62
Plywood, 1/4", 0.7 lb/ft ²	17	15	20	24	28	27
Plywood, 3/4", 2 lb/ft ²	24	22	27	28	25	27
Steel, 18 gauge, 2 lb/ft ²	15	19	31	32	35	48
Steel, 16 gauge, 2.5 lb/ft ²	21	30	34	37	40	47
Sheet metal laminate, 2 lb/ft ²	15	25	28	32	39	42

11. TRANSMISSION COEFFICIENT VALUE TABLE

The focus of the document will now shift with the aim to implement these general ideas into the specific context of the Bellville Public Transport Interchange and pin-point these discussed theories and challenges to the site of my investigation.

CONTEXT ANALYSIS

The following chapter will be an analysis of the BPTI at a contextual level which focuses on the functioning of the context within a TOD informed 500meter radius surrounding the Bellville railway station which is followed by a site analysis which is focussed on the functioning of the spaces immediately surrounding the chosen site. The context analysis will lead to the investigation into phenomena currently present at the BPTI and follow into the identification of problematic areas and unsuccessful patterns within its current functioning. This then gives rise to a personal suggestive response in the form of a proposed urban framework.

Bellville, which is designated as Cape Town’s Second Metropolitan Node, has drawn much attention over the last couple of years with regards to the re-development of the Voortrekker Corridor (Tygerberg 2014) forming part of Cape Town’s Mayoral Urban Regeneration Programme (MURP), with lesser attention being given to the development of the PTI precinct itself. BPTI is also seen as one of the big three in the Cape Town area, alongside Cape Town Station and the Joe Gqabi Interchange (Pollack 2012).



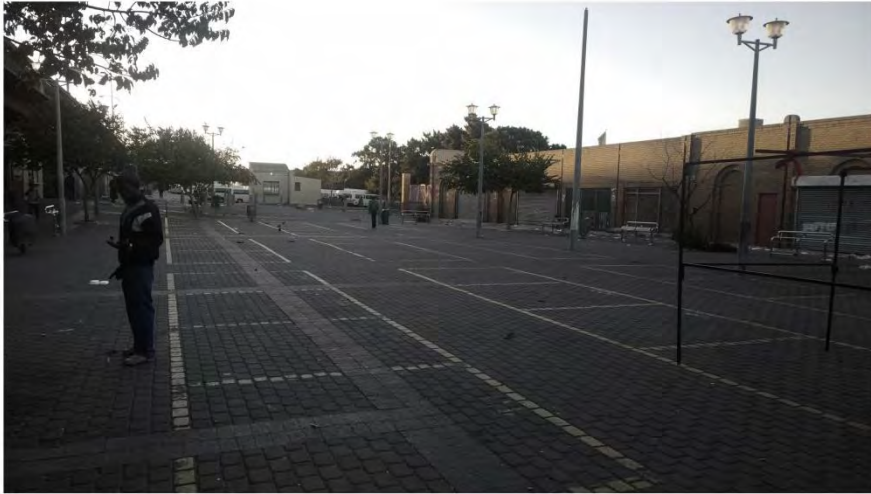
12. CONTEXT PHOTO: Bellville Public Transport Interchange precinct



13. SPATIAL COMPOSITION OF CONTEXT



14. SPATIAL QUALITY



15. BELLVILLE CONTEXT INVESTIGATION



16. TIENIE MEYER ELEVATED HIGHWAY

Three modes of public transport:

- Bellville Railway Station
- Golden Arrow Bus rank
- Taxi Rank



17. BELLVILLE RAILWAY STATION



18. GOLDEN ARROW BUS RANK



19. BELLVILLE TAXI RANK

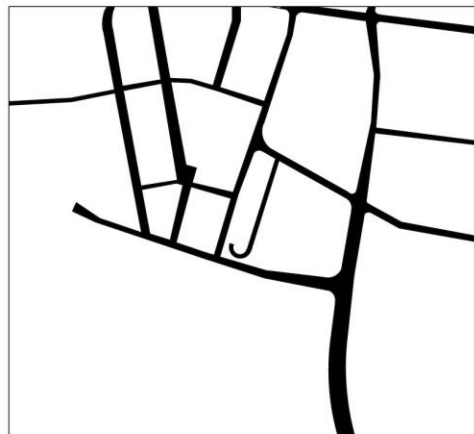
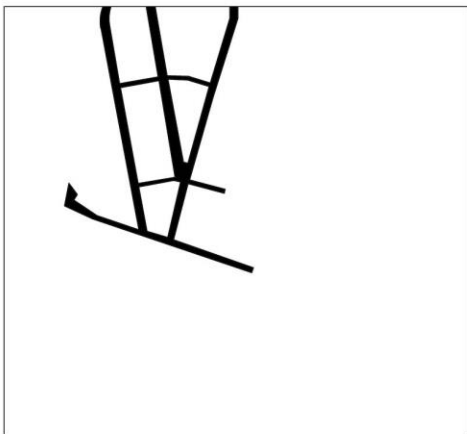
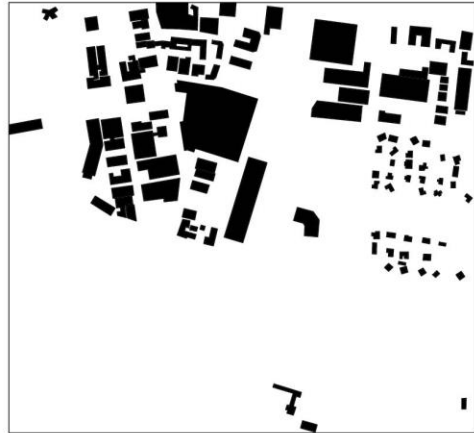
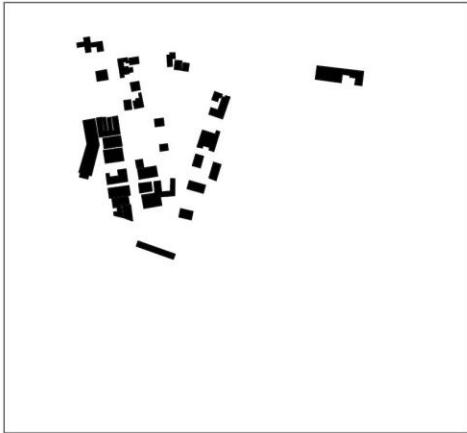
Timeline development of transport and built form



1944



1988



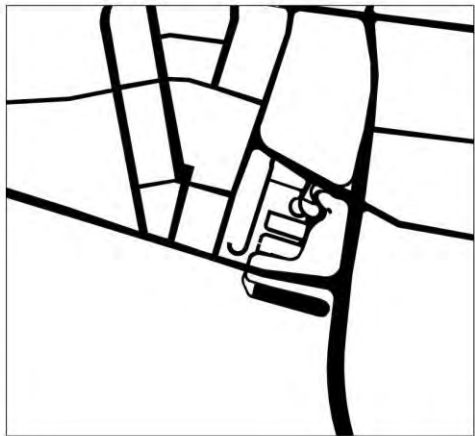
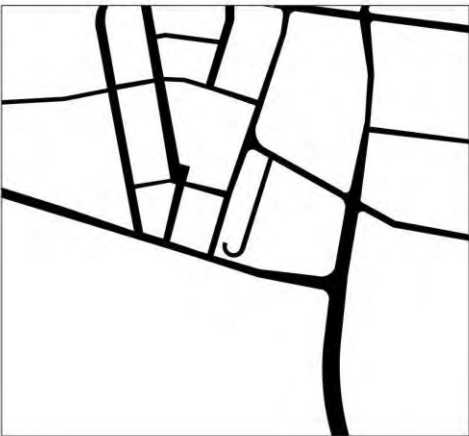
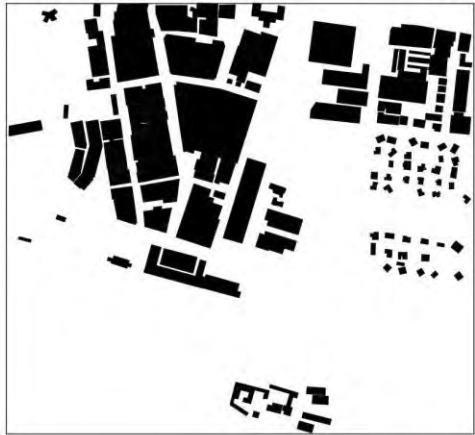
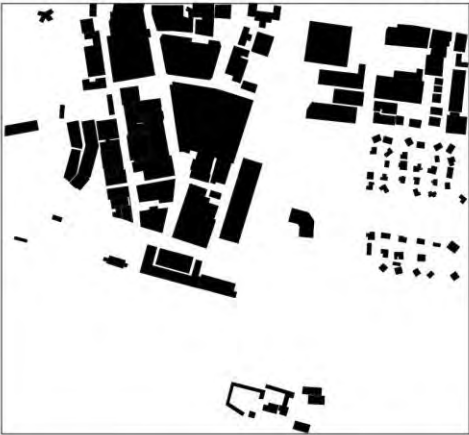
20. DEVELOPMENT OF BPTI CONTEXT:Year 1944-1988



2002



2012

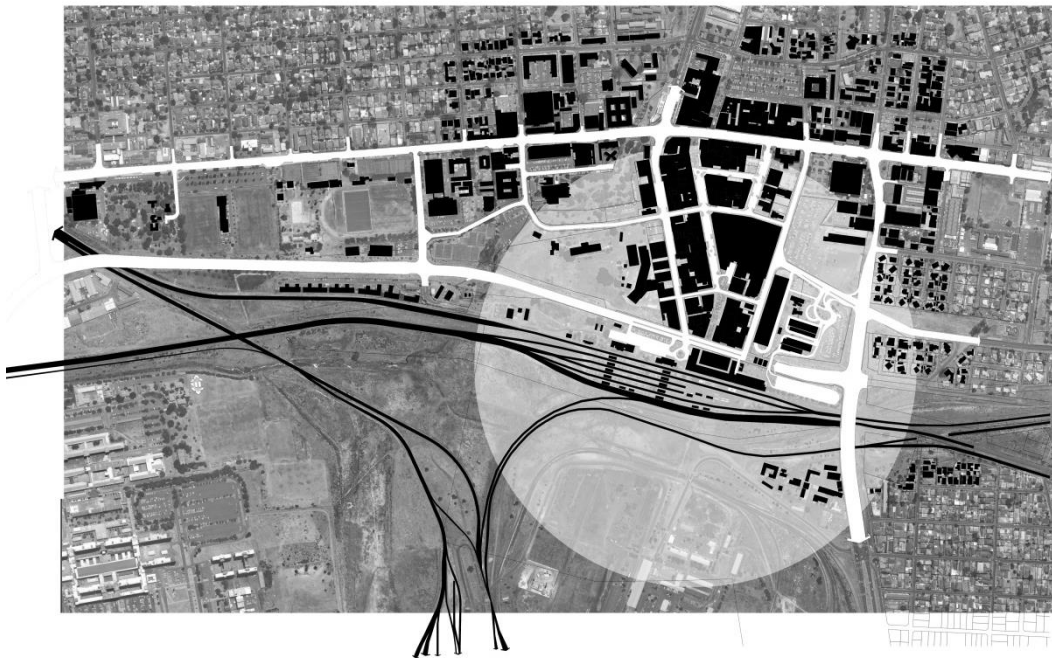


21. DEVELOPMENT OF BPTI CONTEXT: Year 2002-2012

Urban Analysis



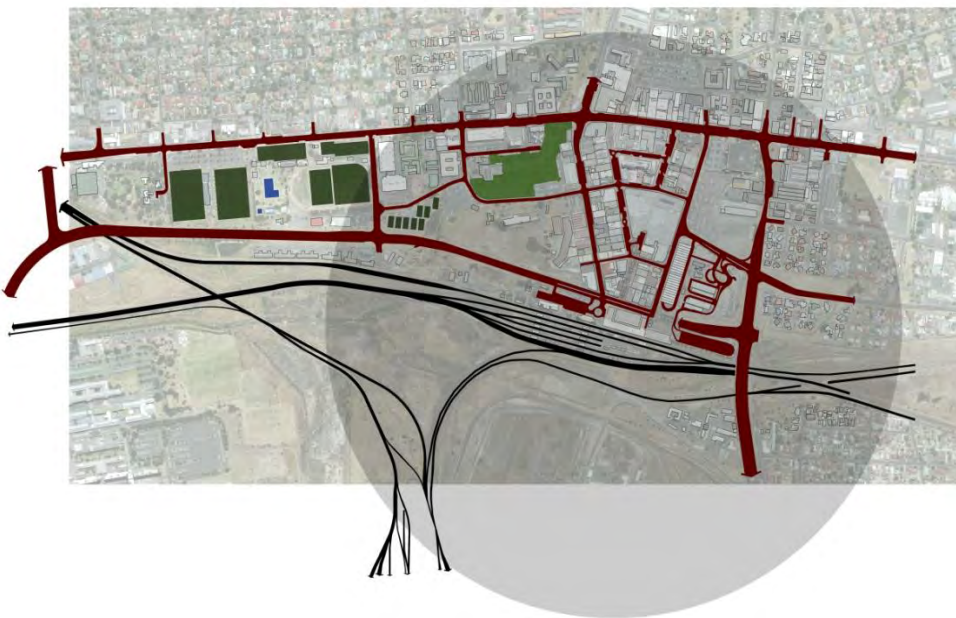
22. THREE MODES OF PUBLIC TRANSPORT: relation to 500m radius zone and railway line



23. BPTI CONTEXT GRAIN: relation to three modes of public transport



24. URBAN GRAIN AND VEHICULAR MOVEMENT PATTERNS



25. SPORTS AND RECREATION

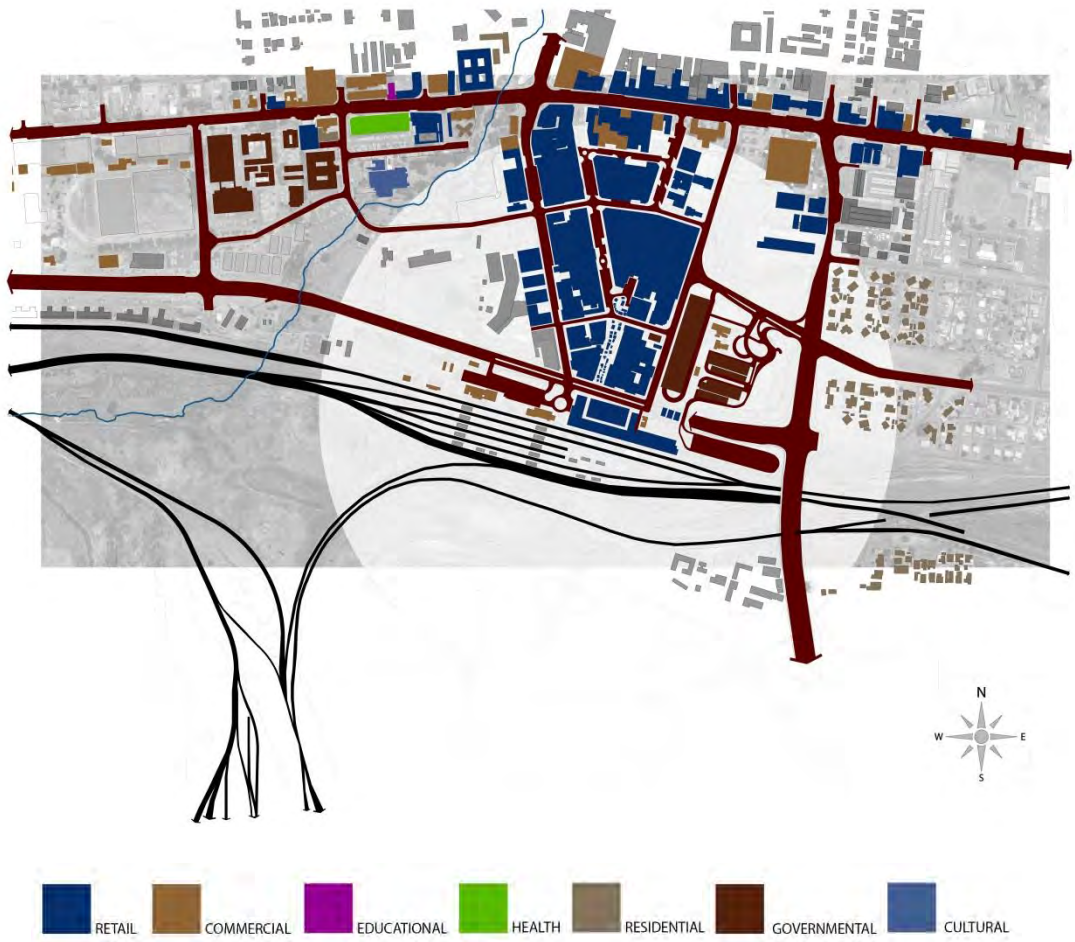


26. PROGRAMMATIC ANALYSIS OF VOORTREKKER ROAD

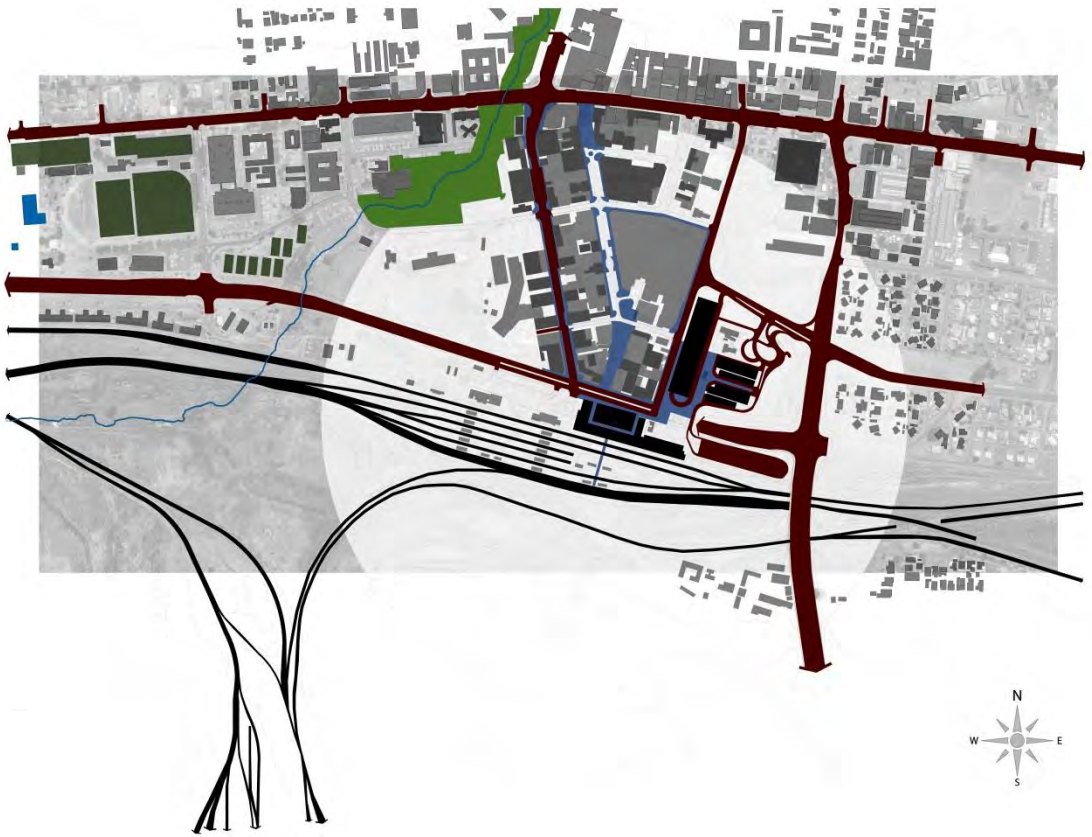


27. BUILT FORM: Taller than two storeys

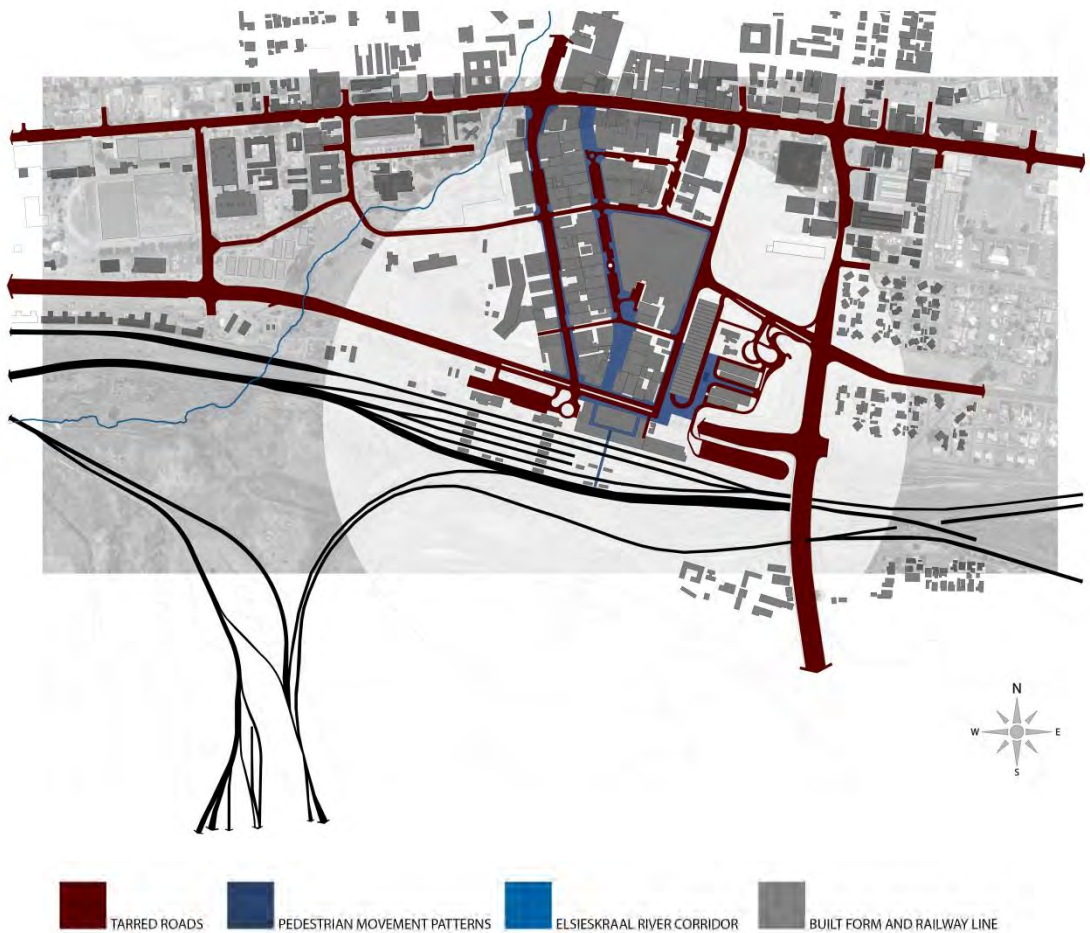
Interchange Precinct focussed



28. PROGRAMMATIC ANALYSIS: relation to 500m radius zone



29. GREEN SPACE AND PROMINENT ROADS



30. PEDESTRIAN MOVEMENT PATTERNS

A thorough context analysis of the BPTI precinct has led to the investigation into a phenomenon, which shall be referred to as in-between space, which has started to emerge within the BPTI precinct as well as other public transport nodes in South Africa, which I believe has created a platform for numerous urban benefits within transport precincts. The current unsuccessful nature of these spaces will be investigated followed by an urban framework which aims to better its current unsuccessful functioning.

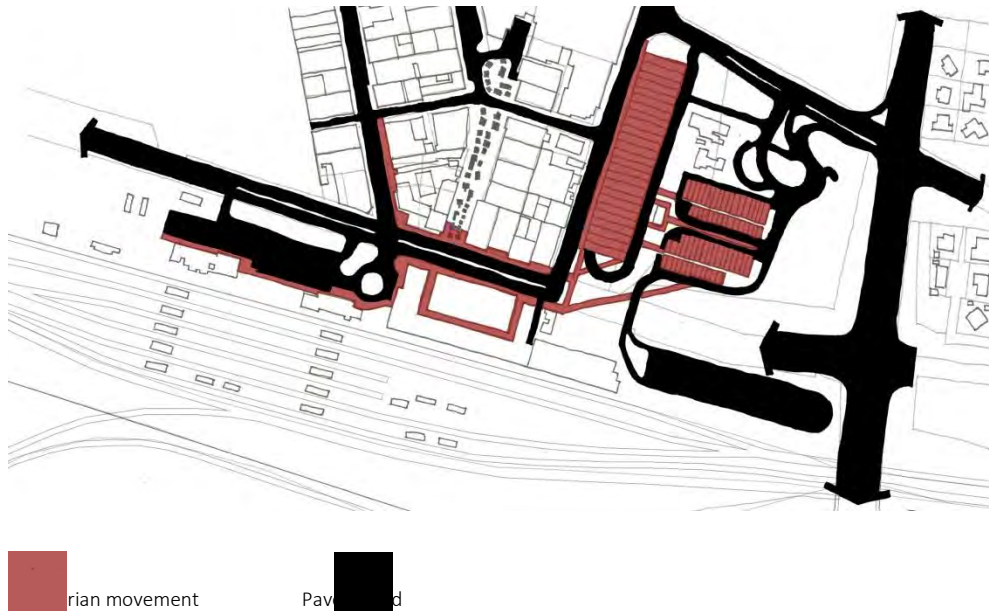
In-Between

Public transport has played a significant role throughout the history of the South African context. Although modally 40% of all work trips in urban areas are by public transport systems (Walters 2007), it comes with great difficulty as the Modernist urban influence promoting suburbia and low density sprawl along with the relocation of communities during the Apartheid act, it gives great limit to the effectiveness of public transport. Since 1997, Rail passenger trips made over the entire City of Cape Town area have decreased at an average of 2.2% per year (DOT 2006), as well as a decrease in bus services usage, as only the Taxi industry show some sort of increase. Understandably, major investment is currently made into the public transport system of RSA as Prasa has invested R123.5-billion in a rolling stock fleet renewal programme which is expected to be up and running in 2015 (Oxford 2013) along with Cape Town setting the target of 10% shift in commuters from **private to public** by the year 2020 (Luke 2013), which emphasises the importance of the emerging space 'in-between'.

Because of urban sprawl and price differences between different modes of public transport, it means that high numbers of commuters make use of various modes of public transport in a single trip. As is the case at the BPTI which results in high flows of pedestrian traffic which takes place when moving by foot from one mode of transport to the next. It is here where this essay will draw its attention to: This subconsciously used in-between transitional space, related to surrounding space but with no exact place of its own (Luz 2006), will be argued to hold great potential for the future of local transport interchange development. The chapter will now try to uncover the reason for the current unsuccessful nature of these in-between spaces.

Poor urban planning

Modernism consciously broke with the tradition of millennia of settlement making to engage with a new experiment of completely rethinking the structure and form of towns and cities (Dewar 2004). One of its focus points included the ability of technology to overcome social and urban issues, but more importantly, to plan and design according to the motor car; with Henry Ford claiming that he would build a car so cheap that every household would be able to own at least one. With most of the built form surrounding the BPTI built in the sixties, the urban planning, strongly influenced by the modernist principles, evolved around the accessibility and movement of the motor car, downplaying the importance of the human body and pedestrian movement as well as creating extreme disconnection between urban planning and public transport. This had massive negative effects on pedestrians at the BPTI as the diagrams below illustrate.



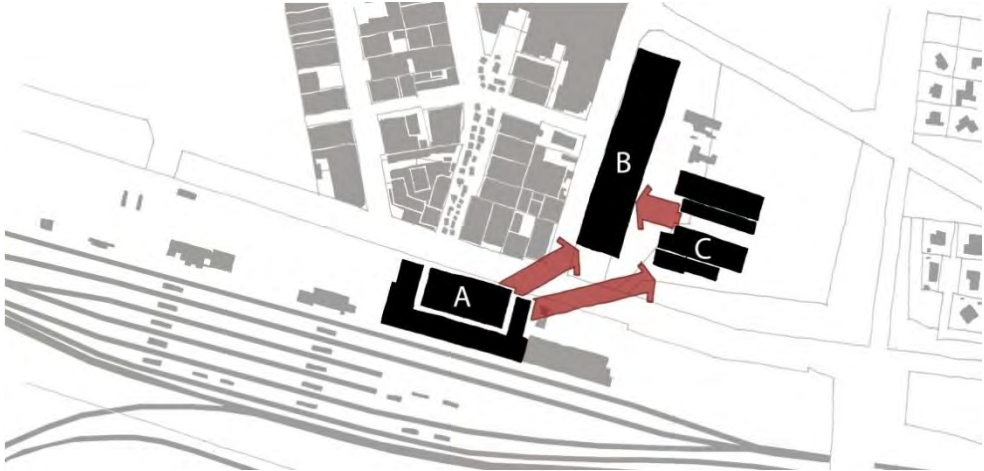
31. PEDESTRIAN MOVEMENT PATTERNS: cutting across tarred roads at BPTI

Figure 31 illustrates how poor planning around the motor car completely undermines the movement by foot present in the BPTI. Here movement patterns cut across busy roads because of lack of provision for pedestrian usage within the urban planning and resulted in the in-between spaces becoming places of danger and discomfort.

Built form development

Because of the order in which an urban setting develops; where roads are planned well before locations of catalyst buildings, it means that the human body will always bear the brunt of this order as the transitional in-between space is purely a result of built form development. This is also the case of BPTI where the in-between spaces are a result of the three main catalyst spaces of A) the Railway Station, B) the Golden Arrow Bus Rank and C) the Taxi Rank. With each of these spaces being a response to needs of different eras and a representation of different social and political ideologies, underutilised in-between spaces have started to form between these catalyst spaces. With the Bus Rank built pre-1940, the new Railway Station built in the nineties and the Taxi Rank post-2000, which explained by David Dewar as being a result of planning and design achieving rational distribution of land uses and facilities (Dewar 2004), unsuccessful transitions were bound to be the result. This means that in the case of the BPTI, the three catalyst buildings might well be argued to be functioning reasonably well individually; however as a collaborative unit, it acts unsuccessfully and is clearly highlighted by the nature of the in-between spaces cutting

across roads and making use of un-designed walkways and passages which is not properly maintained.



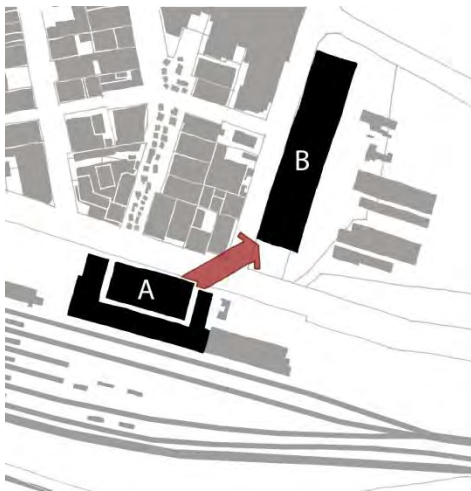
32. THREE CATALYST SPACES CREATING IN-BETWEEN PHENOMENA: A-Train station, B-Bus rank, C-Taxi rank



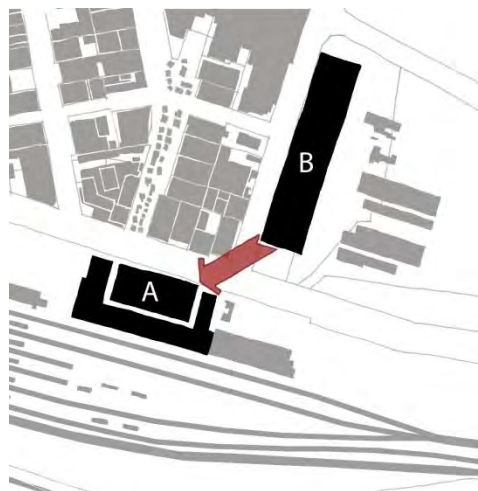
33. IN-BETEEN TRANSITION: spaces not maintained at BPTI.

Urban Sprawl

Due to the poor urban planning, urban sprawl has become a major problem in the immediate context of RSA. Sprawl, along with generally fixed working hours, means that current transport interchanges experience large flows of movement and overcrowded spaces in peak hours in one direction; from places of residence to CBD's or places of opportunity. Statistics show that the 06:00 – 09:00 peak period carries 41% of all day number of boarding passengers in the Railway system of Cape Town, with 19% and 32% in the inter-peak and evening peak periods respectively (Luke 2013).



34. MORNING PEAKS



35. EVENING PEAKS

Urban form

The urban form is something which will differ at every transport interchange however understanding the influencing structures of the urban form could arguably be the most influential factor regarding the successful nature of the in-between space. This could be divided into three categories: 1) Urban grain (relationship to the human body with regards to comfort and usage), 2) public accessibility (public vs. private – open to street or not/ accessibility/ porous nature of in-between), 3) Interaction with in-between (buildings serving the in-between).

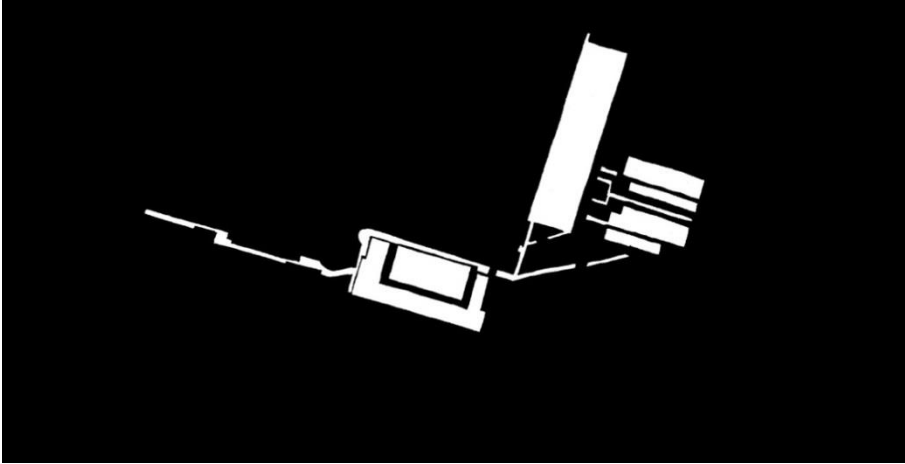
The urban grain's relationship to the in-between space is essential to character of the transition between the connecting catalyst spaces. Clues could be taken from the research into the functioning of the Las Vegas strip in Robert Venturi's '*Learning from Las Vegas*'. The strip is designed to relate to the movement of the motor car as signage and advertisement are sized and positioned to be legible when driving at high speeds. In the same manner the scale of the grain adjacent to the in-between is highly influential with regards to comfort and speed of pedestrian usage. In the case of the BPTI the overall precinct is mostly fine

grain however the in-between spaces connecting the three catalyst transport systems of train, bus and taxi consists of a coarse grain with widely dispersed built form; another reason for its unsuccessful transitional nature.

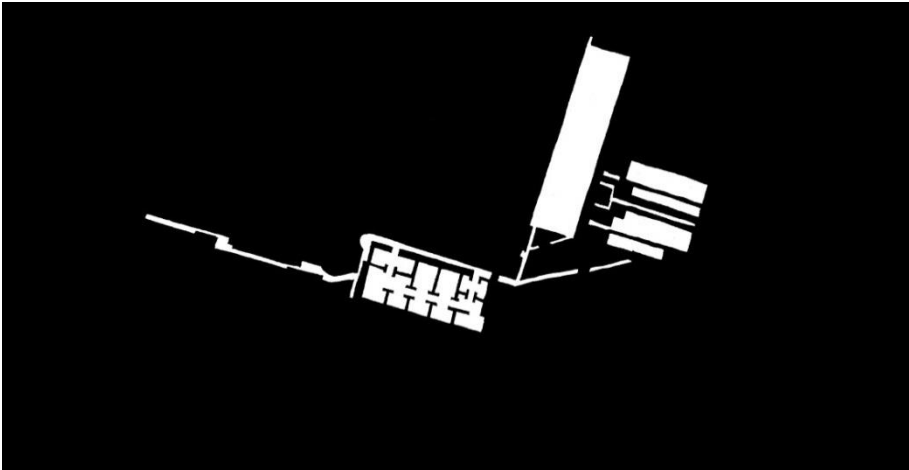


36. BULT FORM GRAIN

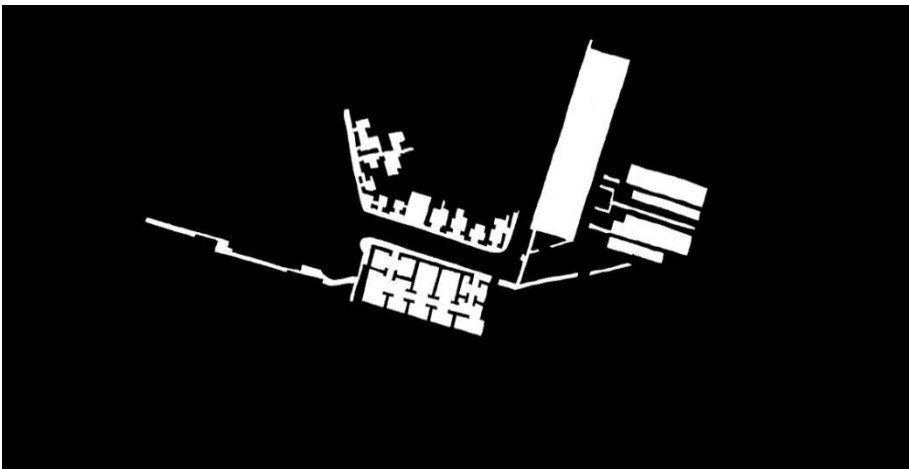
The public nature and accessibility of built form adjacent to in-between spaces also plays a very prominent role in the character and functioning of the transitional space. As the diagrams below illustrates, a large amount of public buildings face the street and walkways of this area of the BPTI precinct, however there is minimal activation or celebration of the in-between spaces connecting the transport modes as only the railway station activates a small portion of the transition.



37. PEDESTRIAN MOVEMENT: connecting three public transport modes



38. PEDESTRIAN MOVEMENT: Railway activation



39. PEDESTRIAN MOVEMENT: Disconnection between active spaces

Summary of unsuccessful context patterns:

Disconnection between modes of transport: The biggest concern currently lies within the disconnection between the three modes of public transport. These pedestrian transition spaces are unsafe as they cross busy roads and are not properly maintained. There is also no architectural form navigating positive connections and supporting successful public activity necessary within a PTI.

Safety: The second biggest source of dissatisfaction within South African railway transport precincts is the security on walks to stations (Van Ryneveld 2008). To better this connection it's fundamental to ensure a pedestrian friendly space. This is currently made difficult due to the Taxi Rank waiting area and busy road's intrusion on the in-between spaces.

Disconnected social spaces: With informal markets scattered over the precinct, it meant that there are inadequate communal spaces for social activity to take place which is fundamental to a successful urban precinct.



40. TAXI MOVEMENT PATTERNS: intruding on in-between transitional space

URBAN FRAMEWORK

In 'The Great Good Place', Ray Oldenburg argues that a positive daily life is a balance between three spheres of space: the first – domestic, the second – work, the third – social. Focussing on the last point, he refers to the “great variety of public places that host the regular, voluntary, informal and happily anticipated gathering of individuals beyond the realms of home and work” (Oldenburg, 1999). This creates the opportunity for connections between social and commercial attributions and the in-between.

Proposed

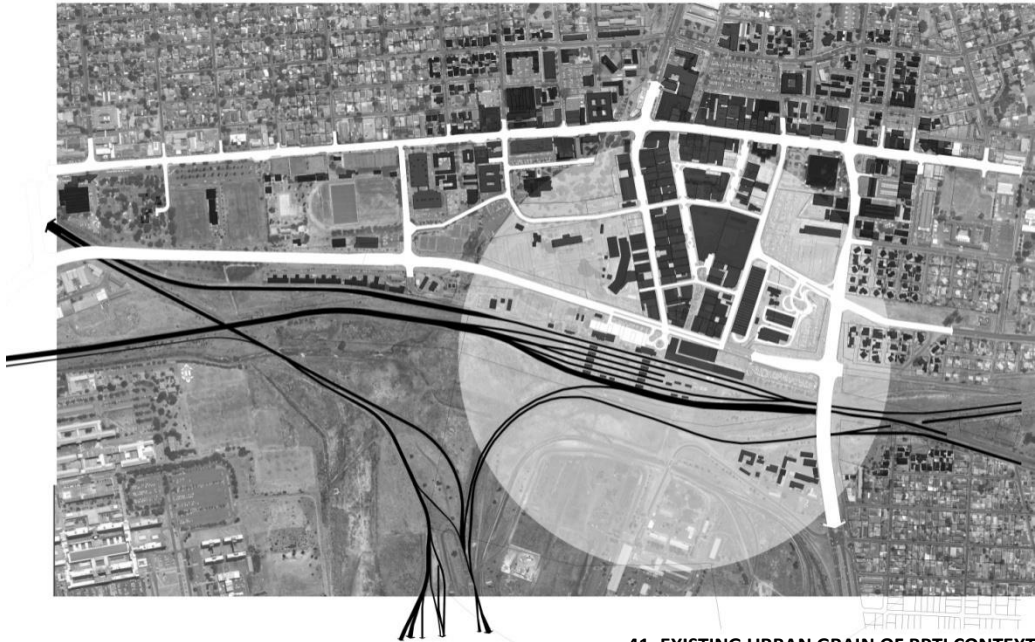
Densification: A relatively dense urban grain is proposed for the 500m radius area surrounding the BPTI, which works towards the ideals of TOD. The presented 50x50m urban blocks, which sizes are taken from the existing context in order to maintain a contextual human-scaled urban experience, are mixed-used urban structures increasing property value in both residential and commercial property markets due to its location and aim to increase the use of public transport while promoting healthier living through walking and cycling.

Railway station Alteration: Through minor design alterations on the east-wing of the Railway station, a more focused connection is made between the railway and the other two modes of public transport, where a singular directed route is formed creating a more active, safe transition. This creates better economic opportunity from a formal and informal-trade point of view.

Public Square: This relationship between the different modes of transport is emphasised through a proposed multi-functional public square, activated by informal markets, which are currently dispersed across the site.

Taxi Movement patterns: The entrance from the taxi waiting area to the taxi rank shifts to East side of the proposed public square to create a separated relationship between vehicular and pedestrian movement on the pedestrian in-between space.

Densification



41. EXISTING URBAN GRAIN OF BPTI CONTEXT



42. PROPOSED DENSIFICATION: mixed use building proposal in 500m radius zone

Railway Station

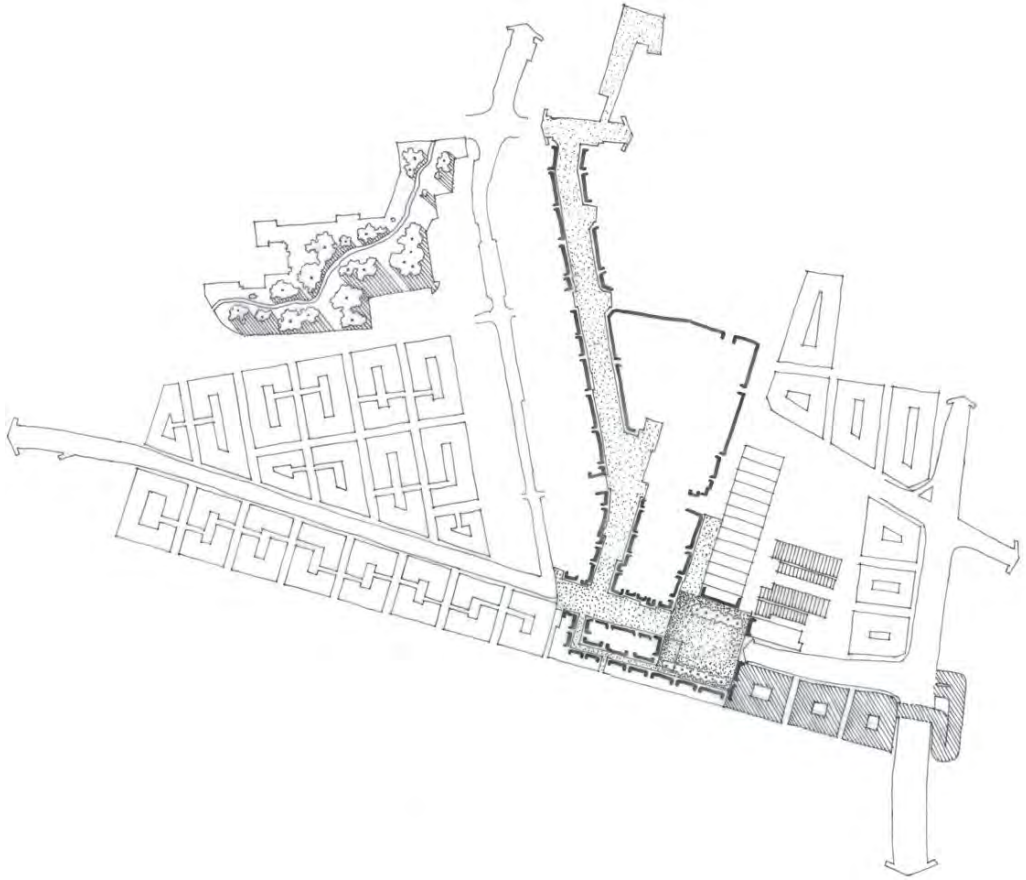


43. EXISTING BELLVILLE RAILWAY STATION



44. PROPOSED RAILWAY STATION: improving connection between three modes of transport

Public Square

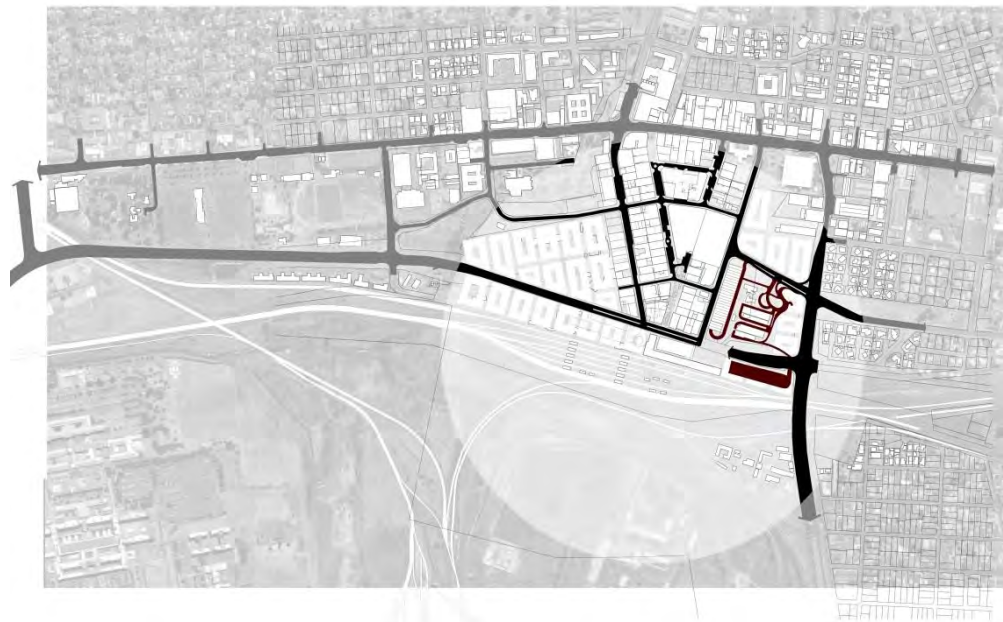


45. PROPOSED URBAN FRAMEWORK

Taxi parking



46. EXISTING TAXI MOVEMENT PATTERNS

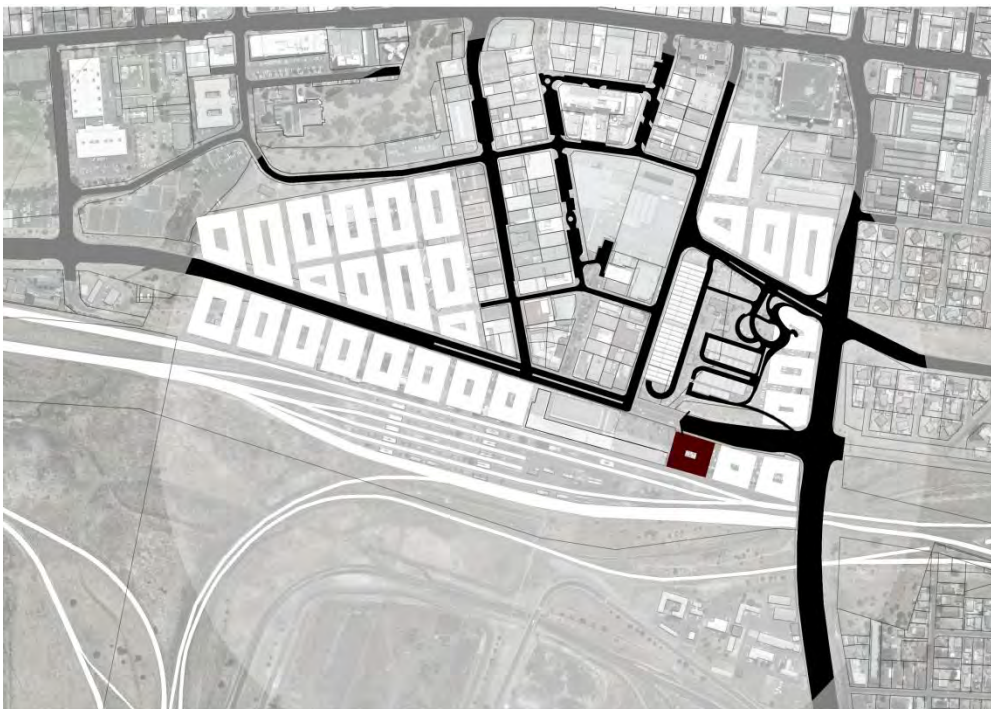


47. PROPOSED TAXI MOVEMENT PATTERNS: Shift to eastern side of the Tienie Meyer Bypass

The site analysis that follows will be conducted in a way that sees the proposed urban framework as the new existing context and should be analysed through this lens.

The chosen site is of great importance to the success of the urban framework and is ideal for exploring the relationship between architecture and the BPTI. The site selection was based on:

- Importance to the proposed urban framework and precinct functioning
- Integrated with the transition between the different modes of public transport and urban square
- Proximity to Bellville Railway Station
- Direct relation to the railway line
- Direct relation to Tienie Meyer Bypass
- Economic viability and alignment with TOD ideals



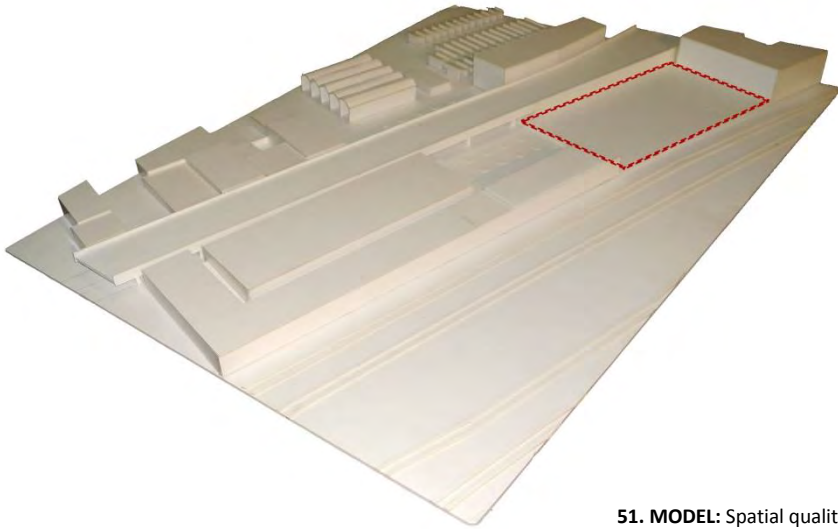
48. INFLUENCING FACTORS ON CHOSEN SITE



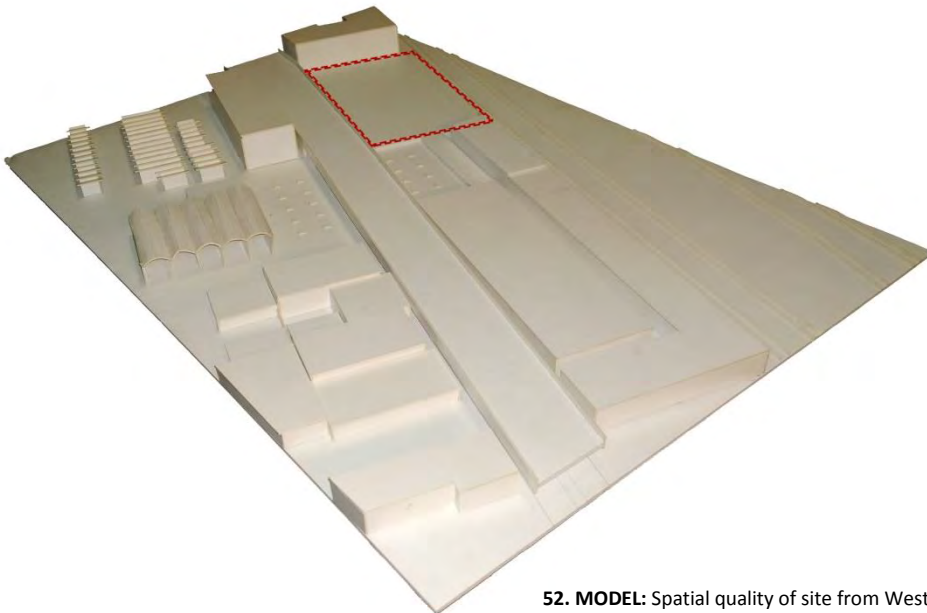
49. SITE FORMING PART OF URBAN PROPOSAL



50. THREE DIMENSIONAL VIEW OF SITE



51. MODEL: Spatial quality of site from railway



52. MODEL: Spatial quality of site from Western edge

Vertical Layering of Site

The first part of the site analysis is to get an understanding of the different influential activities present at the different levels on site, which deals with the first conceptual investigation of vertical layering.

Level one – Ground Floor: Site to In-between transitional space

Time: 24hours. Peak: 06:00-09:00, 12:00-14:00, 17:00-19:00



53. PEDESTRIAN MOVEMENT: Western side of the chosen site

Framed by the chosen site, the connection between the three different modes of public transport through the public square creates major movement patterns throughout the day on the sites western edge, with amplified patterns during morning, mid-day and afternoon peak hours.

Level two –NGL: Site to Railway Line

Time: 05:12-19:10

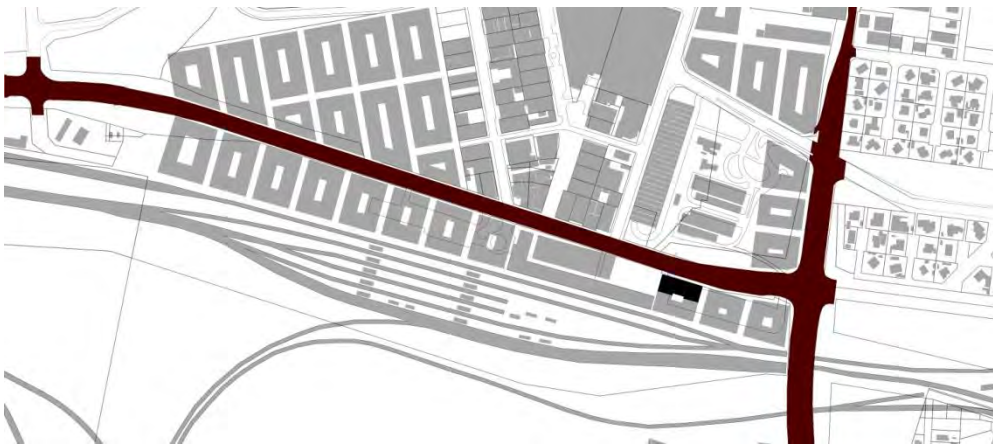


54. ACTIVE RAILWAY LINE: Southern side of the chosen site

Bellville Railway Station consists of 11 tracks running parallel to the chosen site on its Southern side, with the closest being 7m from site. It presents the site with a visual connection to the railway functioning at different speeds of movement throughout its daily running time. The previously chapter investigates the main problems regarding building relationships to railway lines through Noise and Vibration issues.

Level three – 9m: Site to Tienie Meyer Bypass

Time: 24hours. Peak: 06:00-09:00, 17:00-19:00



55. TIENIE MEYER BYPASS: Northern side of the chosen site

Standing tall against northern edge of site, the elevated highway creates noise emission into the site accompanied by a blank concrete retaining wall standing 9m tall to the northern edge of the site.

PROGRAMME

ALIGNING WITH TOD

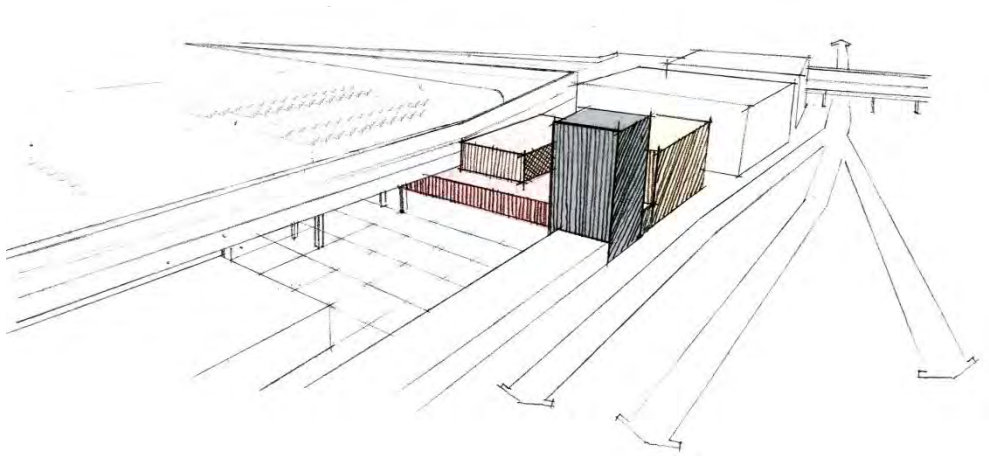
The investigation into the relationship between architecture and the BPTI will be conducted through the suggested programme of TOD which consists of

- Retail (public)
- Commercial (semi-private)
- Residential (private)

Accompanied by a

- Hotel (public, private)
- Taxi parking (private)

This compact programme will serve as precedent for future projects of similar nature and compliments the complexity of the surrounding context.



56. PROGRAMMATIC ANALYSIS: Relation to privacy levels

LAYOUT

LEVELS OF PRIVACY

The document argues for the programmatic arrangement for a project of this nature to be informed by the Public Transport activities present on site. The response and development of the project's programme are conducted according to site functioning which occurs at:

- Time layering
- Vertical layering (levels)



57. PEAK MORNING MOVEMENT PATTERNS

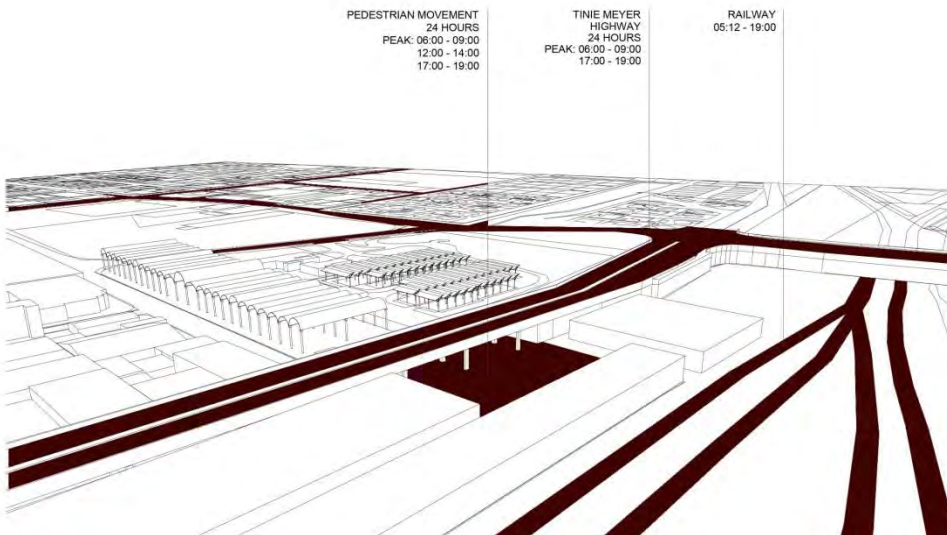
Time layering

Site

Railway: 05:12-19:10

Tienie Meyer Highway: 24hours, Peak: 06:00-09:00, 17:00-19:00

Pedestrian movement: 24hours. Peak: 06:00-09:00, 12:00-14:00, 17:00-19:00



58. FUNCTIONING TIMES: Vertical site levels

Programme

Retail: 06:00-19:00

Commercial: 08:00-17:00

Residential (working class): 06:00-08:00, 17:00-06:00

Hotel: 24hours

Programme relation to time layering

In creating a positive relationship between architecture and the BPTI it is essential for the programme to have an intricate understanding of these different site functioning times and draw

- connected relationships
- separated relationships

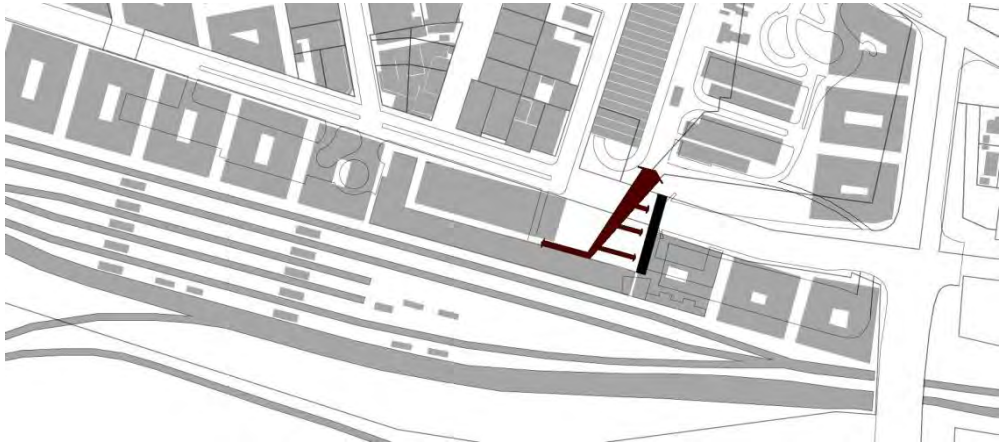
The extent of the type of relationship created is measured according to the five parameters of:

- Visibility
- Vocals
- Olfactory
- Accessibility
- Proximity

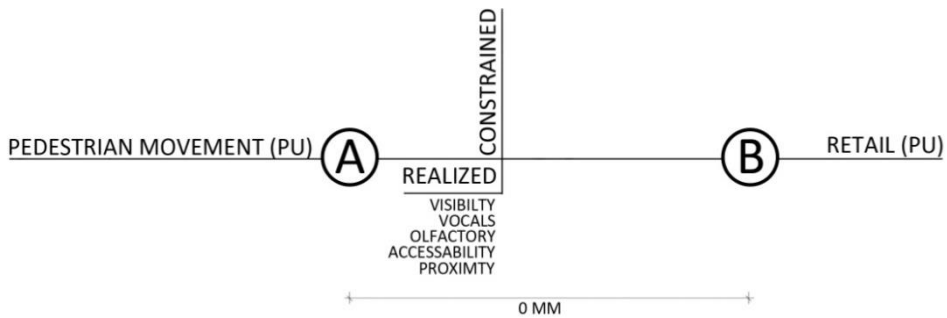
Retail – Pedestrian Movement

(Realised – visibility, vocals, olfactory, accessibility, proximity)

The programme draws from the peak pedestrian movement patterns on site between the different modes of public transport in order to maximise on the success of the retail component and thus has a *connected relationship*.



59. RETAIL RELATIONSHIP



60. RETAIL TO PEDESTRIAN MOVEMENT RELATIONSHIP

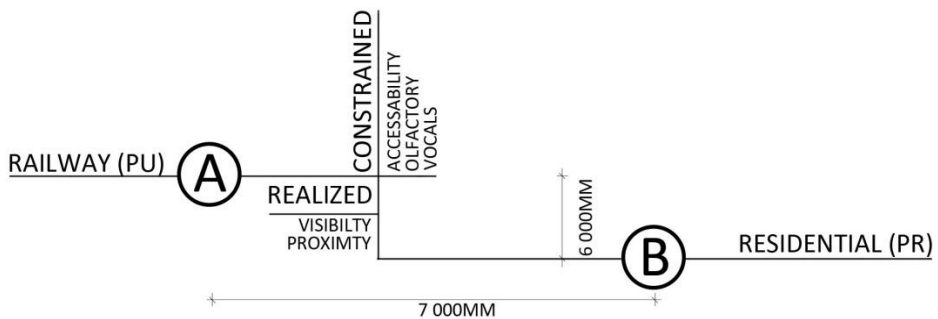
Residential – Railway

(Realised – visibility proximity, Constrained – vocals, olfactory, accessibility)

A *separated connection* is made as the absent functioning time of the railway compliments the active functioning time of the residential component to minimise noise impact on the proposed architectural element. Through this a positive relationship is established which counters one of the most prominent problems of transport interchange precinct which is that of railway noise emission.



61. RESIDENTIAL RELATIONSHIP



62. RESIDENTIAL TO RAILWAY RELATIONSHIP

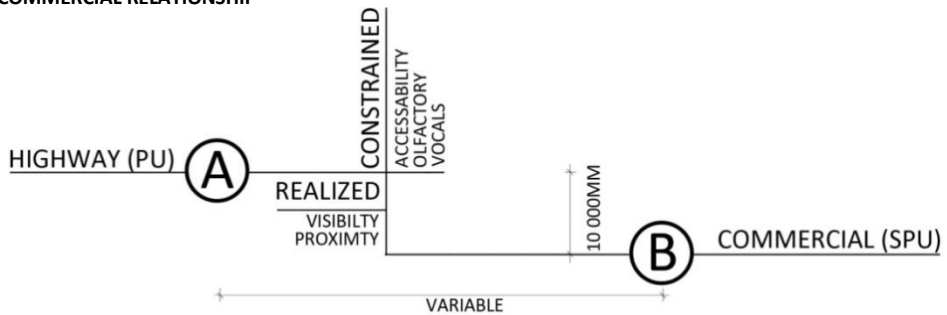
Commercial – Highway

(Realised – visibility, proximity, Constrained – vocals, olfactory, accessibility)

Arranged in a way that the absent functioning time of the commercial component compliments the active highway peak functioning time of the Tienie Meyer Bypass, a *separated connection* is created. The connection between commercial offices and the highway is one of minimal interaction to counter noise emissions which does occur from 08:00-17:00, where both parties are active at the same time.



63. COMMERCIAL RELATIONSHIP



64. COMMERCIAL TO HIGHWAY RELATIONSHIP

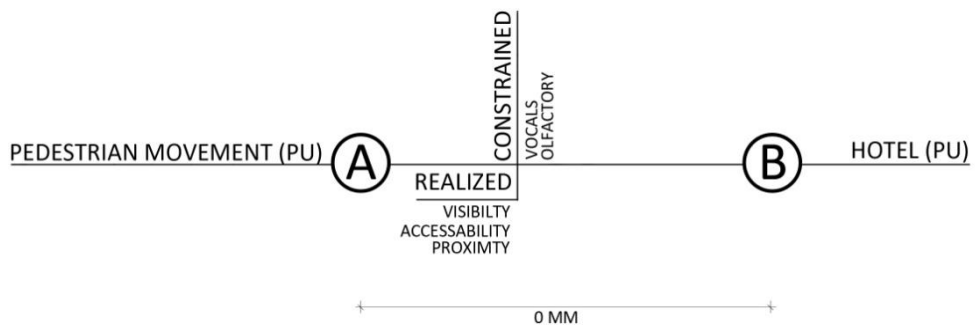
Hotel – Pedestrian movement, Railway

(Realised – accessibility, proximity, visibility, Constrained – vocals, olfactory)

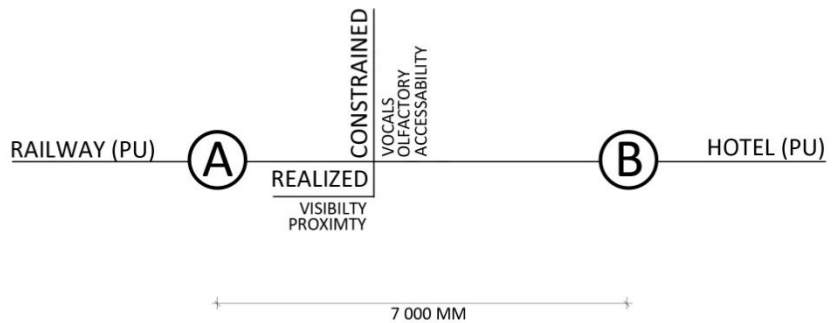
A *connected* relationship is created, drawing from pedestrian movement and having visible connections to the Bellville Railway Station and the public square, announcing its location and its change in programme.



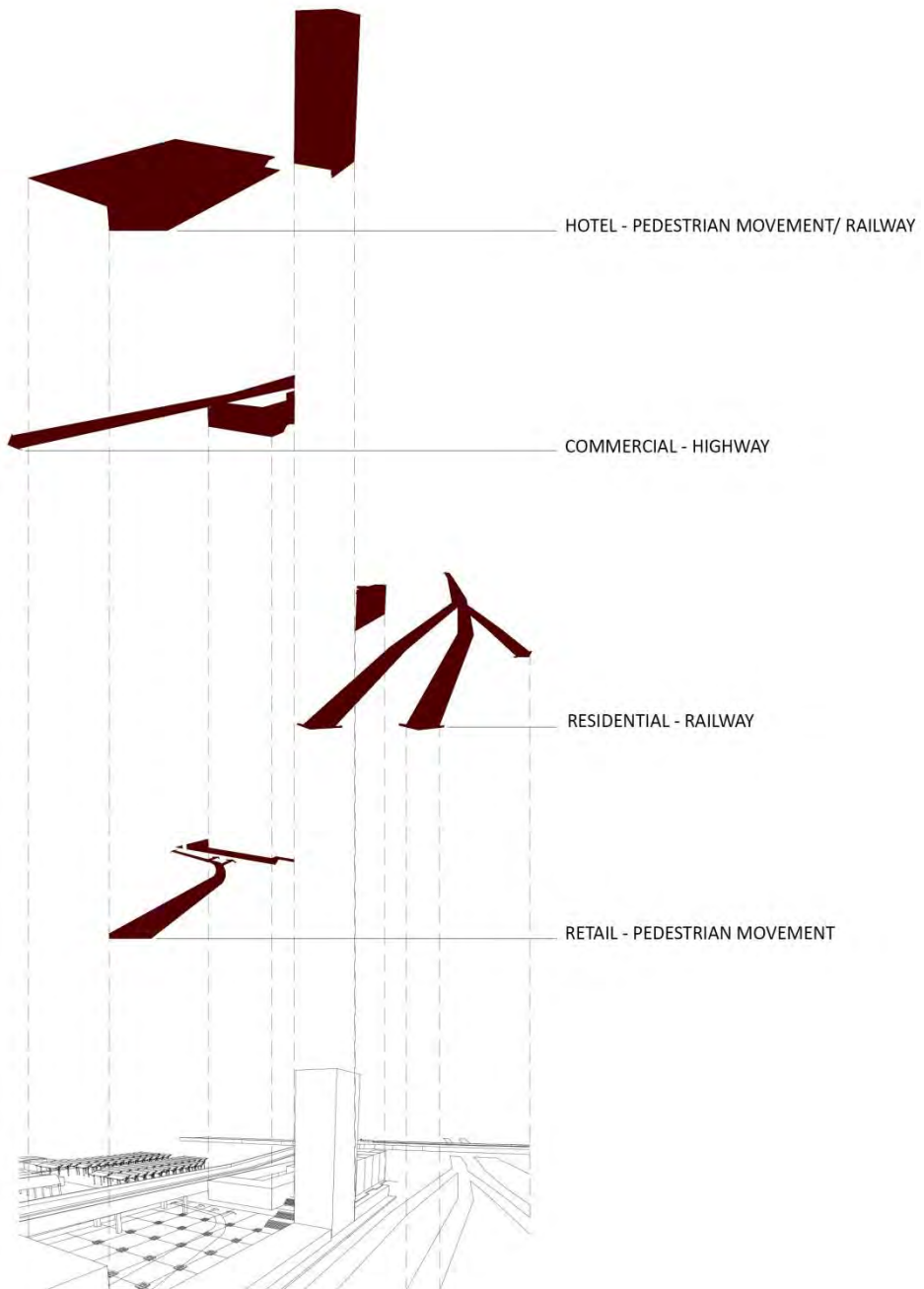
65. HOTEL RELATIONSHIP



66. Hotel to pedestrian movement relationship



67. HOTEL TO RAILWAY RELATIONSHIP



68. EXPLODED THREE DIMENSIONAL: Programme relation to time layering

Programme relation to vertical layering

Part reason for the complexity of the BPTI is due to the site which all functions at different levels. After allocation planning relationships, the aim is now to create positive relationships by aligning programme Vertically with Privacy levels on site. The document proposes that the vertical layering process aligns itself with Robinson's theory of Static privacy, as it deals with fixed level changes.

Public – PU, Semi-public – SPU, Semi-private – SPR, Private - PR

Level zero:

Taxi parking (PR): not accessible from the public square, dropped half-level under NGL giving expression through level changes to level above while giving maximum privacy to taxi parking.

Level one:

Retail (PU) – Pedestrian Movement (PU): the retail component is placed on level one for a positive relationship with the pedestrian movement patterns active between the different modes of public transport.

Hotel (PU) – Pedestrian movement (PU): the hotel is more complex in character as it draws different connections at different levels. The entrance to the hotel takes place on *level one* as this component of the hotel is one of public nature and is responsive to the movement patterns on this level.

Level two:

Retail (SPU) – separated from the public level, a semi-public courtyard serves the main retail tenant and is activated by retail shops.

Level three:

Forecourt (SPU) – commercial (SPR), residential (PR), hotel (SPU): elevated from the public level, the forecourt creates a gathering point prior to the more private spaces of the commercial offices and the residential units.

Level four:

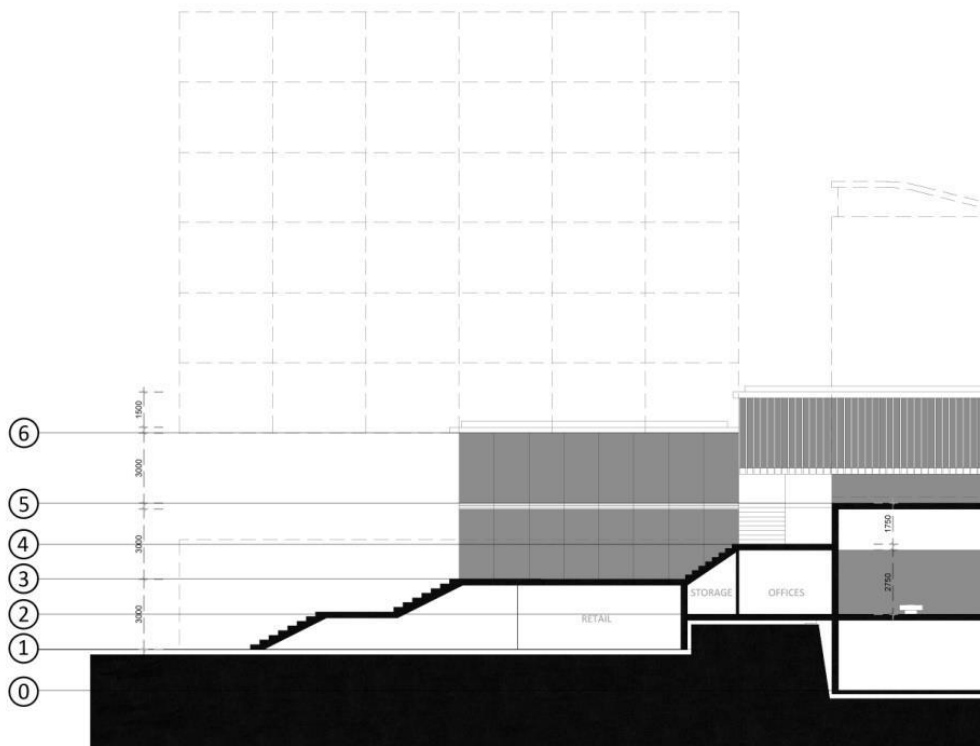
Commercial (SPR): this component of the project is more private and is responsive to the Tienie Meyer Bypass and separated from the Public and Semi-Public level for privacy and provides for an open plan *level one* which is allocated to the retail component.

Level five:

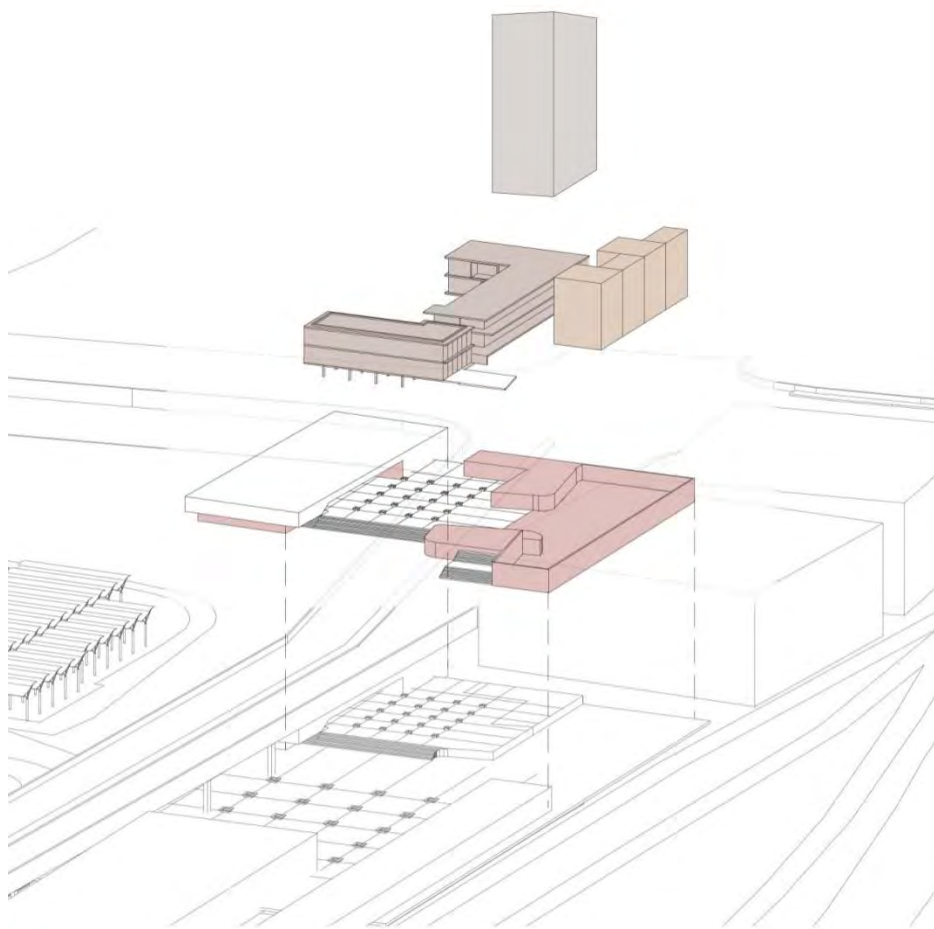
Residential (PR): being the one most private programmes of the project, this component is placed at *level five* to firstly create a separated relationship with the railway line, and is raised from *level three and four* in order to create a more privatised space.

Level six:

Hotel (PR): a visible connection is made between the Bellville Railway Station and the hotel for a clear understanding of location, and speaks to the public square to the North in a positive manner.

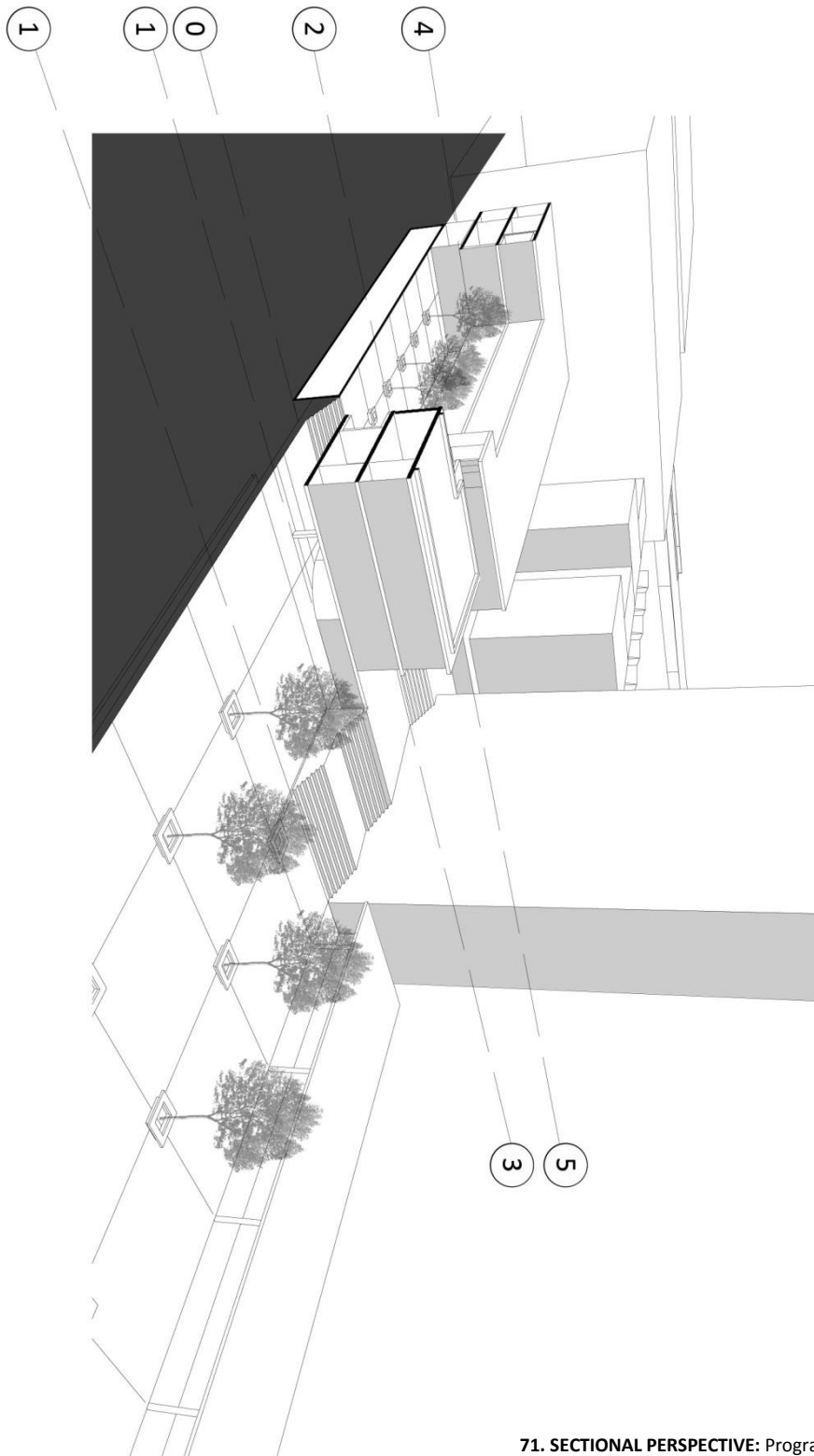


69. SECTION THROUGH FORECOURT: Programmatic level change

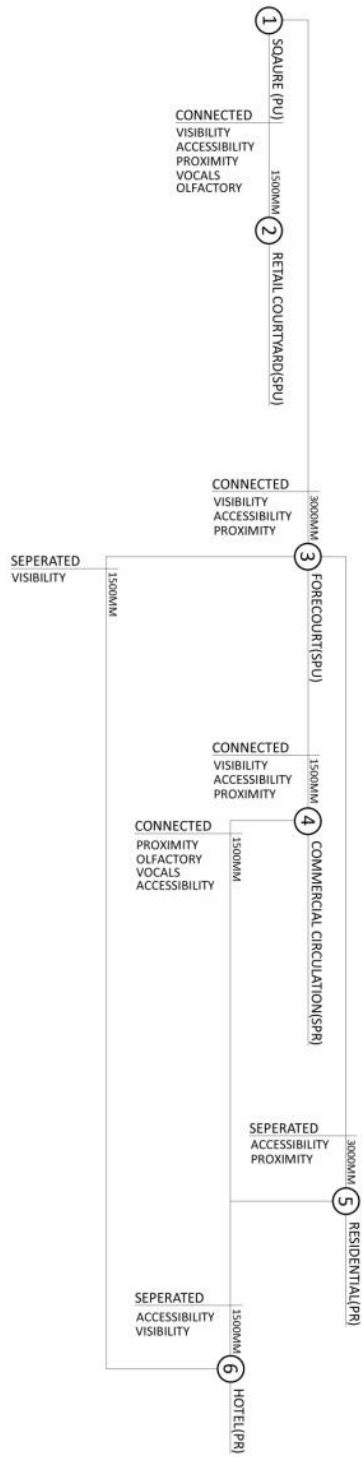


- RETAIL
- COMMERCIAL
- RESIDENTIAL
- HOTEL

70. EXPLODED THREE DIMENSIONAL: Programme levels



71. SECTIONAL PERSPECTIVE: Programme levels



72. SEQUENCE OF PROGRAMME EVENTS

STRUCTURE

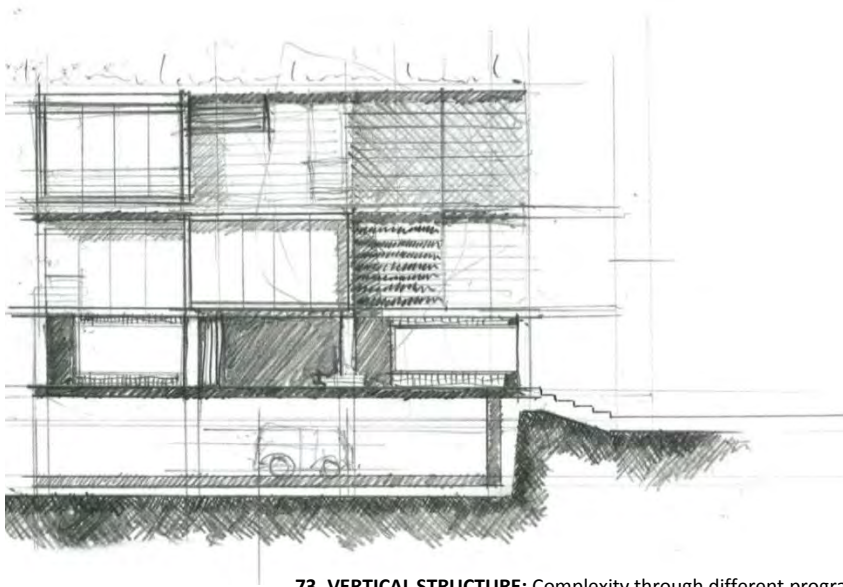
EXPRESSION OF LAYERING

As discussed earlier, the selection on a structural approach for project of this nature is very much dependant on its exact location, which in the case of the BPTI is in close proximity to the elevated Tienie Meyer Bypass to the Northern edge and active railway lines to the Southern edge of the site. Not only does it need to support vertical loads of the roof and building itself, but needs to address lateral loads from wind and seismic loads related to vibrations caused by the active railway lines.

Expression of Layering

The document argues a secondary conceptual investigation of creating a structural approach which complements the concept of architectural layering in both vertical and horizontal systems. The structure will be used to practically and visually reinforce the public nature of different spaces.

Complexity lies within the fact that the project deals with spaces of vast different privacy levels and character located directly above or below one another. The challenge for the structural approach lies in the way in which the structure responds differently to these different spaces while still navigating a practical and uniform language.



73. VERTICAL STRUCTURE: Complexity through different programmes

CIRCULATION

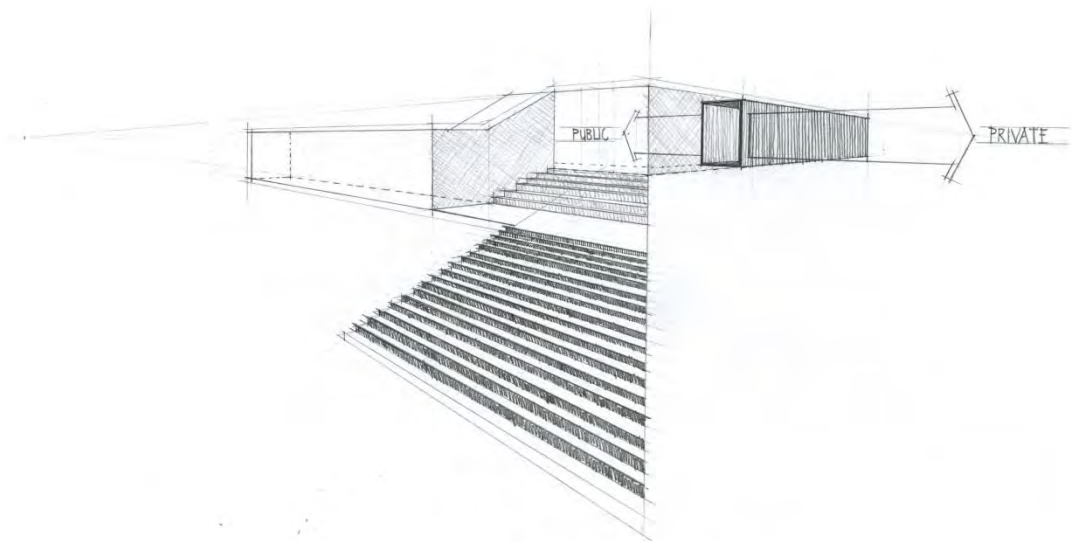
MEDIATING PRIVACY

VERTICAL EXPRESSION

Not only does the circulation firstly need to be used in strategic ways which works best within its context relating to site movement patterns and comfortability to sequence of events, but it also, in the case of the BPTI, argues the value of circulation creating new connections between architecture and the BPTI system.

Mediating privacy:

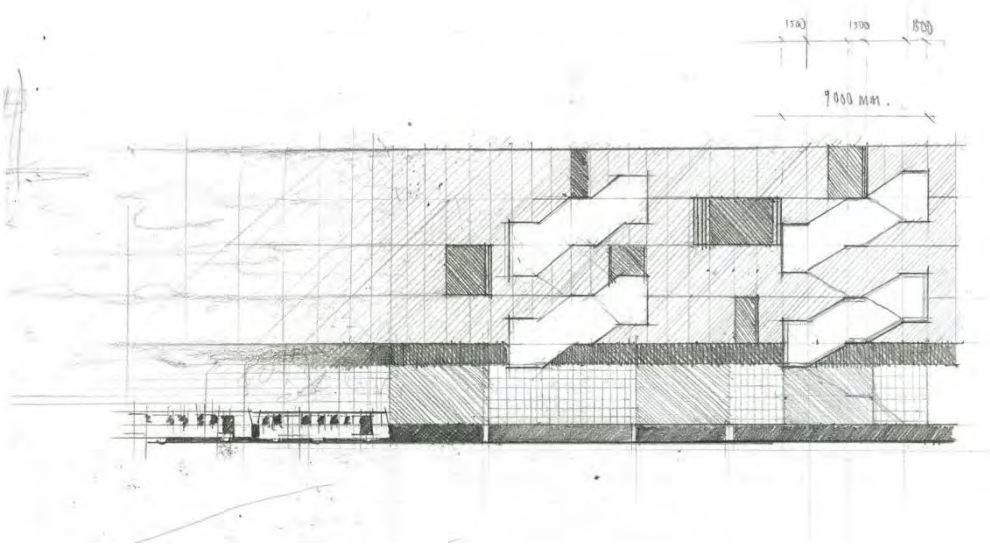
The document presents the argument for circulation to be used secondly as a mediating device. This addresses noise pollution, unwanted sun exposure and more importantly creating necessary privacy between different spaces which calls for it. This contributes to the idea of architectural layering, where a separated or connected relationship is created through the use of circulation depending on the privacy levels of the spaces to which the circulation connects.



74. CIRCULATION AS PRIVACY MEDIATOR

Vertical Expression:

The idea of vertical circulation between levels is also used as a tool to create a connected relationship between architecture and the observer. Here an expressed visible connection is made between the two, acting as a revealing element, giving the viewer a sense of understanding over the building and its different vertical layers.

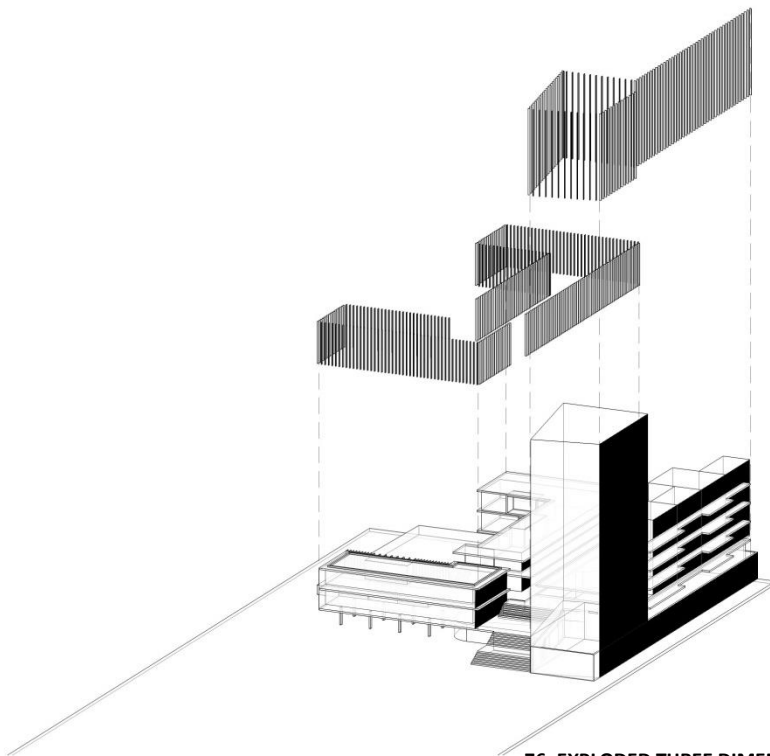


75. EXPRESSED CIRCULATION: Railway facade

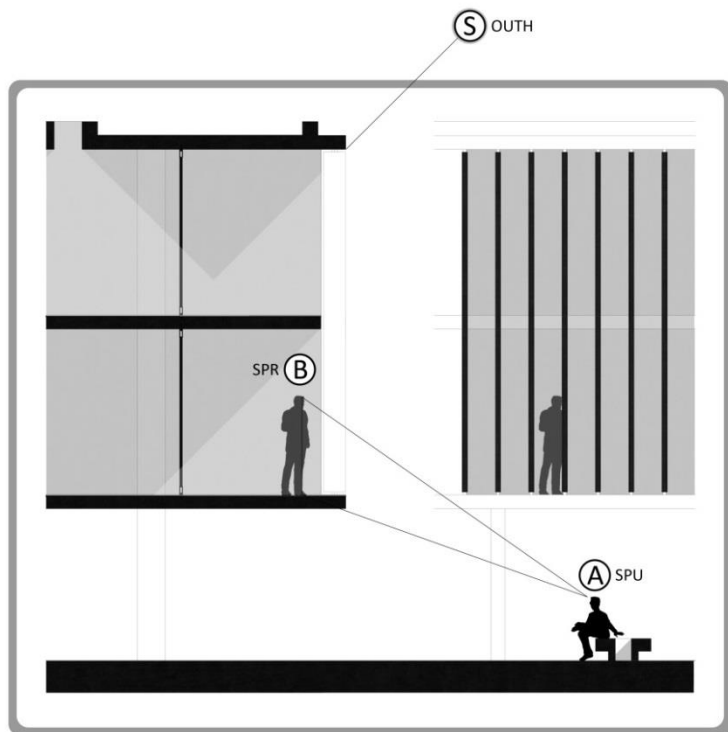
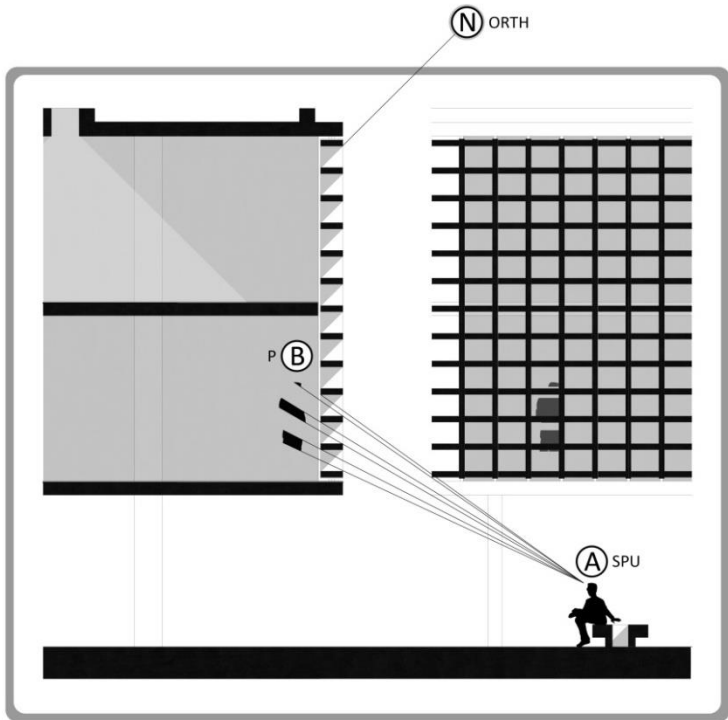
This document argues the three important roles of the building skin which is fundamental in creating positive relationships between architecture and the BPTI users are sun control, noise control and privacy regulation.

Static and Dynamic layering

Through vertical and horizontal systems within the skin, the aim is to create positive relationship by aligning itself with both the **Static** and **Dynamic** theories on architectural privacy. Due to the overall interplay between different vertical layering systems (different floor levels), it means that the horizontal element of the skin has become the tool in which the skin deals with privacy control (see figures below) between different levels and takes on the idea of Dynamic privacy where the building user have control over privacy levels. The vertical element is used as a Static tool which deals with Sun and Noise control.



76. EXPLODED THREE DIMENSIONAL: Skin layering



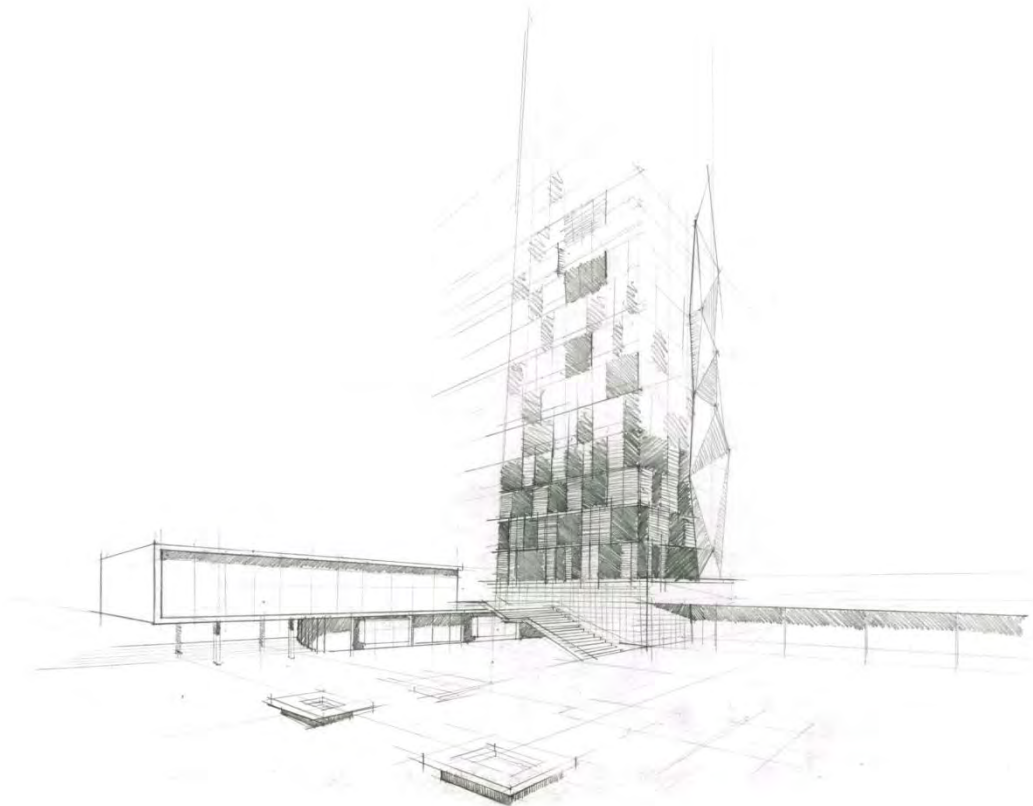
77. PRIVACY CONTROL: Horizontal layering

DESIGN DEVELOPMENT

At this point in the project a site with various influencing factors as different levels has been established along with fundamental links between programme and site functioning times with regards to layout and levels through separated and connected relationships. The design process that follows will be investigated through the conceptual lens of vertical and horizontal layering alongside the theme of architectural privacy.

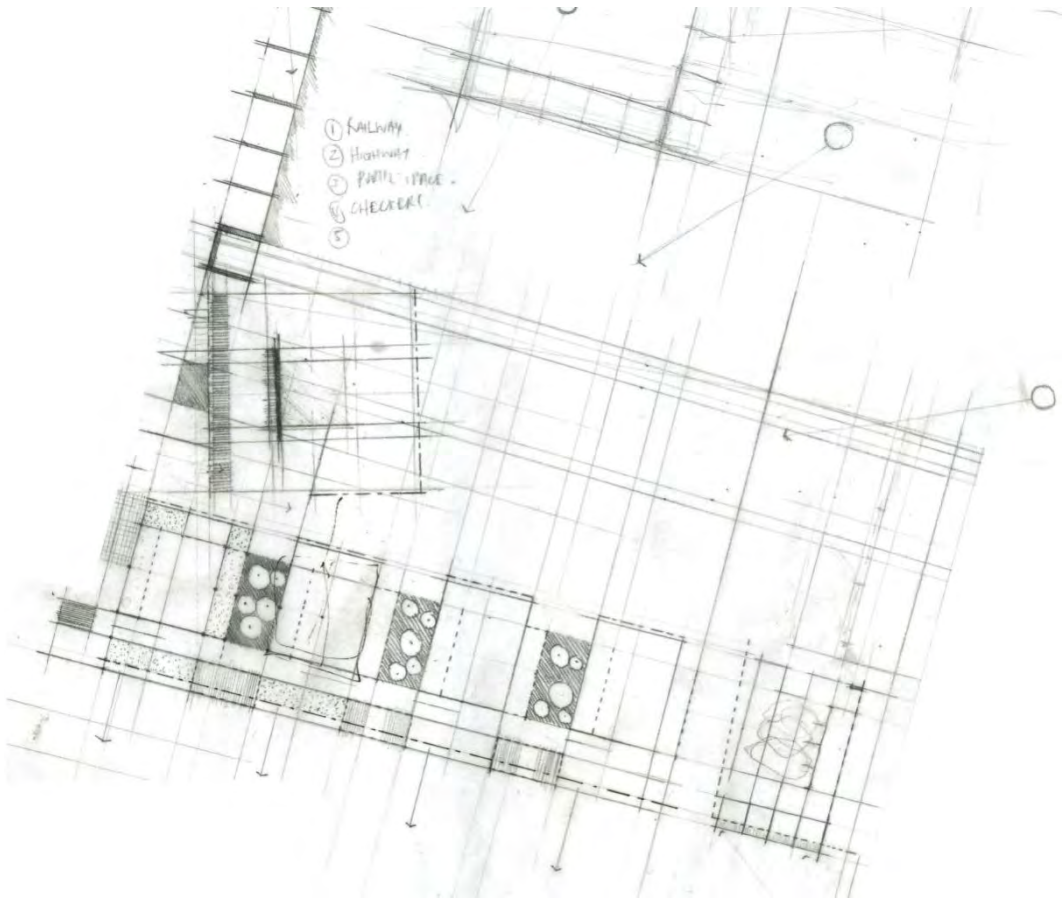
Site Strategy:

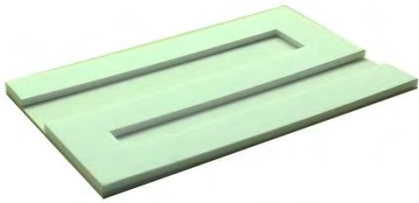
The initial site strategy consisted of a response to the site levels and its functioning within a proposed urban framework. The design was approached as an urban precedent for future projects which investigates relationships between spaces of vast different privacy levels in close proximity to one another through the use vertical and horizontal layering methods.



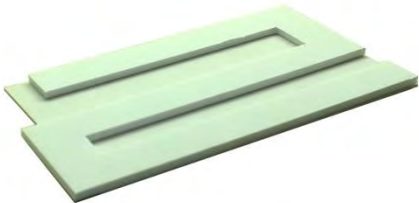
Site Arrangement

The overall arrangement of programme on site was a result of an understanding of the surrounding context. By understanding the planning relationships and site functioning times, major on site issues such as noise pollution are already dealt with and results in a good foundation being set up for the investigations to follow.

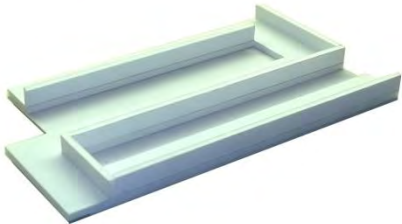




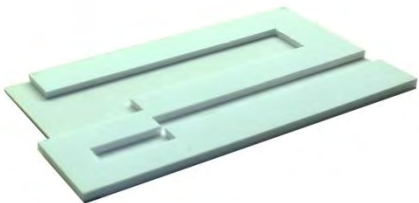
Holding the site



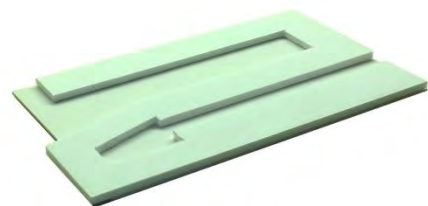
Hotel expressing change in programme



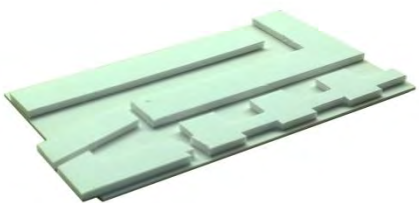
Interface relationships



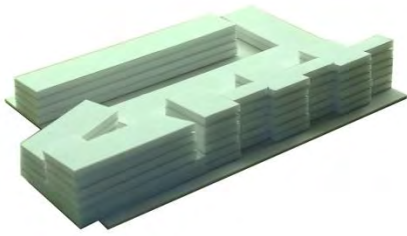
Programmatic grid change



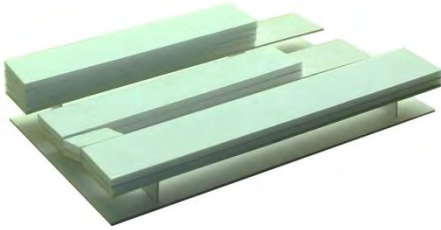
Capitalising on movement patterns



Programmatic character



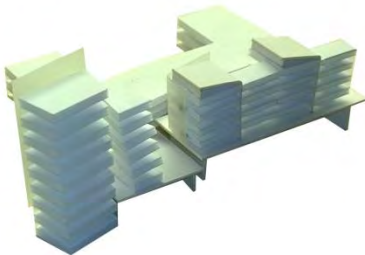
Massing investigation



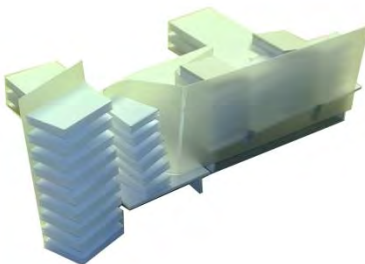
Vertical layering



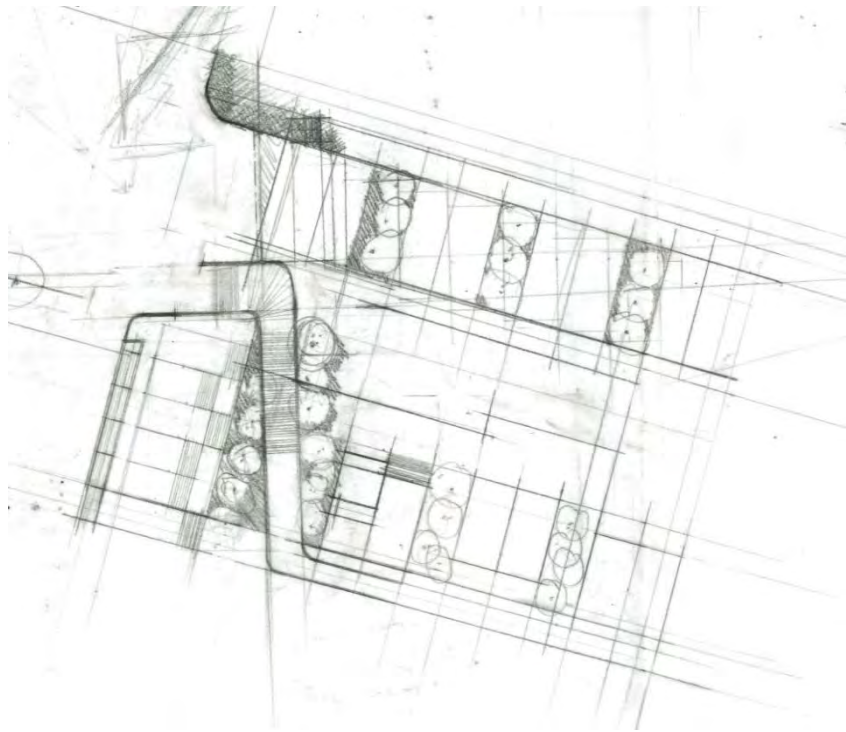
Horizontal layering



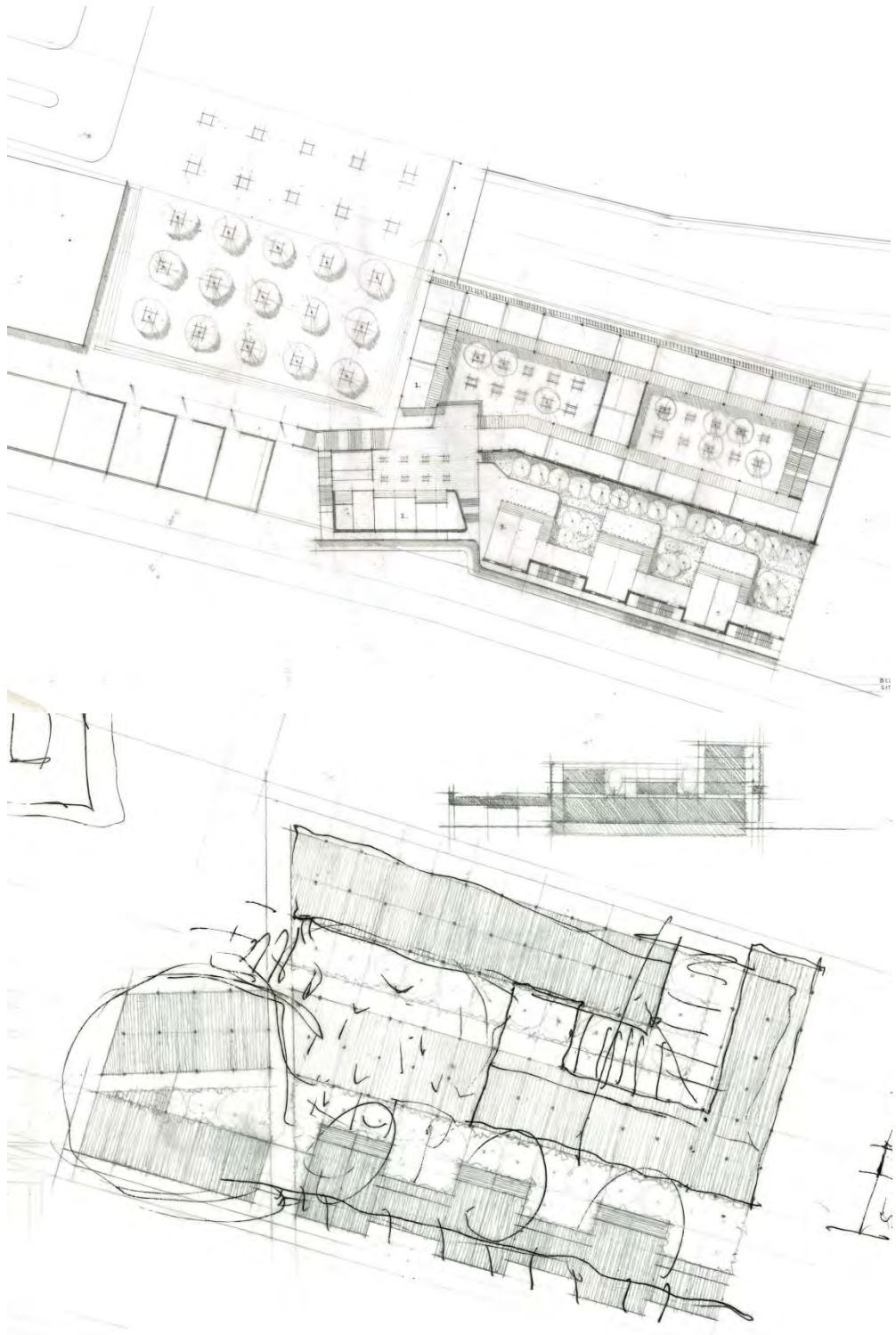
Programmatic character



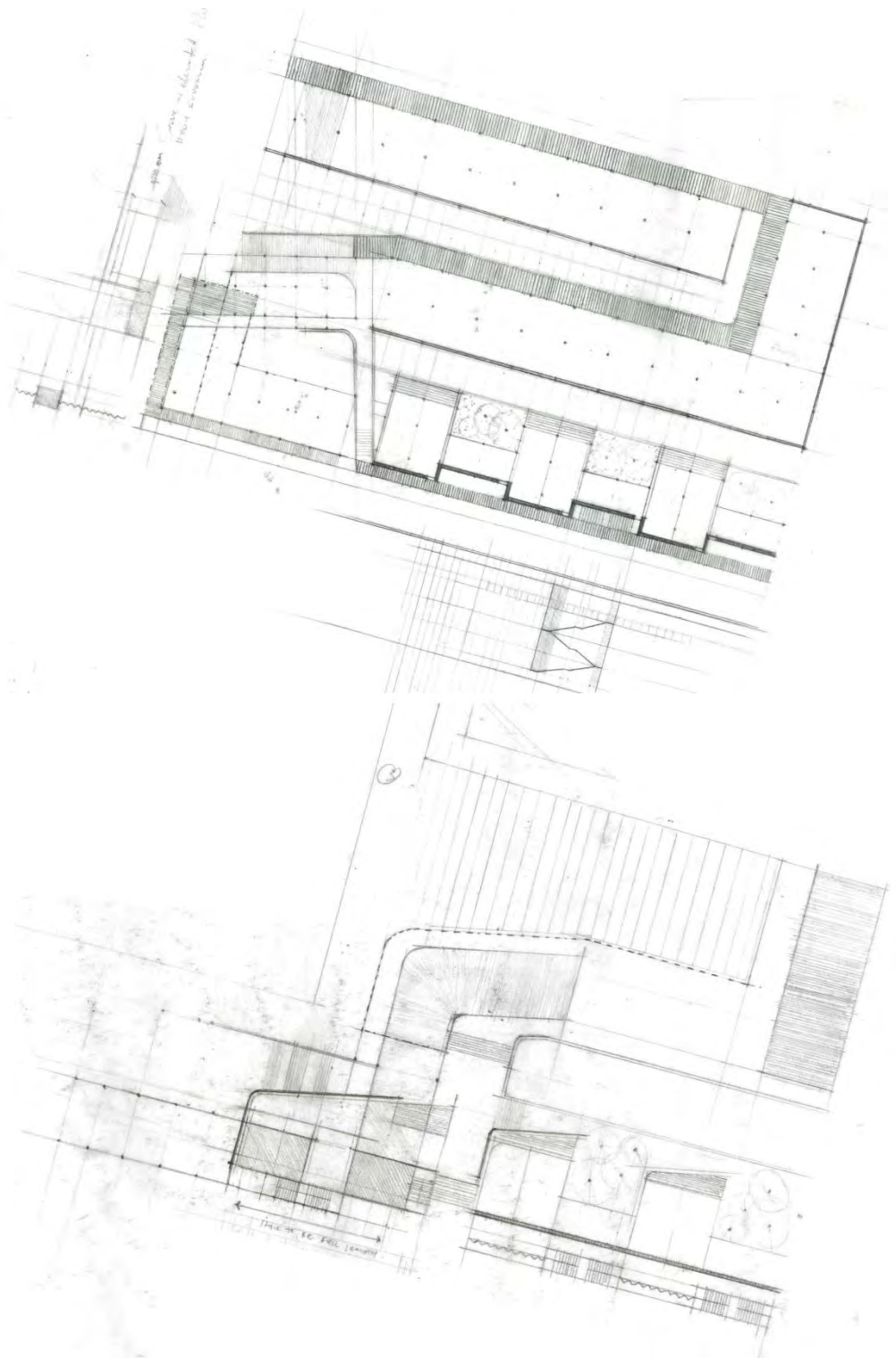
Vertical and horizontal layering



81. PLANNING DEVELOPMENT

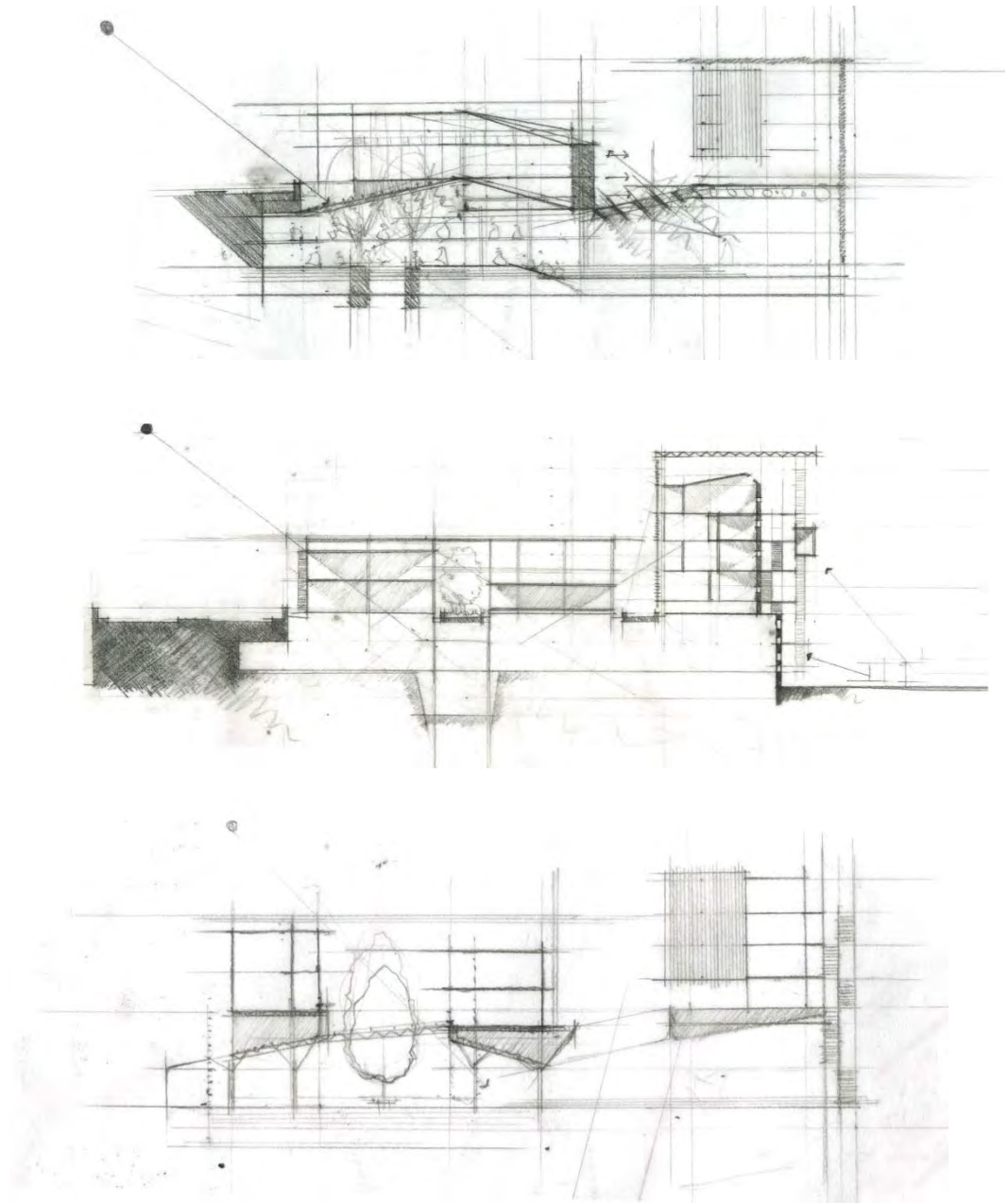


82. PLANNING DEVELOPMENT

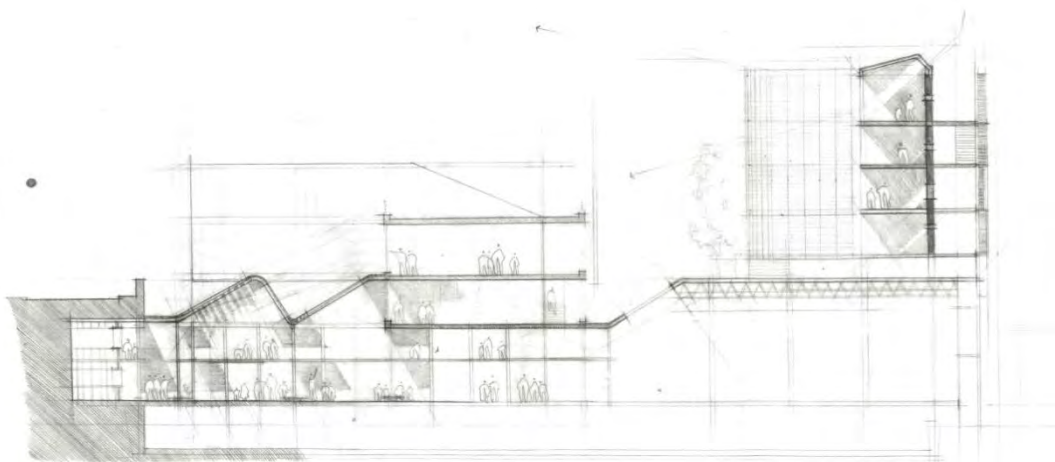
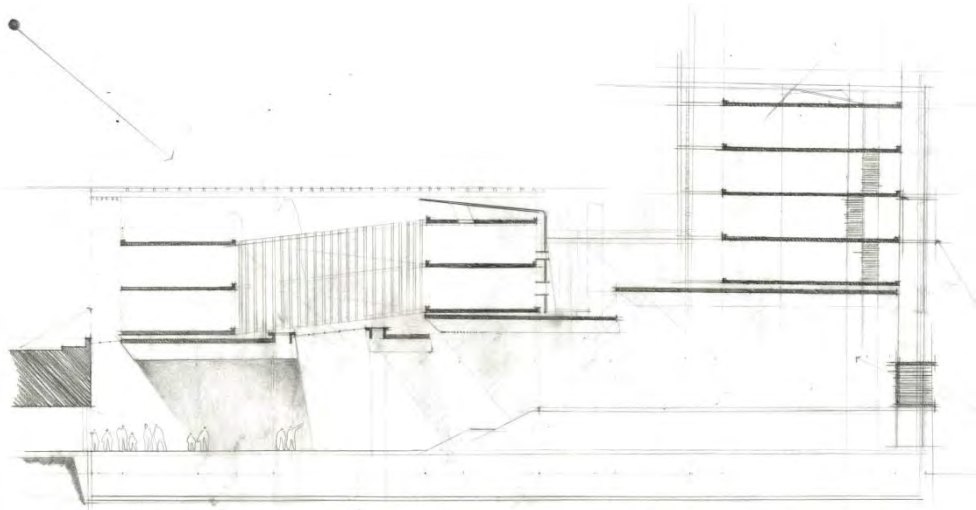
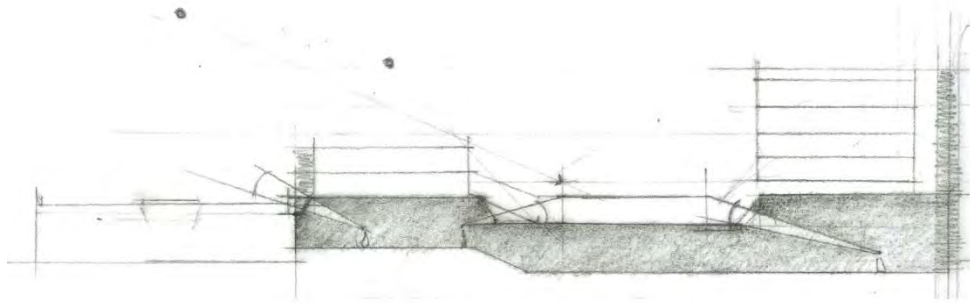


83. PLANNING DEVELOPMENT

The scaling of the project was also determined by the existing context grain while drawing from direct site influences such as the Tienie Meyer Bypass and the Railway journey. Because of the compact nature of the site, it meant that the scaling of each programme was to respect its neighbour with regards to privacy levels, views and natural lighting.



84. SCALING: Sectional investigations



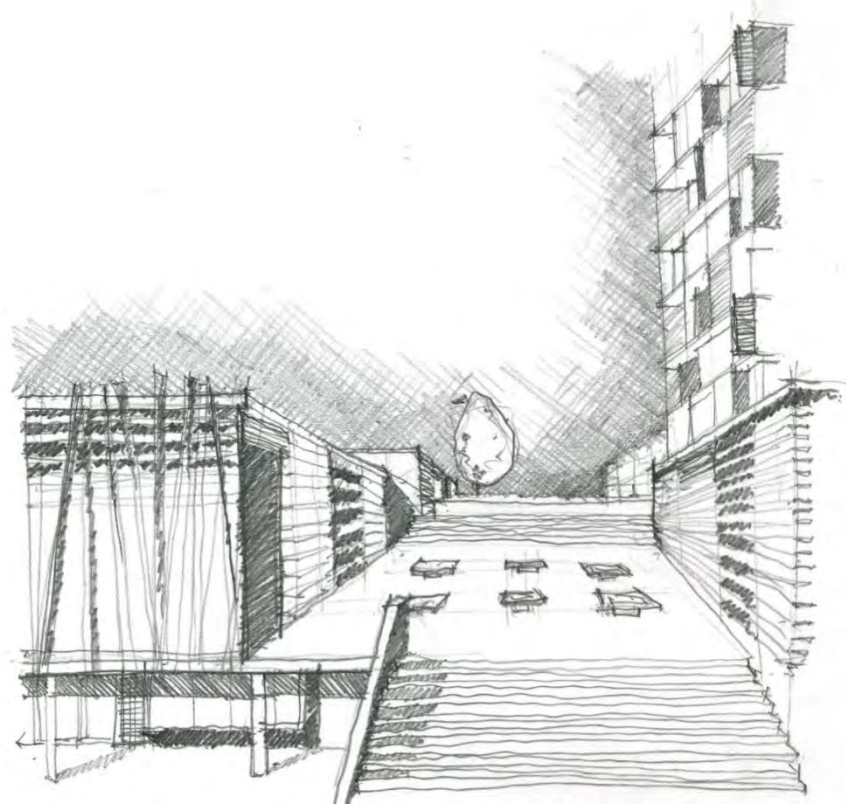
85. SCALING: Sectional investigations

Privacy Development

Vertical layering is used as a tool to navigate privacy between different types of spaces. Investigations were made into the character of the different programmes and the level of privacy they required. The challenge was to find balance between vertical and horizontal layering systems to achieve the best architectural outcome.

The process started with an investigation into Robinson's theory on static privacy, by firstly arranging the vertical layering process through different floor levels. Challenges lied in the fact how these vertical elements connect, collaborate and create a visual understanding of the layering process, while responding positively to its context.

What followed was an unpacking of each programme and its approach to horizontal layering methods. The idea was to create spaces of different privacy levels within each programme which were complimented by the use of horizontal layering methods. Here the theory of Dynamic privacy was investigated as control was to be given back to the building occupants.

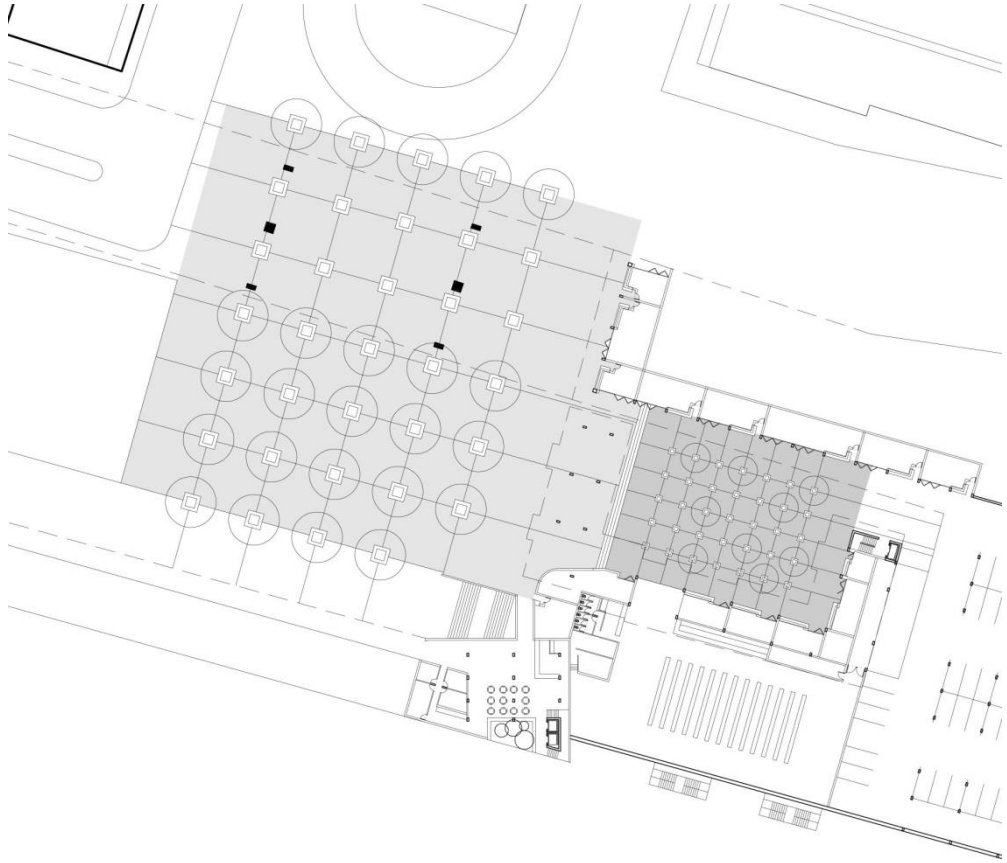


86. FORECOURT

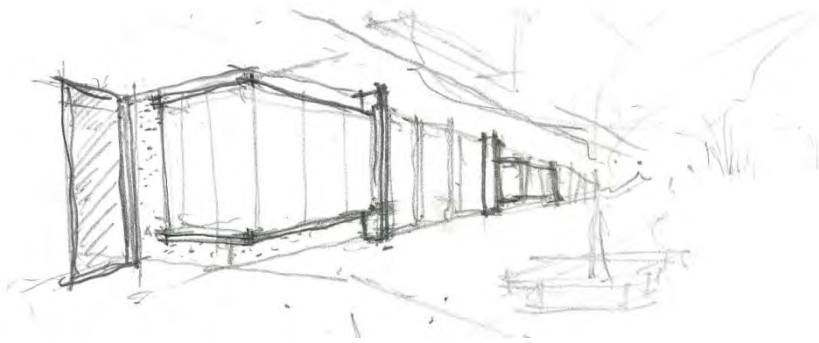
Retail and the public realm:

The retail component consists of the informal trade market, formal retail stores, and a main tenant. Through analysis of the movement patterns on site, two courtyards at different levels were created, one public, the other semi-public. Through architectural form a threshold is created between the two, activating different spatial character as well as providing for the taxi rank parking underneath. The main entrance to the SP courtyard is through the PU square while the secondary entrance is from the under-roof parking area to the East of the square. The development of the retail component revolved around these two courtyards.

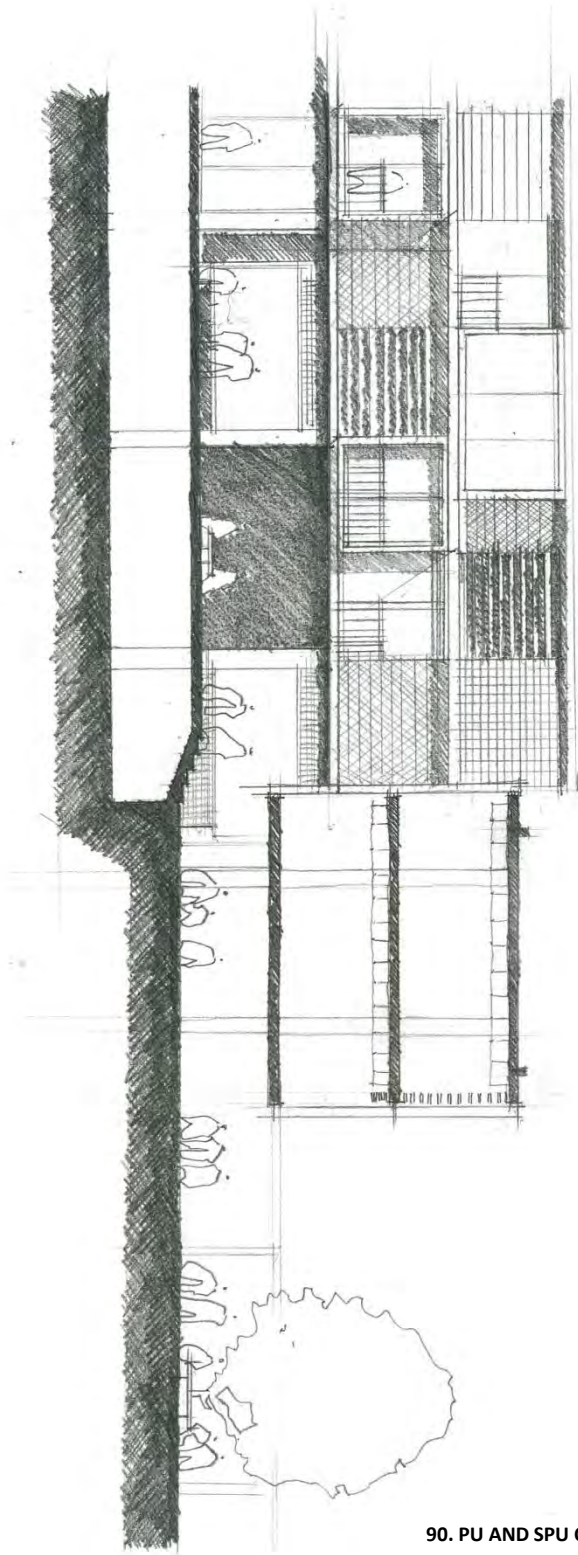




88. PU AND SPU COURTYARD



89. ACTIVATING SOCIAL ACTIVITY



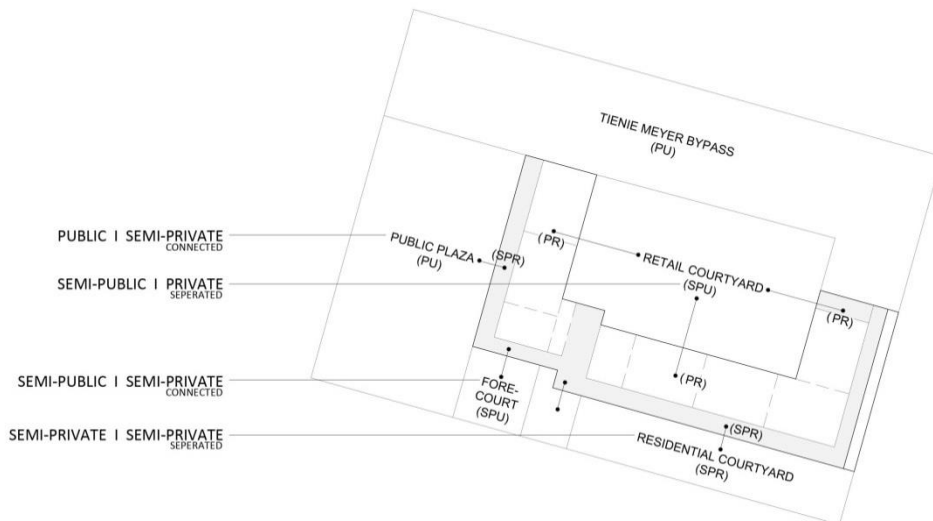
90. PU AND SPU COURTYARD RELATIONSHIP

Commercial:

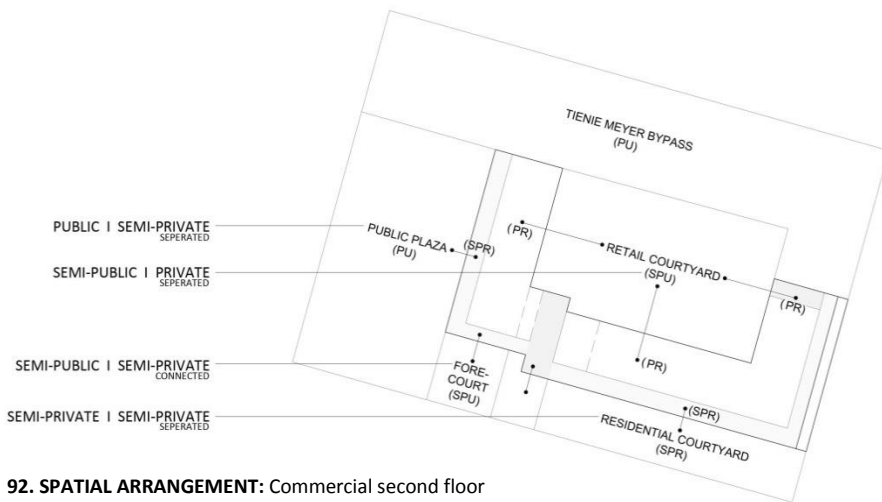
Through various experiments, two types of office spaces were created, the first floor allocated for smaller rentable tenants, the second designated for bigger. An open floor plan was designed to maximise flexibility. Circulation was used as the first horizontal privacy regulator (static), mediating relationships between different kinds of public spaces. Investigations followed into additional horizontal layering through the use of different vertical and horizontal skins (static and dynamic). Complexity emerged as different interfaces required different treatments with the introduction of social spaces amongst them.

The diagrams below illustrate the spatial arrangement and interface relationships between the offices and its surrounding spaces and the types of connections made between them. Connections are made between interior circulation (SPR) and exterior public spaces (PU) while more private office (PR) space is connected to more private external spaces (SPU).

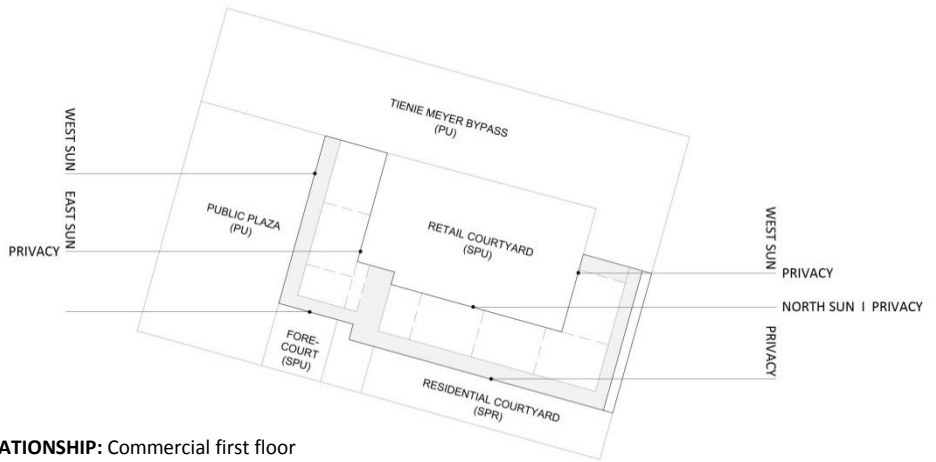
Spatial arrangement:



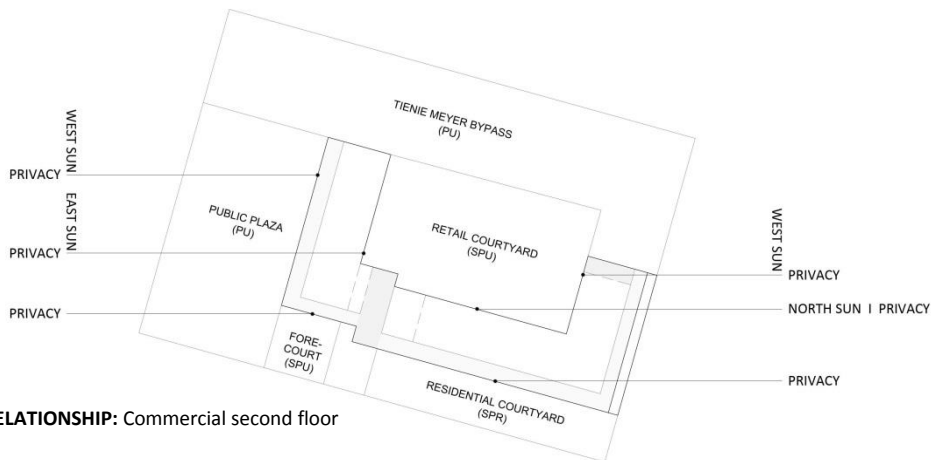
91. SPATIAL ARRANGEMENT: Commercial first floor



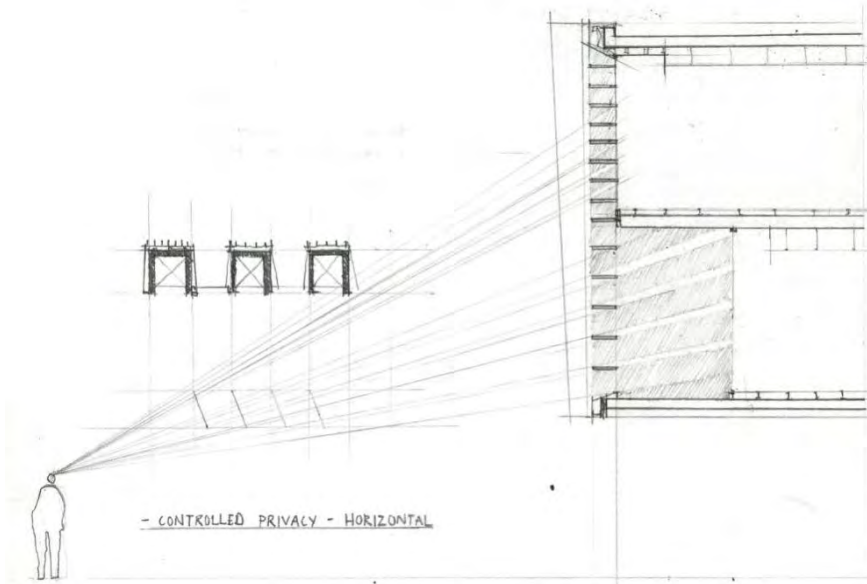
92. SPATIAL ARRANGEMENT: Commercial second floor



93. INTERFACE RELATIONSHIP: Commercial first floor



94. INTERFACE RELATIONSHIP: Commercial second floor

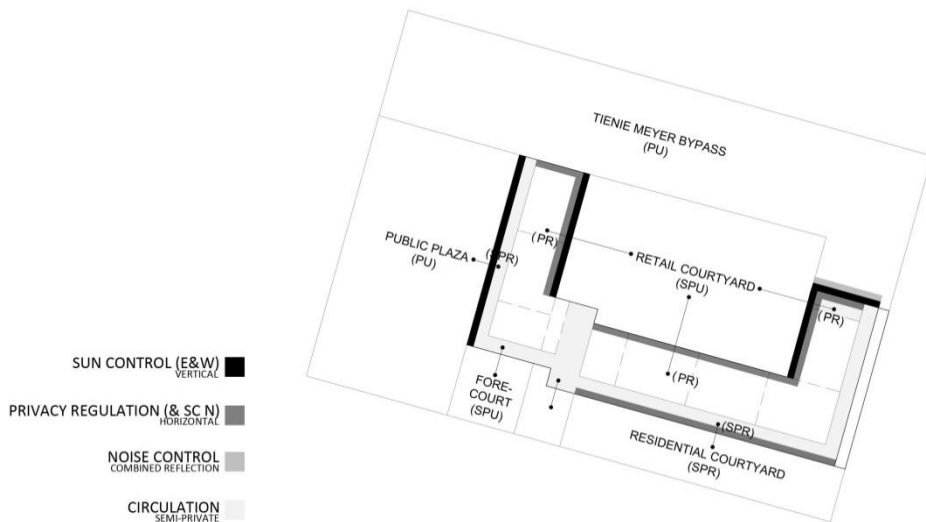


95. CIRCULATION AS MEDIATING DEVICE

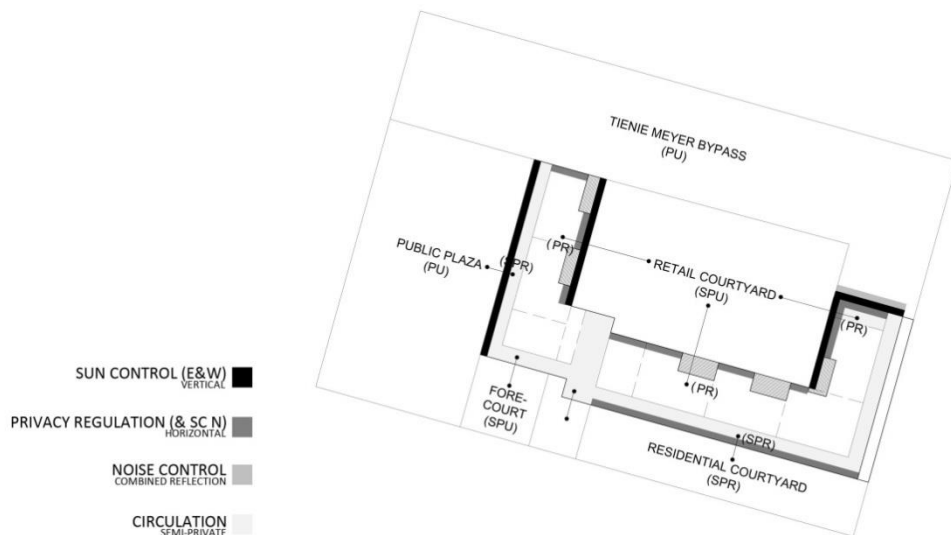
Here the focus shifts to the vertical and horizontal layering methods needed on each interface for a positive relation between inside and outside.



96. PRIVACY REGULATORS: Commercial first floor



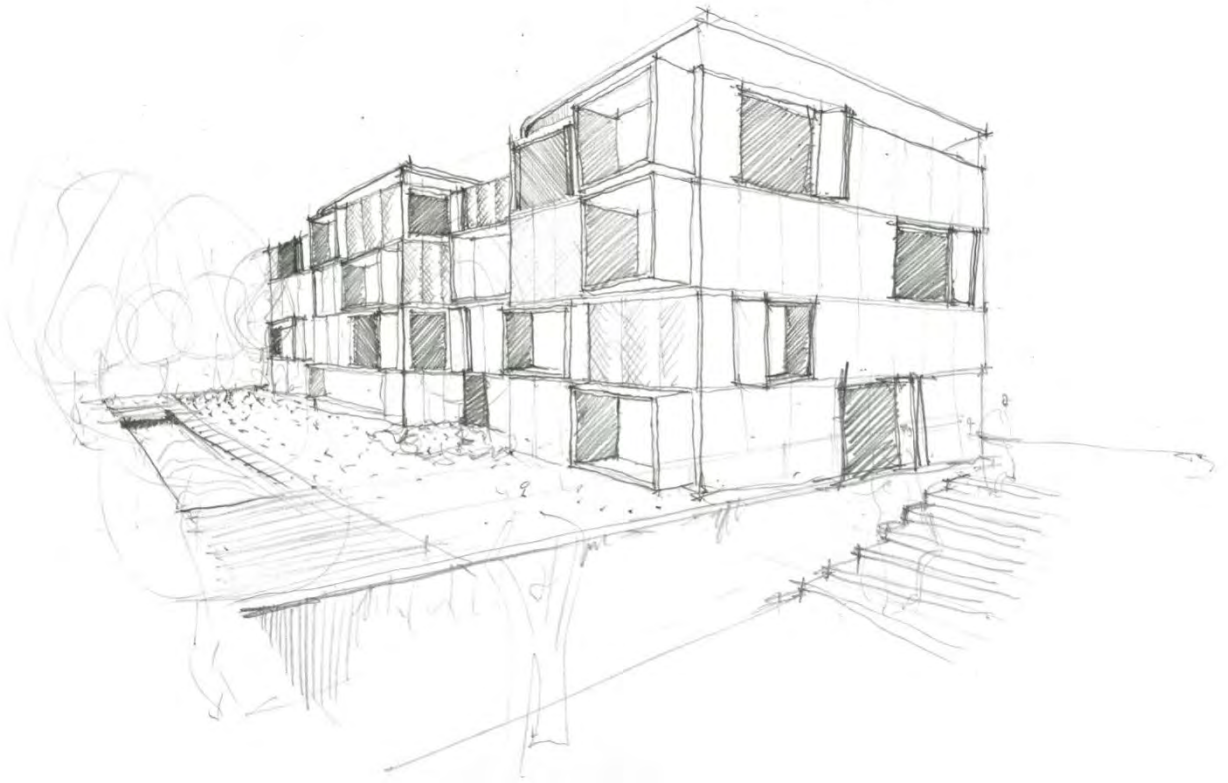
97. PRIVACY REGULATORS: Commercial second floor



98. PRIVACY REGULATORS: Introducing social spaces

Residential:

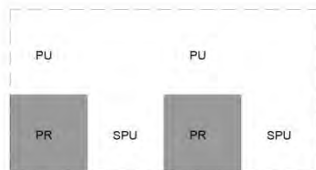
The residential component developed in a way which seeks to find balance between architecture as a buffering device while still creating different levels of positive private spaces. Circulation was used as a mediator between architecture and the active railway line, while the northern side developed in way which created opportunity for different unit typologies, each with its own unique spatial character and privacy regulators. Static privacy was created through architectural layout while the dynamic property is regulated by horizontal skin layering.



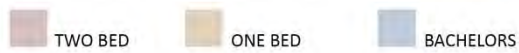
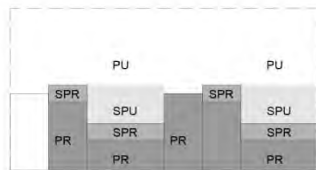
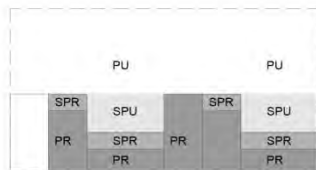
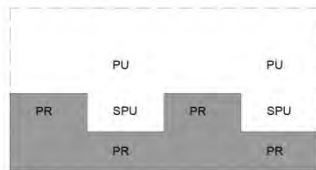
Privacy development:



UNIT TYPOLOGY ARRANGEMENT ELEV



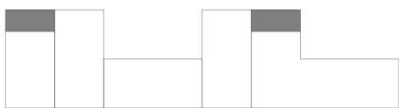
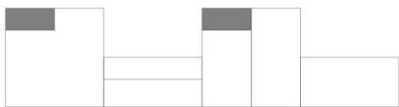
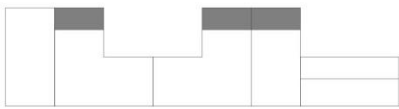
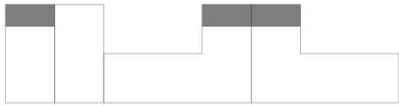
UNIT TYPOLOGY ARRANGEMENT PLANS



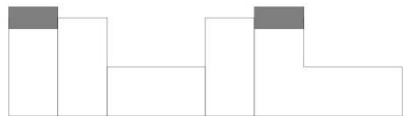
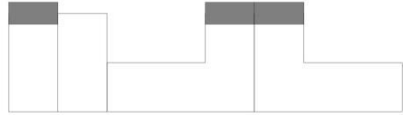
100. SPATIAL ARRANGEMENT AND PRIVACY DEVELOPMENT

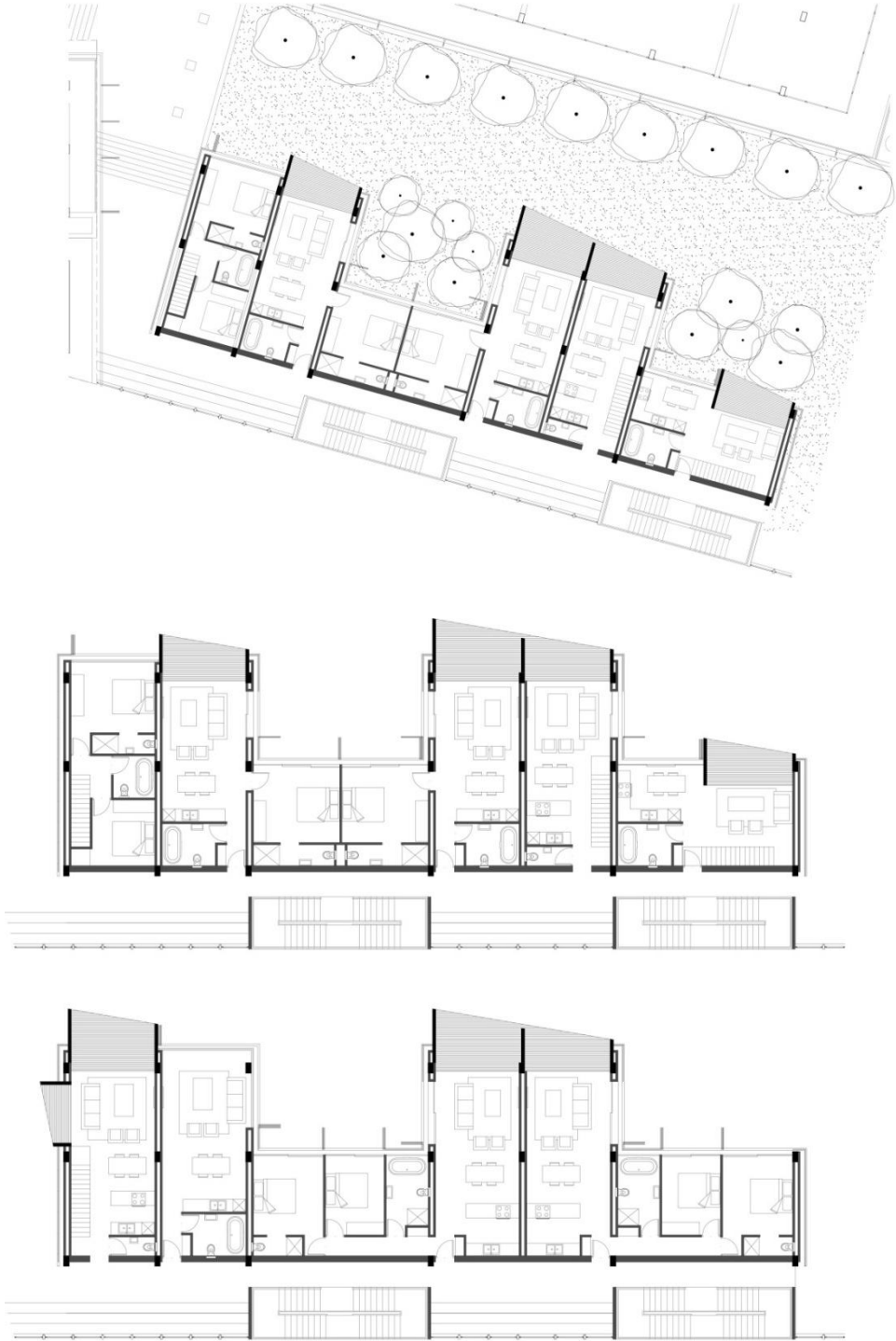
Throughout the project the social aspect has been seen as the special and in the residential design it was no different. The aim was to create a connected relationship between the balcony social spaces and the communal public courtyard (PU – PU) while providing for some privacy to the spaces outside the residential realm (PR – PU).

SOCIAL SPACE INTRODUCTION



SOCIAL SPACE EXPRESSION



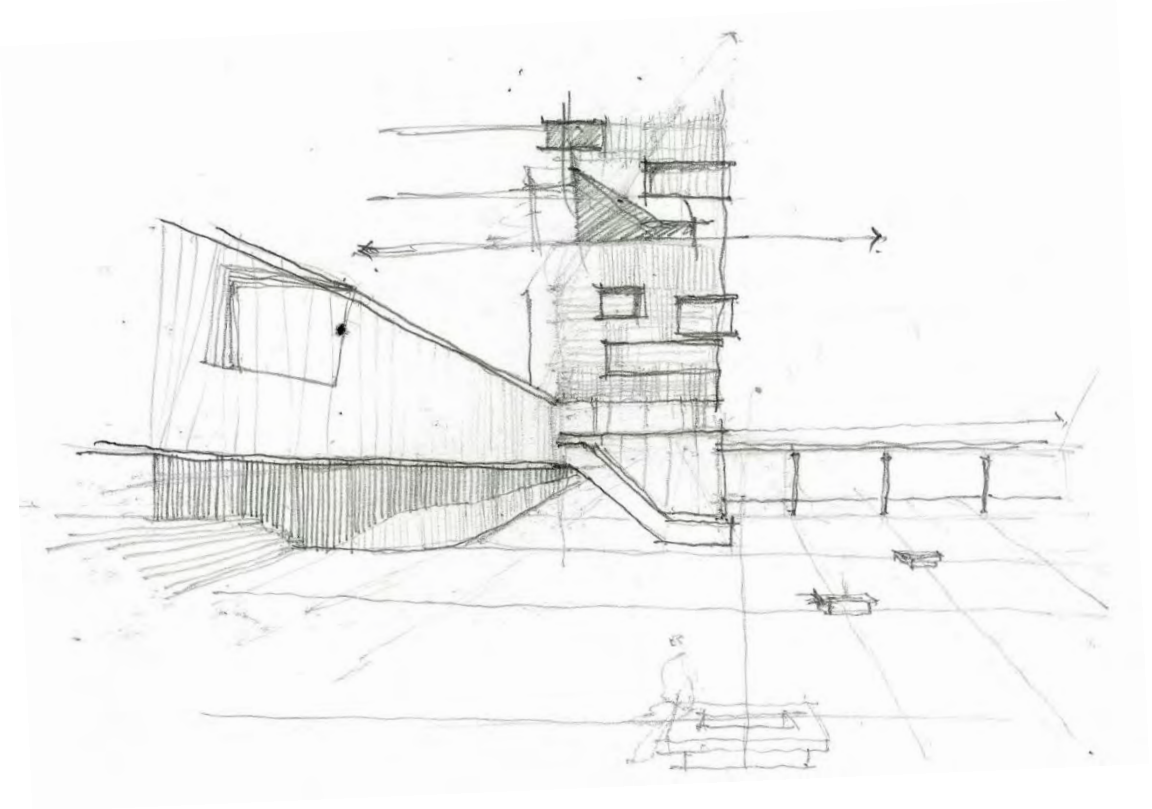


102. RESIDENTIAL PLAN TYPOLOGIES

Hotel:

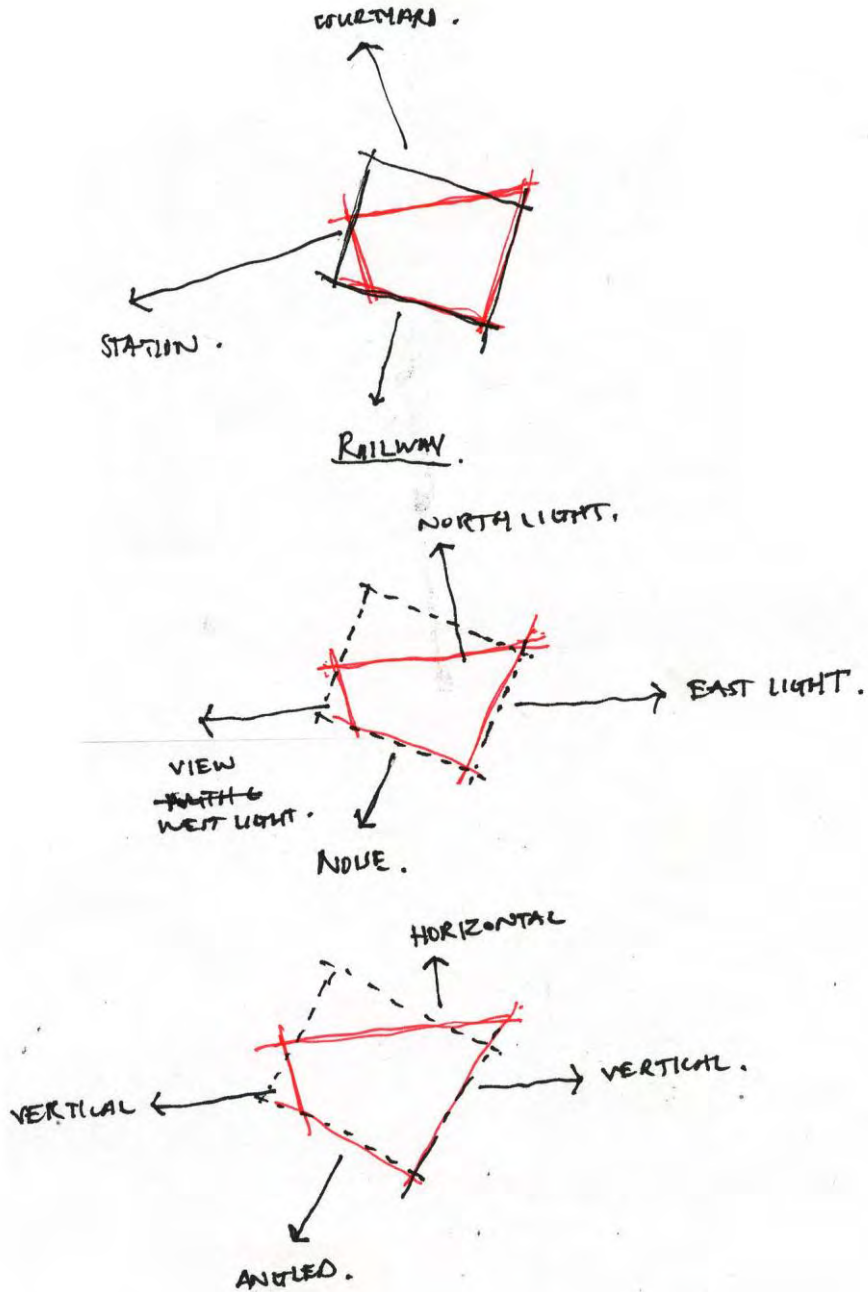
The complexity and different types of spaces in the hotel meant that architectural form were to respond differently at different levels. The public level was developed in a way which capitalised on movement patterns while upper levels responded to the public courtyard and railway station as a visual anchor. Positive relationships were created by aligning public to public facilities while more private spaces were placed at higher levels.

Because of the height of the structure, natural light was a challenge and was provided in the form of an atrium that runs vertically throughout the hotel height. Rooms were designed to face north to capitalise on natural light as well as having a better connection to the public square.

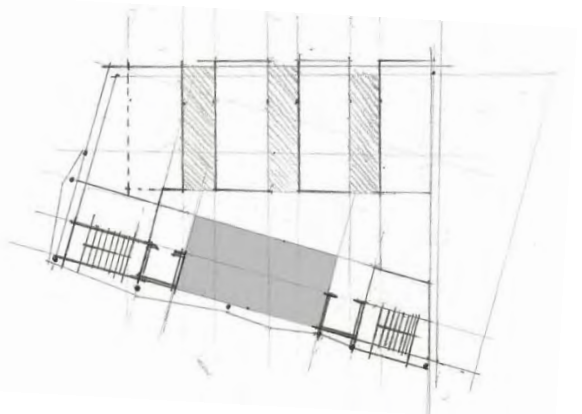
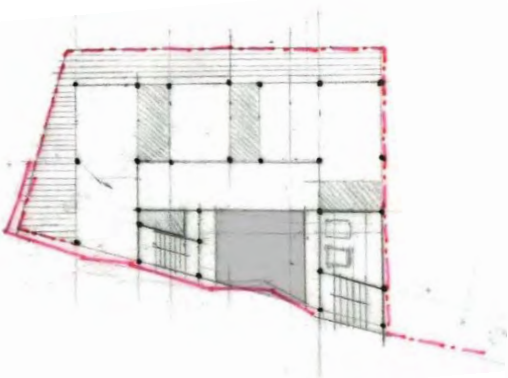
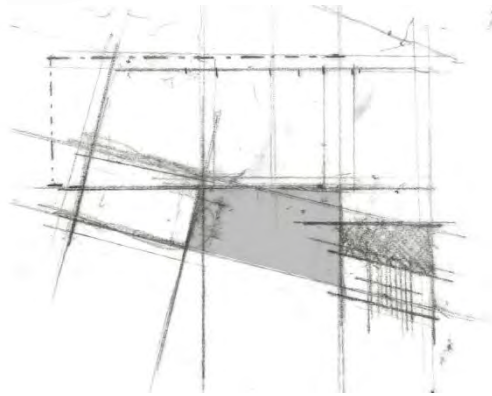
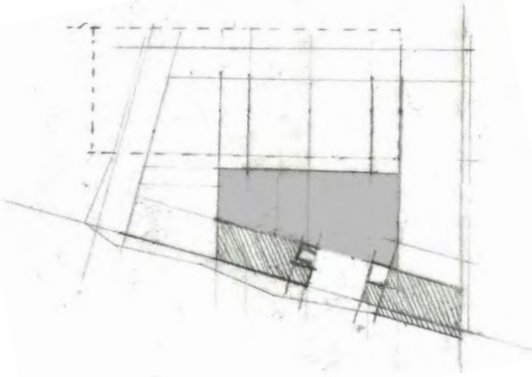
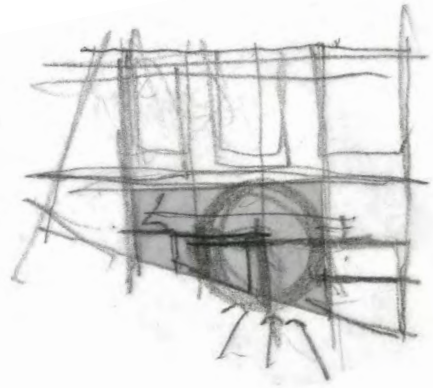


103. HOTEL: From PU courtyard

Hotel Relationship investigation:

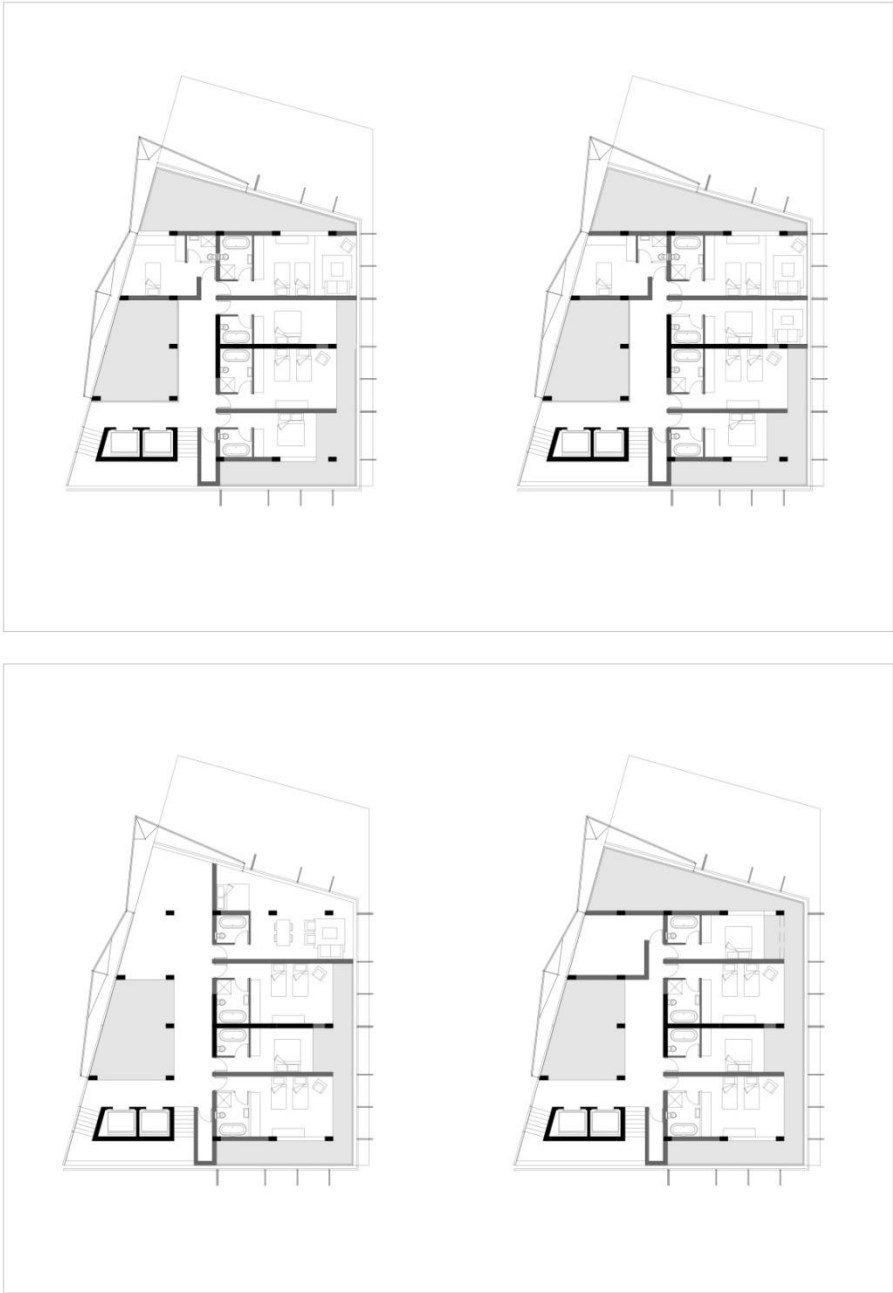


104. HOTEL PLANS: Responding to different influences



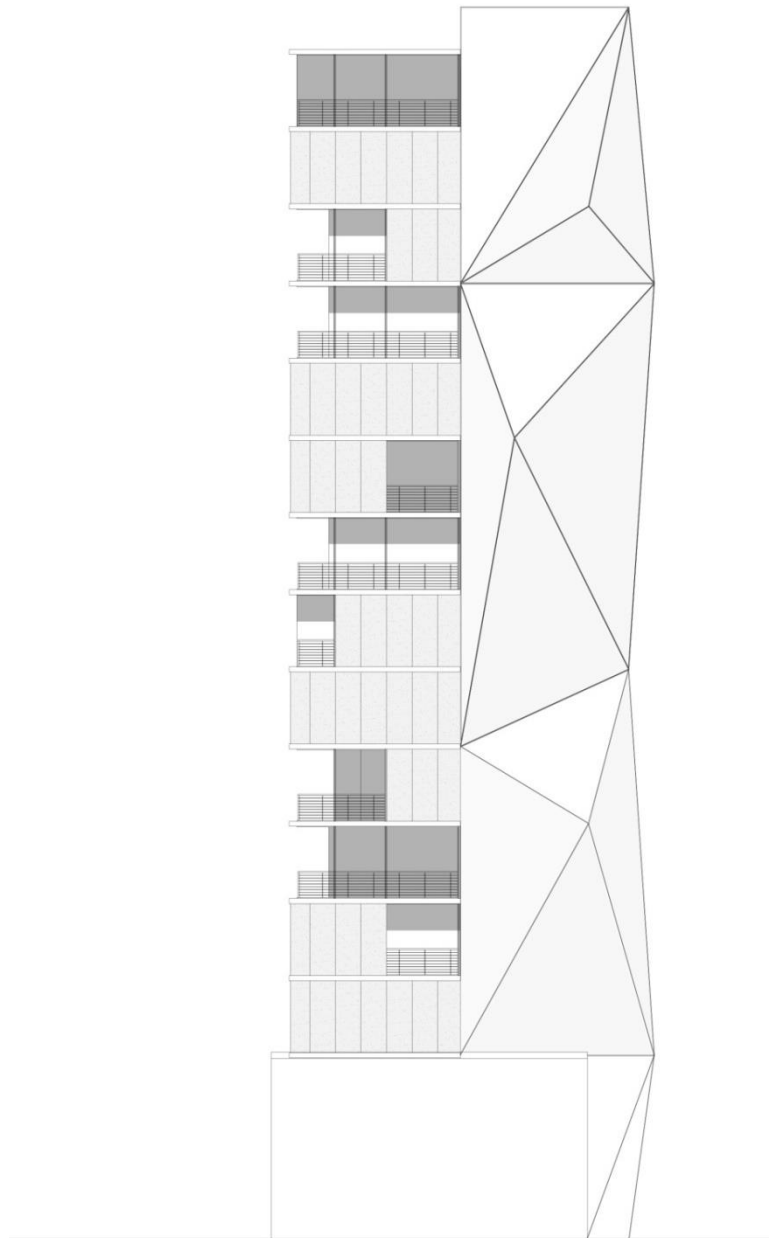
106. PLAN DEVELOPMENT

The plan provides for either one bed or two bed units, each with three different options in size to provide for different markets. This makes sense from a financial point of view as well as creating a playful facade.

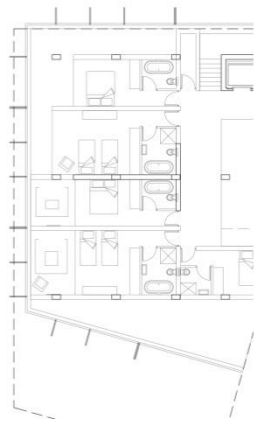
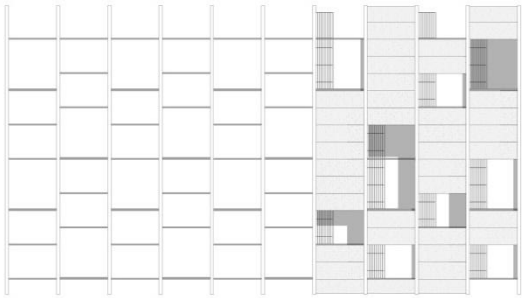
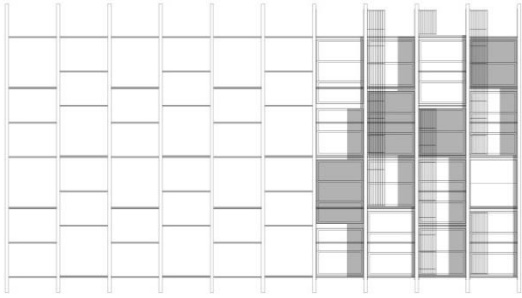


107. HOTEL PLAN TYPOLOGIES

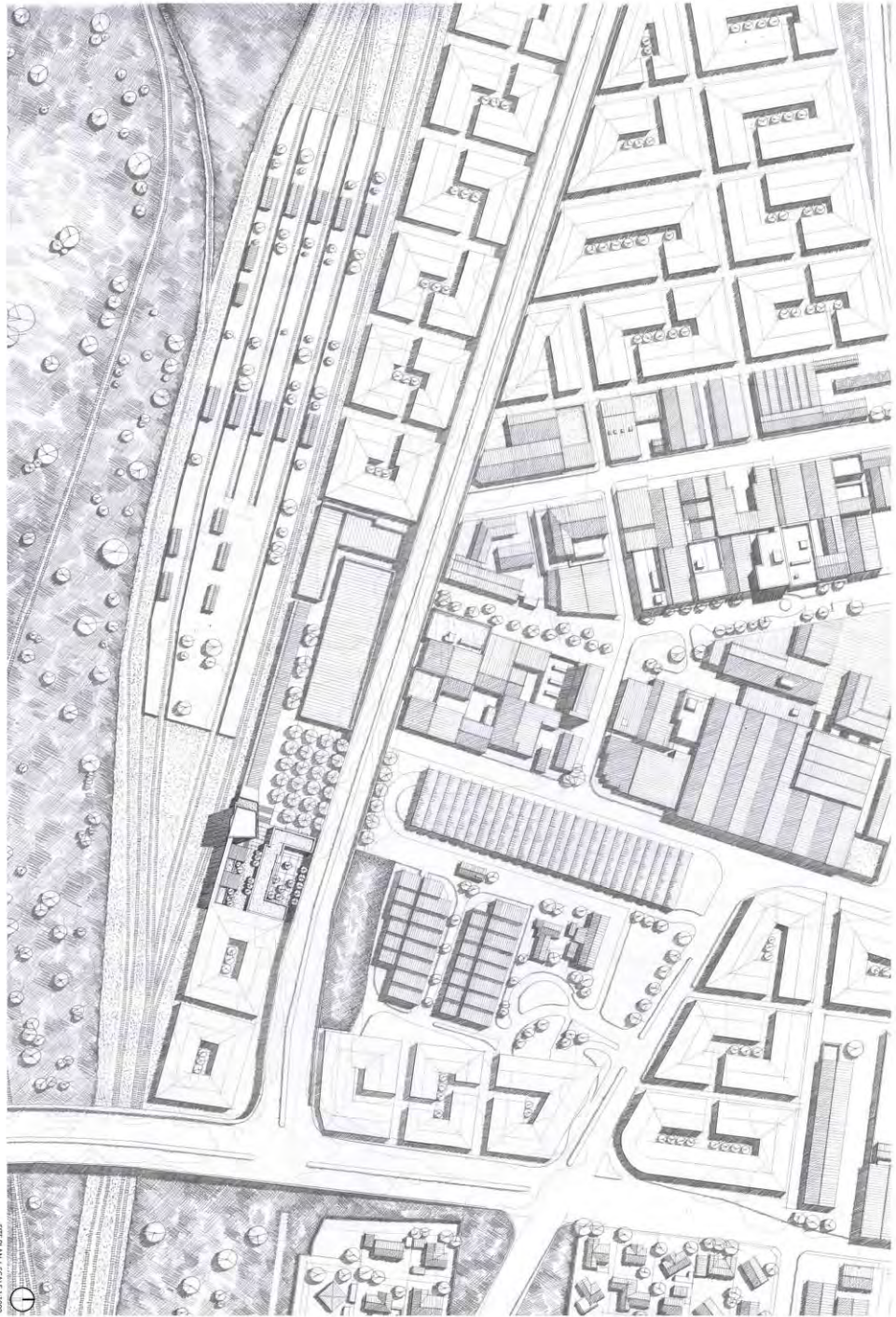
A secondary investigation was done into the skin of the hotel. The first was to the railway side expressing the presence of the railway line through static noise reflection panels while the northern edge facing the public square took on the theory of dynamic privacy with a moveable screen providing a sense of control for the occupants.



108. STATIC AND DYNAMIC: Hotel facade



109. DYNAMIC FACADE



110: SITE PLAN



111: GROUND FLOOR PLAN



SECOND FLOOR PLAN SCALE 1:200
MILLI METRE (1:2000) IMPERIAL METRE (1:2500) ARCHITECTURE

112: UPPER FLOOR PLAN



SKIN
 The building's facade is a key element of its identity, designed to be both functional and aesthetically pleasing. It features a mix of materials, including glass, metal, and concrete, which help to create a sense of depth and texture. The skin is also designed to be responsive to the environment, with features like shading devices and green walls that help to reduce energy consumption and improve air quality.



RESIDENTIAL AND HOTEL
 The residential and hotel components of the project are designed to provide a high-quality living and working environment. The residential units are spacious and well-lit, with large windows and balconies that offer views of the surrounding area. The hotel is a modern, multi-story building with a mix of room types and amenities, including a restaurant, bar, and conference facilities.



OFFICES
 The office spaces are designed to be flexible and collaborative, with a mix of open-plan areas and private offices. They are well-lit and have access to natural light, which is important for productivity and well-being. The office building also features a central courtyard and a range of amenities, including a gym, lounge, and meeting rooms.



RETAIL AND HOTEL
 The retail and hotel components are designed to be integrated and complementary. The retail spaces are located on the ground floor and are designed to be easy to access and navigate. The hotel is located on the upper floors and is designed to provide a high-quality stay for guests.



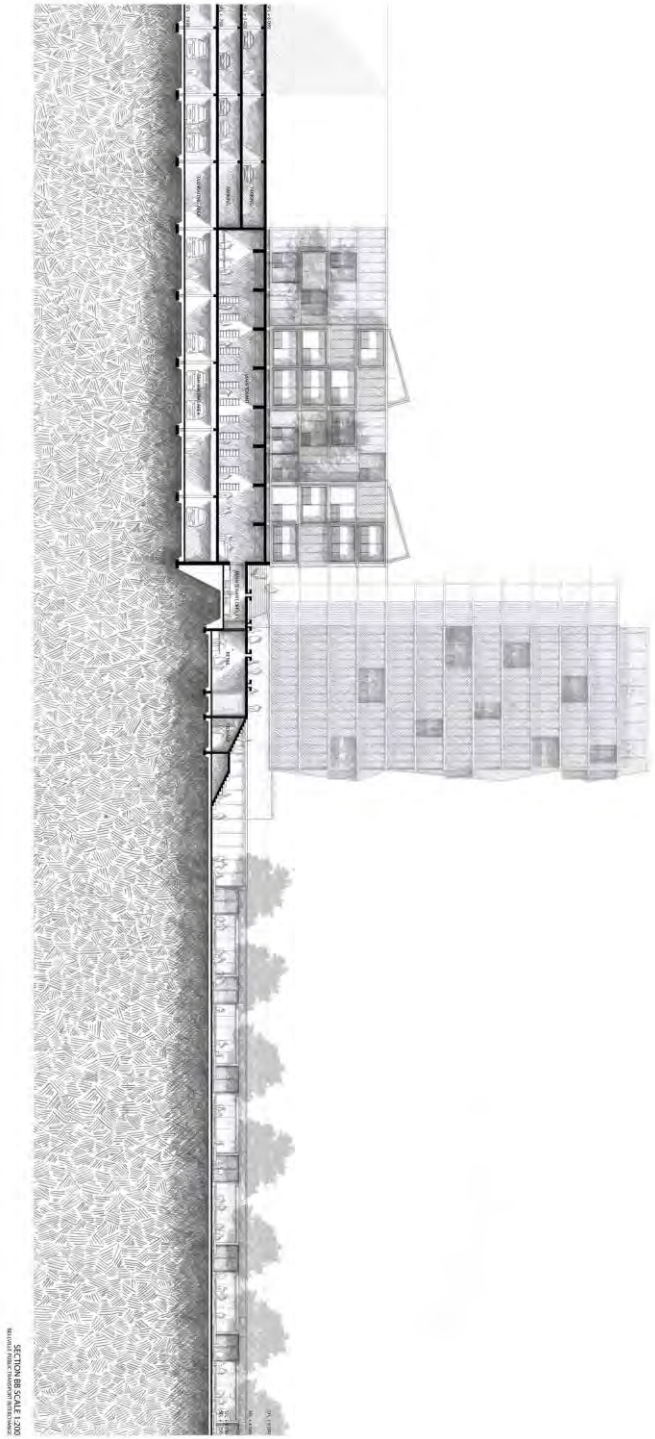
TAXI PARKING
 The taxi parking area is designed to be a convenient and secure place for taxis to wait for passengers. It is located near the main entrance of the building and has a large, open-plan ground floor that is easy to access and navigate.



SITE
 The site is a prime location for the project, with excellent access to public transport and major roads. The building is designed to be a landmark structure that will enhance the surrounding area and provide a high-quality environment for its users.

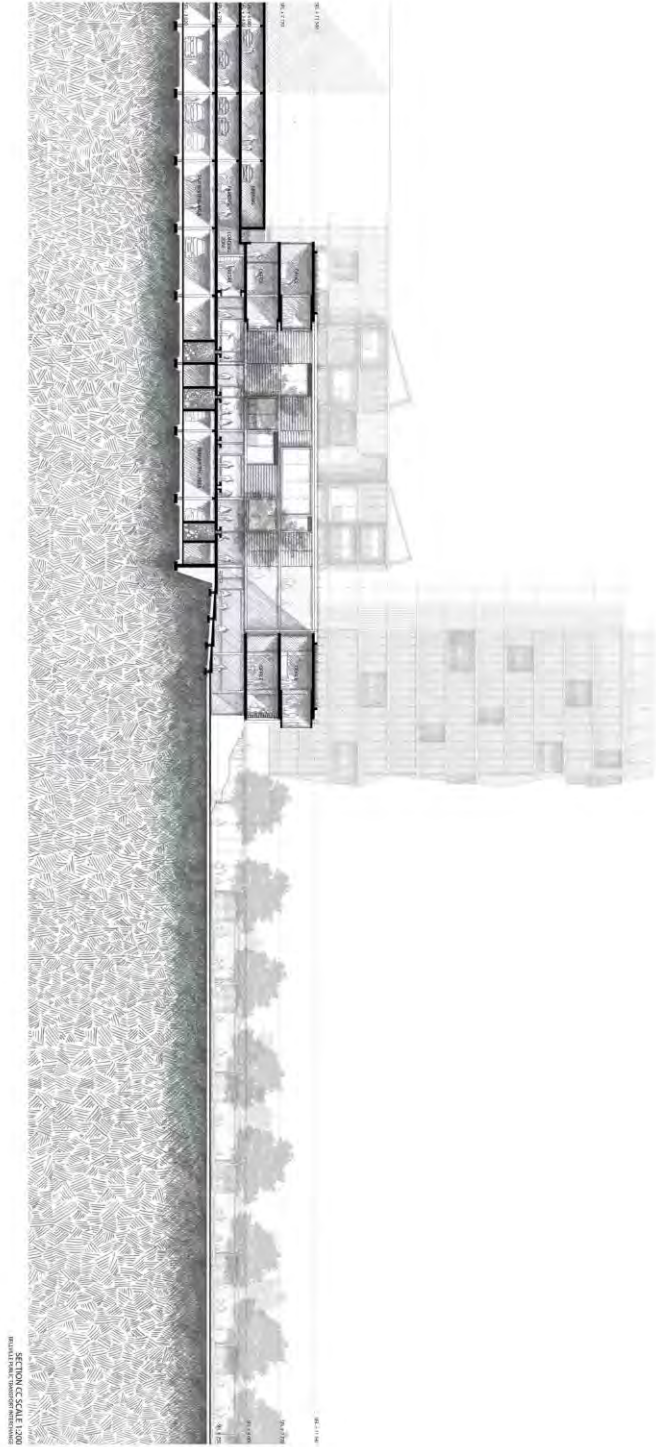


LAYERING ANALYSIS

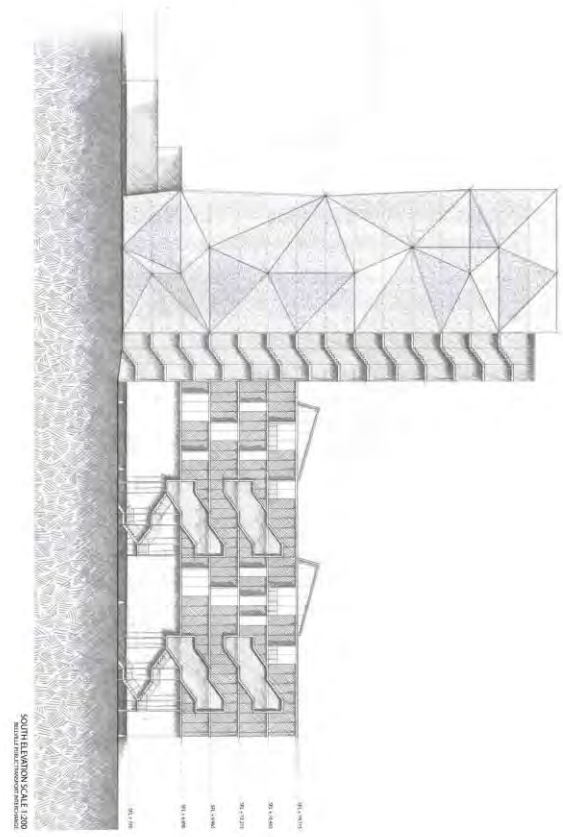
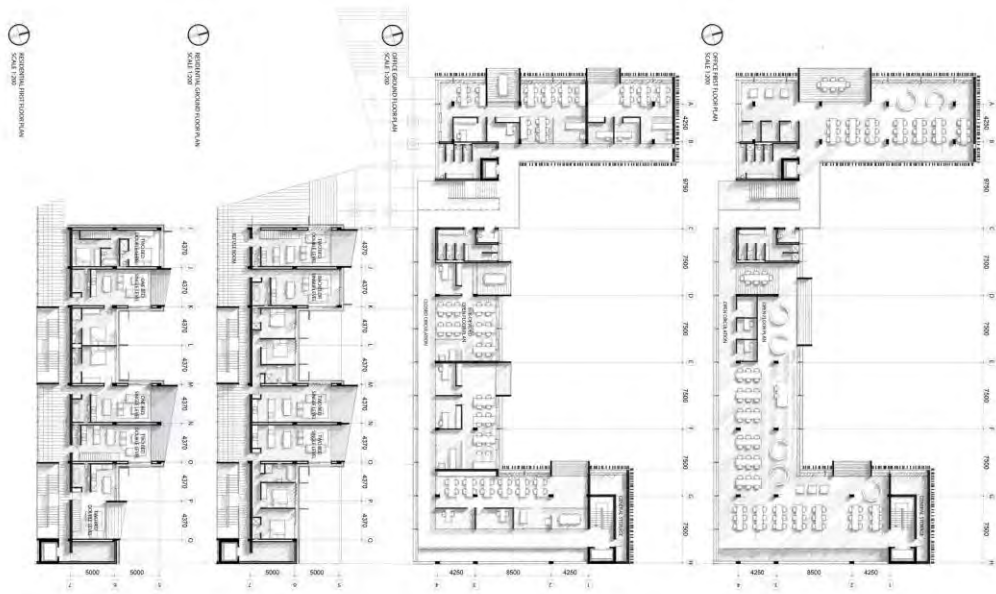


SECTION 02
1:100

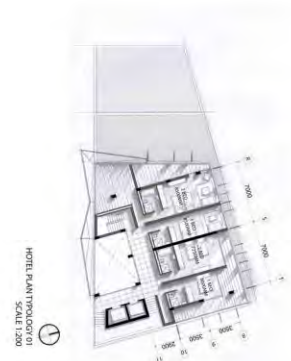
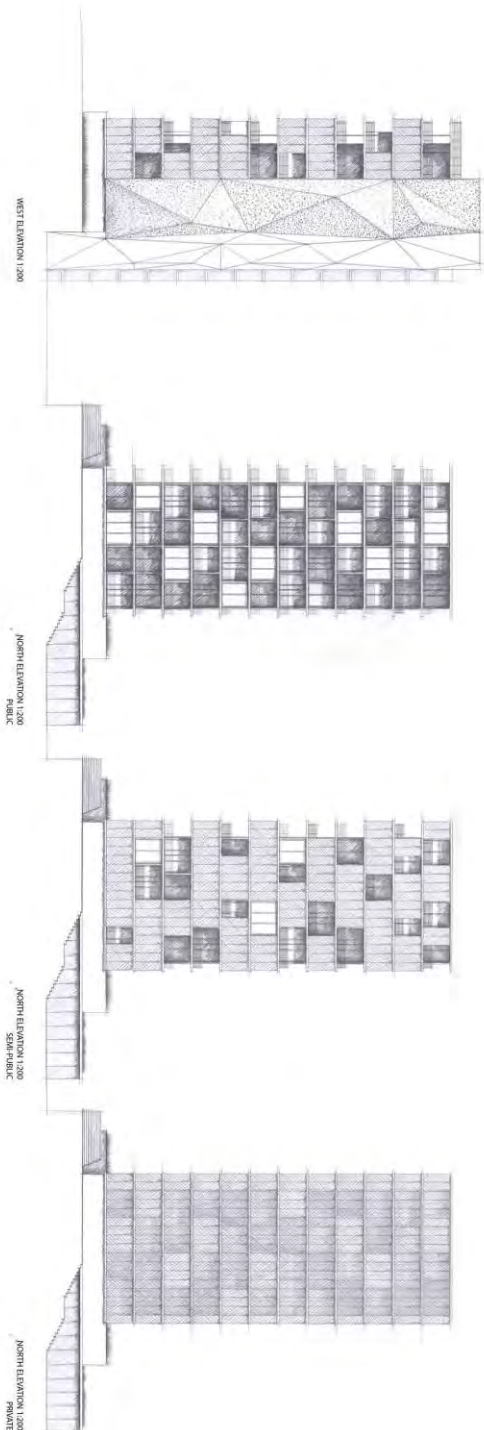
115: SECTION 02



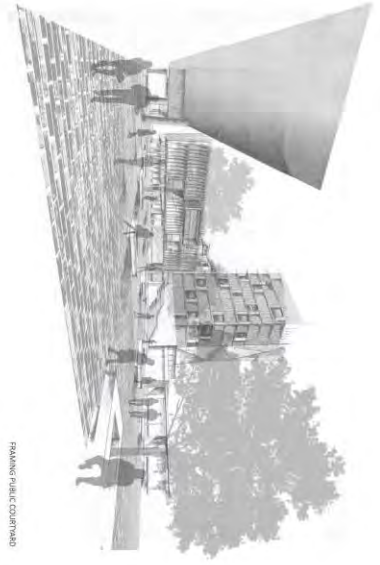
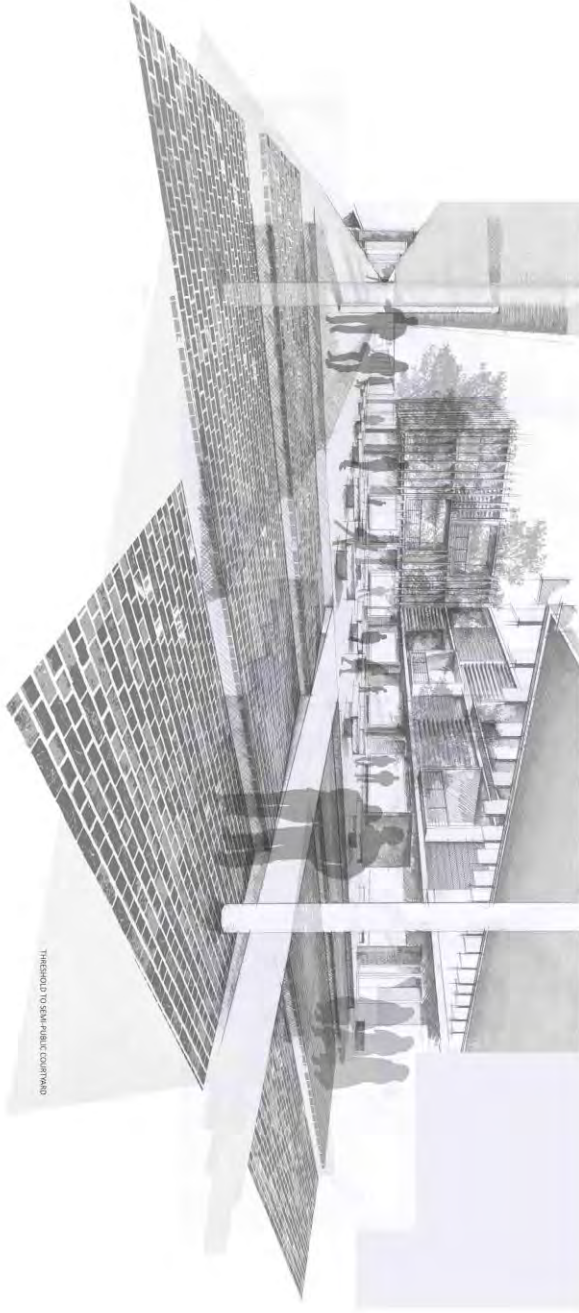
116: SECTION 03



118: RAILWAY ELEVATION



119: HOTEL PLANS AND ELEVATIONS



122: THREE DIMENSIONAL INVESTIGATION

CONCLUSION

The document argues the importance of architectural contribution in a city which aims to radically increase the use of public transport. The contributions that architecture offers are fundamental to the success of the Bellville Public Transport Interchange, and it does so through different kinds of architectural layering methods. Through research and different investigations the project successfully deals with numerous complexities within a transport precinct and aims to strengthen the argument for the implementation of a Transit-Oriented Development strategy within the Bellville Public Transport Interchange precinct, with the addition of architecture within this theory. It is through this approach that the BPTI will become a successful precedent for future projects of similar nature.

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Images

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11. TRANSMISSION COEFFICIENT VALUE TABLE

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