University of Pretoria

DIT 801 MINI DISSERTATION:

Exclusion, emergence & mobility:

A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs

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2023-07-24

Exclusion, emergence & mobility: A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs.

Declaration of originality

I declare that the mini-dissertation, “Exclusion, emergence & mobility: A critical spatial assessment of inequality within Hatfield revealing potential for stations as socio-economic integration hubs”, which has been submitted in fulfilment of part of the requirements for the module of DIT 801, at the University of Pretoria, is my own work and has not previously been submitted by me for any degree at the University of Pretoria or any other tertiary institution.

I declare that I obtained the applicable research ethics approval in order to conduct the research that has been described in this dissertation.

I declare that I have observed the ethical standards required in terms of the University of Pretoria’s ethic code for researchers and have followed the policy guidelines for responsible research.

Signature: 

Date: ……2023-07-23……

Exclusion, emergence & mobility: A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs.

Abstract

Spatial inequality in urban regions of Gauteng, South Africa remains reminiscent of the apartheid era, with marginalized communities pushed to the peripheries, excluded from core socio-economic opportunities, and restricted by the shortcomings of the public transport system. Emergent networks like mini-bus taxi transport and informal trade evolved to circumvent these shortcomings and challenge inequality.

This study focused on public transport gateways and interfaces, particularly the Metrorail, which is understudied despite its significance for the urban poor. The research took place in Hatfield, Pretoria, and revealed exclusion and inequality by examining the interactions between hard and soft infrastructure, influencing spatial organization and socio-economic networks associated with public transport infrastructure.

The study aimed to uncover how transport infrastructure perpetuated exclusion, informing opportunities for socio-economic transformation and equitable transport infrastructure development. It did so by assessing the extent to which the current infrastructure facilitated socio-economic upliftment for marginalized communities and the integration of associated emergent networks.

Within a qualitative grounded theory approach, the method followed an iterative, multi-scalar design. Interviews, observations, and desktop studies informed the socio-spatial mapping and "lifeworld" sketching analysis, comparing the Metrorail and Gautrain, while examining the taxi and trading networks for integration opportunities and transformation potential. Critical analysis of the interactions between hard and soft infrastructures uncovered instances of exclusion and inequality.

The findings revealed that the Metrorail does not fully support socio-economic development for its users and associated networks. However, potential areas for transformation were found in the informal adaptation of hard infrastructures around the station. Comparing with the Gautrain identified gaps and integration possibilities. The taxi network analysis showed opportunities for informal systems to be adopted into the formal transport sector. The findings shed light on inequalities and suggested transformative interventions for addressing socio-economic exclusion and promoting equitable urban development.

This study highlighted the importance of conscious efforts in future transport-oriented developments to foster emergence, integration, vibrancy, and multi-functionality.

Key words:

Spatial inequality, public transport infrastructure, emergence, socio-economic transformation

Exclusion, emergence & mobility: A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs.

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1 Introduction

Current spatial inequality in the urban regions of Gauteng bears much resemblance to that of the apartheid era (Ndwandwe and Gumbo, 2020:988). Similarities between past and present settlement patterns manifest through the spatial exclusionary development decisions made by the government. The impacts are especially felt by marginalized communities forced to settle on the peripheries, away from the core metropolitan areas' socio-economic opportunities (Mosaine, 2021: 540). The remnants of the Apartheid system persist today, perpetuating both inequality and exclusion. Notably, the present manifestation of this system primarily revolves around class distinctions rather than being solely based on race (Mosaine, 2021: 540).

Currently, the state's investment focuses have begun to shift towards public interest and socio-economic transformation (Mosaine, 2021: 541). However, it can be argued that the skewed investment and favouring of private and "elitist" development is still producing exclusionary effects on marginalised populations (Mosaine, 2021: 541). Disproportionate development has led to the concentration of most socio-economic opportunity within city centres, at the detriment of the peripheral areas (Mosaine, 2021: 54). The railway system, developed within the apartheid era, has had a restricting effect on the mobilisation of socio-economic transformation of these marginalised communities due to their spatial limitations. Based on this premise, the macro-scale analysis of this study focuses on the socio-economic exclusion and marginalization experienced by commuters residing in peripheral areas.

This restricting effect of railway infrastructure, coupled with the great distances between and inaccessibility of segregated settlements, has given rise to emergent networks like mini-bus taxi transport and informal trade. These networks have evolved to adapt and circumvent failures of the state to overcome inequality (Olsson and Haas, 2013: 95).

Conversely, railways possess significant potential in fostering the development of urban areas by increasing their reach and accessibility. Globally, there are many examples where rail infrastructure facilitates access to a variety of economic and social infrastructures of cities. If appropriately developed and operationalised, there is potential to transform urban apartheid buffer zones and their divisive infrastructures.

This study shall be situated in the context of Hatfield, Pretoria, South Africa (SA) and shall focus on public transport gateways and urban interfaces. Instances of social exclusions shall be compared and revealed through interrogating spatial organisation and designation around railway sites in Hatfield. The focus of investigation centres on the Metrorail and its potential as a multi-functional site of integration and socio-economic upliftment. The Metrorail is significant as many low-income users rely on the infrastructure for affordable access to areas of greater socio-economic opportunity. However, its full potential is currently not being reached (Ndwandwe and Gumbo, 2020:991-992).

A critical analysis of the interactions between hard and soft infrastructure can reveal instances of exclusion and inequality (Rubin *et al*. 2020:164). Through the lens of critical urban theory, one can assess the extent to which socio-economic transformation is either limited or promoted in some cases. An investigation shall be conducted to determine the degree to which the Metrorail station presently functions as an integrative hub for socio-economic upliftment of users from marginalised communities and associated emergent networks.

The aim of this investigation is to critically assess how effectively railway and associated taxi systems within Hatfield serve marginalised communities, uncovering opportunities for socio-economic integration and the facilitation of emergence.

2 Background

The following background shall contextualise the study within its historical context and the current urban issues concerning inequality in relation to mobility infrastructure. It is structured into two parts, namely factors perpetuating inequality, and potential opportunities for equitable urban integration.

2.1 Historical background and context of the study

2.1.1 Factors perpetuating inequality

2.1.1.1 Spatial manifestations of inequality rooted in apartheid

Currently, the spatial forms inherited from apartheid, are still hindering socio-economic development and transformation (Ndwandwe and Gumbo, 2020:988). Marginalised communities are forced to resign to past apartheid infrastructure and spatial organisation developed for restriction and then bear the responsibility of having to adapt (Mosaine, 2021: 540).

Metrorail

The railway infrastructure, within which the Metrorail operates, was historically used to transport black labourers from the peripheries to work within the core economic metropolitan areas. It formed an integral role in perpetuating the segregation and marginalisation of Apartheid through regulating and limiting the movements of non-white occupants into urban areas (Lucas, 2010:6). This resulted in control over labour flows and material, for capitalisation. The restricting impact of Apartheid legislation manifested through control of access to specific non-white peripheral areas such as Mamelodi, Mapbopane, Soweto and others. Additionally, many homelands and bantustans were entirely excluded from the railway line's reach (Lucas, 2010:6) (Mosaine, 2021:544). These measures were implemented by the apartheid government to limit the number of non-white residents accessing the opportunities of urban areas.

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During apartheid, black Africans were forced into navigating the unfavourable conditions of the railway systems such as overcrowding, too few trains, and inconvenient or inaccessible platforms (Pirie, 1992:672) (figure 1).

Figure 1: Image taken in 1967 showing the overcrowding on the trains (Cole, 1967: Online).

Figure 2: Overcrowding on the Metrorail trains in 2016 (Bega, 2016: Online).

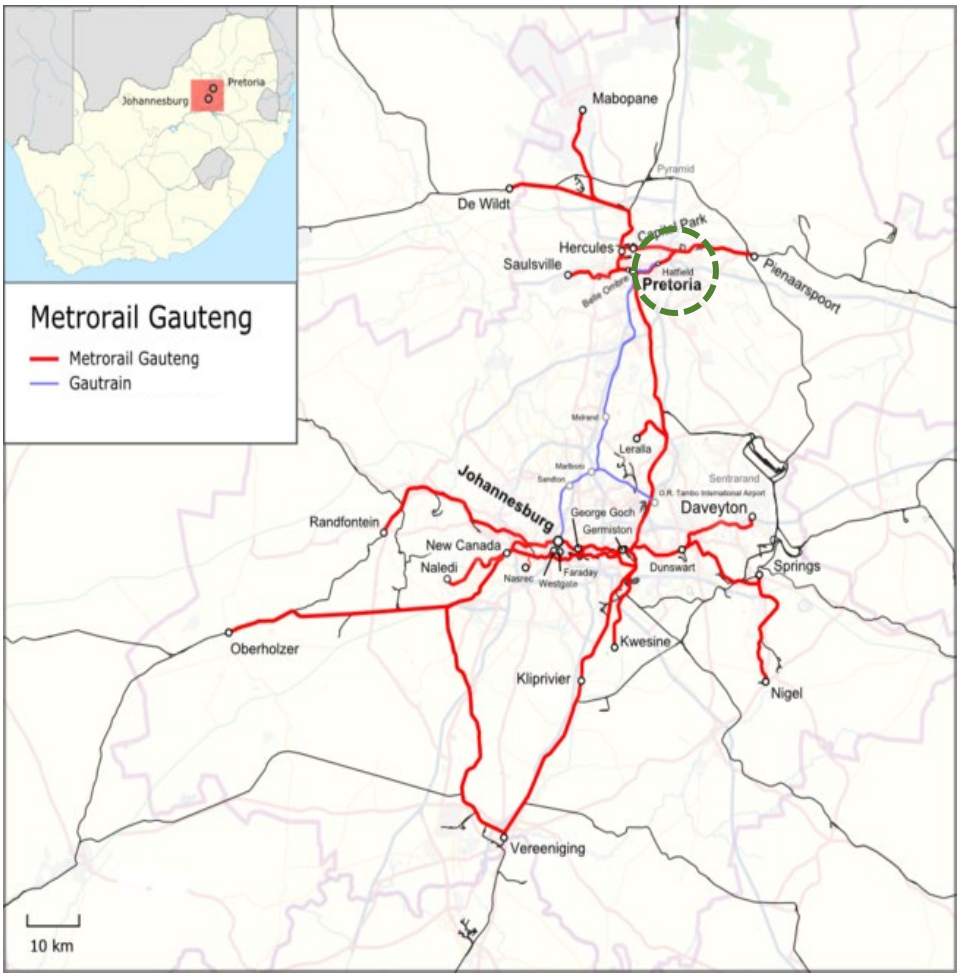

Figure 3: Map showing Metrorail routes and Gautrain routes in Gauteng (Unknown, 2016: Online).

Although a system of control and degredation, one must also consider, the railways' connective potential through it's limited, but, large reach. The railway currently connects urban zones, industial zones, and historically white and non-white areas (figure 3).

Minibus taxis as an emergent system challenging spatial divide

Figure 4: Diagram showing the relocation of individuals to the peripheries (Schouland:2010)

Due to the forced removal of the black population to the peripheries, as seen in figure 4, a need for a more flexible transport system arose (De Beer, 2019:20). The limited reach of the railway to homelands and bantustans, coupled with the steady disinvestment of state infrastructure in the 1980's (Lucas, 2010:7), informed the development of the mini-bus taxi industries. The minibus taxi industry allowed black labourers to reach their places of work and facilitated access to sites not reached by train (De Beer, 2019:20).

The informal economy

The formation of the informal economy within South Africa stems from past apartheid political and economic repression of black individuals (Motala, 2002:9). Restrictive legislation on mobility and property rights lead to skewed urban development, therefore, innovative methods of income generation were needed (Motala, 2002:9).

2.1.2 Opportunities for equitable urban integration

2.1.2.1 Emergent urbanism & informality for challenging exclusion and inequality

Spatial division and limited acces to opportunity has lead to the emergence of alternative networks, like the mini-bus taxi system, as a solution to circumvent the limitations of the railway system and adapt to core infrastructural failures. These emergent processes of structural change can influence landscape regeneration (Olsson and Haas, 2013: 95) (Mosaine, 2021: 538). This study, therefore, adapts an emergent urbanist approach in order to understand these everchanging cultures and happenings of the city (Olsson and Haas, 2013: 101).

Informality

Dovey (2012:349) defines informality as focussed on entrepreneurial flexibility and the ability for adaptation. Informal practices are often in contrast to urban regulation (Dovey, 2011,2014). Pieterse (2009:2) further supports the definition of informality as, activities occurring outside of the state's control.

Following the approach of Dovey (2012) and Schnachtebeck (2017), this study shall investigate how informality addresses the spatial injustices of a city and its significance. The need for these networks, therefore, reveals the inequalities attempting to be addressed.

2.1.2.2 Transport orientated development for challenging inequality in architecture and urban design

Investment in public transport infrastructure can facilitate the growth of surrounding local businesses and small-scale entrepreneurship as well as facilitate easier multi-modal transport (Ndwandwe and Gumbo, 2020:987).

South Africa (SA), since 1994, has placed socio-economic transformation at the forefront of development principles (Ndwandwe and Gumbo, 2020:988). However, the SA government has continued to produce policies which appear to be beneficial, but, in reality, have a limited impact on the everyday lives of its users and connected networks (Ndwandwe and Gumbo, 2020:988). The need exists for public transport infrastructure development which prioritizes spatial strategies that facilitate socio-economic transformation and integration to create realistic solutions for communities (Ndwandwe and Gumbo, 2020:988).

Transport-oriented development (TOD), therefore, becomes the key approach to achieving transformation and challenging segregation (Ndwandwe and Gumbo, 2020:988)(Mosaine, 2021: 538). TOD can lead to significant changes in the livelihoods of ordinary everyday users, by providing affordable access to urban areas for people to earn incomes, access education, healthcare, services, resources and other opportunities (Mosaine, 2021: 538).

2.2 Urban issues

2.2.1 Inequality at a macro scale

The extreme segregation inherent in South Africa's spatial forms necessitate its urgent redress and transformation (Ndwandwe and Gumbo, 2020:987). The historical apartheid-based pattern of laborers commuting via public transport from areas with limited formal economic opportunities continues to persist today. Marginalised communities are still disproportionately affected by spatial organisation inequality due to limited access to public transport options. Their access to the resources and opportunities within the urban core remains governed by often unreliable public transport systems such as the Metrorail (Mosaine, 2021: 537) (Lucas, 2010:6).

Metrorail

Post 1994, much capital has gone towards semi-privatised investment of elites such as the Gautrain systems (Mosaine, 2021: 541). The state subsidy for PRASA had been scaled down by 50%, causing schedules to be reduced by 20% and the number of operational trains to also decrease (Mosaine, 2021: 548). PRASA has since embarked on renovating its train stations and begun renting spaces out to bus companies, informal traders, and other networks.

(Mosaine, 2021: 548). The specific execution and implications of this are explored on a micro-scale particularly at Rissik Station further on. The upgrades and leasing of space suggests an initial consideration for the role of stations as facilitators of socio-economic transformation, however, recent interviews and social media comments (appendix 7 and 9) by users suggest overcrowding, train delays and a lack of trains remains an issue, much like apartheid times (Pirie, 1992:672).

Spatial exclusion on a macro-scale, coupled with the Metrorail's unreliability has resulted in emergent systems, such as informal trade and taxis, arising to address the often-overlooked needs of communities (Mosaine, 2021: 537).

Informal trade

Income disparities, poverty, and difficulty entering the formal employment sector has led to informal trading becoming the most viable income source for the urban poor and disadvantaged populations (Ndwandwe and Gumbo, 2020:989).

Therefore, mechanisms must be created to facilitate the legal operation of these actors around sufficiently designed station nodes to promote integrated socio-economic upliftment (Ndwandwe and Gumbo, 2020:989). Although a significant sector, the informal economy has barely benefitted from the installment of the updated public transport systems in Pretoria such as the Gautrain in 2011 and the recent update of the Metrorail (Ndwandwe and Gumbo, 2020:989).

Mini-bus taxis

Taxis are more convenient than Metrorail as they are often faster, with more flexible stops depending on the commuters' needs, however, as discussed in interviews and informal conversations, they pose safety concerns and are less affordable (appendix 4) (Mosaine, 2021: 547). It is trade-offs like these that marginalised communities must negotiate daily because of limited transport availability, affordability, and distance.

2.2.2 Macro-meso scale: Exclusion within Hatfield

In South Africa, the development of the Integrated Rapid Public Transport Networks initiative led to the introduction of both the Gautrain and Bus Rapid Transit (BRT) systems within Hatfield (Ndwandwe and Gumbo, 2020:988). Low-income earners residing in isolated townships are still the most affected by spatial fragmentation, with little positive impact made on their livelihoods through the development of the Hatfield Gautrain station in 2011 and the Areyeng BRT system in 2014 (Ndwandwe and Gumbo, 2020:988). The Metrorail remains the most viable, affordable option for low-income users, however, current issues still limit their use of this system as described above.

Travel poverty

These users are often forced to sacrifice almost a third of their income on transport due to the large distances of their commutes (Ndwandwe and Gumbo, 2020:989). The additional need to use multiple forms of transport for one trip (multiple fares) hinders access to economic opportunity and maintains poverty, further exacerbating inequality. This is primarily attributed to a lack of modal integration and no option for single-fare travel (Ndwandwe and Gumbo, 2020:989). The term “travel poverty” is used to describe such occurrences (Lucas, 2010:2).

Criteria for assessment of exclusion on a macro-meso scale

Lucas (2010) identifies four key underlying factors facilitating transport exclusion and disadvantage in the South African context. These criteria, tailored to this study, form the basis for evaluating the exclusion of marginalised communities and the perpetuation of “travel poverty”.

The criteria for investigation include:

-Affordability

-Accessibility to public transport

-Over reliance on taxis

-Various physical or legislative hindrances

Within the context of this study, the reference to “marginalised communities” may refer to people commuting from previously segregated neighbourhoods through the lens of apartheid spatial planning such as Mamelodi or Atteridgeville. Occupants of said “marginalised communities” often remain disadvantaged and face considerable financial and physical limitations, of which mobility infrastructure plays a significant role in either restricting or facilitating access to areas of socio-economic opportunity (Lucas, 2010: 18).

2.2.2.1 Missed opportunities within Hatfield

This study focuses on the Metrorail Rissik station and associated emergent networks (informal trade and taxis) to identify opportunities for improved integration and inclusivity of marginalised or disadvantaged user groups. For comparison purposes, the Hatfield Gautrain station is investigated to better understand forms of urban exclusion and inequality. This manifests as a meso-scale understanding of different networks within Hatfield at a “neighbourhood or urban fabric” level.

It can be argued that the current public transport developments in Hatfield do not improve accessibility or convenience for the marginalised communities but are additionally limiting their growth and socio-economic development (Ndwandwe and Gumbo, 2020:991-992). For instance, the convenience and efficiency of the Gautrain development is financially inaccessible to low-income, marginalised South Africans. Additionally, the recent Metrorail train updates, although remaining affordable, have demonstrated little improvement in

reliability and frequency of the service (appendix 8 and 10). Rissik train station, specifically, has been included in the recent train upgrades and general station updates. However, there still appears to be little consideration for other networks such as buses and taxis. A limited number of informal traders are permitted to trade outside of the station yet appear restricted spatially with few facilities provided such as storage, trading shelter or services such as water or electricity. This is further explored at a micro-scale later in this report.

This and many other instances represent missed opportunities in the development of public transport infrastructure in Hatfield (Ndwandwe and Gumbo, 2020:995).

As a counterpoint, Hatfield, as a developing precinct possesses a range of potential. Hatfield has many anchor points and a large amount of urban infrastructure supporting a range of social needs. It is possible, therefore, to understand the socio-economic limiting factors in view of Hatfield's potential.

2.2.3 Micro scale issues perpetuating exclusion and limiting socio economic transformation

Inequalities manifesting at a micro scale shall be further analysed within the urban sample to follow. Ndwandwe and Gumbo (2020:989) assessed spatial organisation and features around public transport stations in Hatfield in the following manner:

- Structure and physical appearance of surrounding small-scale emergent businesses.
- Proximity of the business to the stations.
- Other informal activities on site.
- Other forms of public transport interacting with the station.
- Any underutilized space for potential activities.

These criteria prove valuable to this study and shall be adapted accordingly. Additionally, boundary and control of space can be assessed to determine why access to certain territories is allowed. This could link to governance and legislation regarding access. This micro analysis of the hard and soft interactions shall uncover nuanced inequalities and can reveal opportunities to inform spatial development principles.

2.3 Approach to the study

By focusing through a critical spatial lens one can assess the interactions of territories, resource flow and spatial designations perpetuating inequality. The critical approach to the study acts as a method of analysis which reveals missed opportunities and potentials for socio-economic transformation. This can subsequently inform spatial principles and considerations for architects and urban designers to employ when considering the role of transport

infrastructure within the larger network of socio-economic transformation to address urban segregation and exclusion (Lucas, 2010:4).

3 Literature review

In sections 3,1-3,4of this mini dissertation, the theoretical argument is developed by framing and defining key themes applicable to the study as they occur in published literature. Additionally, section 3,5 emphasises the relevance of this study by including the author's critical assessment of similar studies.

3.1 Understanding infrastructure and inequality through spatiality & marginalization

To holistically assess infrastructure and inequality, it is essential to consider both the physical services (hard infrastructure) and spatial organisation, governance, urban actors and everyday practices (lifeworlds and soft infrastructure) within urban environments from an interactional perspective (Rubin *et al*. 2020:163-164). Through these interactions, one is able to critically examine how people relate to or circumvent inadequate infrastructure and spatial organisation and how these instances can reveal inequalities (Rubin *et al*. 2020:165). Inequality shall be considered through a lens of unequal access to opportunities such as jobs or key resources within urban environments and how this is perpetuated by spatial designation and mobility infrastructure (Gates et al., 2019:2).

3.2 Hard and soft infrastructure interactions

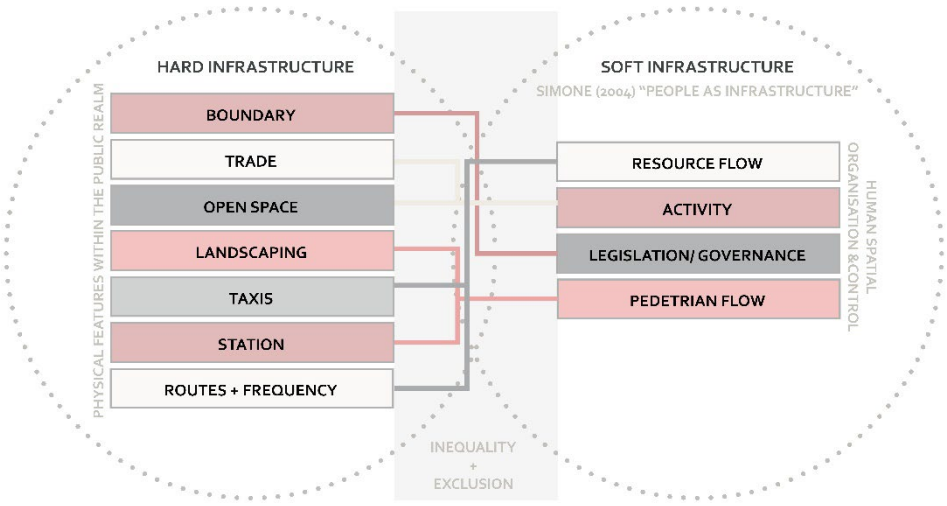

Figure 5: A diagram showcasing hard and soft infrastructure interactions (Author:2023)

Rubin et al. (2020: 164) defines soft infrastructure as facilitators to the operations of hard infrastructure . Similarly, Simone's (2004) "People as Infrastructure" approach is also adopted to define the soft infrastructures of focus. People form part of the soft infrastructural matrix of urban environments. Their actions, spatial inhabitation, systems of organization and legislation all are then represented on physical landscapes through built environment elements (hard

infrastructure: access control features, location of stations etc.). These hard infrastructures are accessed and function through the means of human interaction with them. Therefore, the spatial patterns of arrangement and interactions of people with built infrastructure shall be analysed on a macro, meso and micro scale. This is to understand the role soft infrastructures have on the urban built environment (hard infrastructure) and how these interactions reveal inequality and exclusion. Figure 5, above, illustrates the hard and soft infrastructures of focus within this study as well as their interactions with one another.

3.2.1 People as infrastructure

African cities are defined by activities that often manifest as flexible, emergent intersections without clear prescriptions of spatial inhabitation (Simone, 2004: 407). Within these flexible configurations, there is a nuanced ordering system, in relation to hard infrastructures, that my study begins to decode to understand how inequality is being perpetuated and the potentialities which lie within these systems.

Simone (2004:409), after Lefebvre's (1991) representation of space, continues this description by considering the link between places, people, actions, and things. The perceived, conceived and lived space produce a social space in which potential exists for the emergence of systems that lie outside the specifications of the domains of power (Simone, 2004: 409). This topic of emergence shall be unpacked to a greater extent further on in this review.

3.2.1.1 Open space and the production of social space

Within the understanding of "People as Infrastructure," Simone (2004:419) discusses the role of open space in the production of social space.

Simone's writing is further supported by Dovey's (2014: 46) argument for the use of leftover open spaces to more appropriately suit the dynamic city context in which it sits. These open spaces are commonly referred to as "spaces left over after planning" or "SLOAP". These sites pose opportunities for development as they are often ideally located for economic opportunity with emergence already occuring there (Dovey, 2014:47).

A portion of my study identifies the role of open spaces around transport nodes as spaces facilitating the functioning of emergent networks, revealing their potential as sites for future equitable development.

3.2.1.2 Relevance of my project within the theme of "People as Infrastructure"

Simone (2004:428), frames a gap that my study aims to address: the growing disconnect between the actual lived experiences of occupants or "lifeworlds" (Pieterse,2009) (Long,2001) and urban development trajectories.

This can be addressed in this study through a socio-spatial mapping and "lifeworld" sketching process, where certain relationships between hard and soft infrastructure interactions shall be

revealed as well as specific characteristics either perpetuating inequality or possessing the potential to promote future equitable design.

3.2.2 Understanding the "lifeworlds" of urban occupants

The "lifeworld" mapping approach is adopted within this study after Pieterse's (2009) and Long's (2001) description of "lifeworlds". This term can be understood as the complex and diverse lived experiences of urban inhabitants (Pieterse, 2009: 5). Long (2001) further develops this description through an "actor-oriented approach" to analysis, placing emphasis on understanding the external and internal factors and relationships which shape human action. This study adapts this approach by focusing on the human experience of transport infrastructure and the hard infrastructure which shapes various actions and emergent activities from the perspective of occupants everyday lived experiences.

3.2.2.1 Application within exclusion, inequality, and infrastructure

Lifeworld mapping

Attention to "lifeworld" analysis results in a macro-understanding of concepts grounded in the micro-everyday experiences of people (Long, 2001:64). This, in turn, exposes nuances that would otherwise go unnoticed. The socio-spatial analysis of spaces around modes of transport and routes connected to them shall reveal nuances of factors perpetuating inequality which can deepen the macro-understanding of inequality. This socio-spatial understanding can then also reveal potential opportunities for future transformation.

Interface interaction analysis

Understanding people's "lifeworld's" results in an analysis of the interaction of networks and built interfaces (Long, 2001:65). Both discontinuity and linkages exist in an interface whereby various organizational situations are revealed (Long, 2001:65). My study adapts an approach to understanding the physical built interface and its effects on the lifeworld's of users.

The writing of Dovey and Wood (2014) argues for this approach to interface interaction analysis and shall be adopted within my study. In agreeance with Long (2001:65), Dovey and Wood (2014: 1) describe how social activity often occurs in the interstitial space of the interface. The street interface of buildings and the spaces associated become important points of analysis to grasp adaptation, innovation, and transformation within these interstitial spaces in relation to larger built actors (Dovey and Wood, 2014:1). As Dovey and Wood (2014:3) attest, the physical attributes of interfaces, "…are geared to practices of economic exchange, social reproduction and transport technologies." This socio-spatial understanding of interface can therefore inform transformative approaches for equitable future development.

3.3 Emergence within this study

The writings of Dovey (2011, 2012, and 2014) become key studies in the definition of emergence within the context of my study and its emergent urbanist approach.

Dovey (2014:46) views emergence as systems that arise and are accommodated outside of the control of the state. These often “simple” organizations and practices can create large scale order which transcends the original networks from which it emerged (Dovey, 2014:51). This study, after Dovey (2014:47), shall analyse the connection made between emergence and informality whereby informal practices emerge through micro-spatial adaptations. Informality often presents opportunities that lack in formal systems such as pedestrian-focused or transport-orientated environments whereby integration is more prevalent (Dovey, 2014:47).

3.3.1 Relevance to the study

Dovey (2014:46) outlines a gap in traditional urban practice and its insufficient methods of coping with the continuous evolvement, complexity, and resilience of cities. This reveals the need for understanding these informal and emergent practices to best accommodate them within future development.

To reiterate, the emergent networks of focus for this study include the informal trade network around transport sites and the mini-bus taxi networks within Hatfield. These flexible networks can be considered as emergent systems that, since their formation in Apartheid, have operated outside of and in response to the inadequacies of trading and transportation facilities offered by the state. They arose from existing systems as circumventive measures which have since transcended the original networks provided.

3.4 Critical urbanism and its approach to uncovering marginalization and exclusion

Lucas (2010: 5) after (Levitas et al., 2007: 9), defines social exclusion as the inaccessibility to resources, rights, goods, and services. It is also an inability to participate in activities and social, economic, cultural or political opportunities available to society (Lucas, 2010:5).

It, thus, becomes interconnected with powerlessness in decision-making, limiting social and cultural participation within a community, resulting in underrepresentation (Price, n.d.:1). The critical urbanist approach to research aims to uncover exclusion by emphasising the disconnect between actuality (lifeworlds) and possibility (Brenner, 2009:198). A lifeworld can, potentially, reveal possibility through challenging the status quo of a system’s intentional use compared to its actual use (Pieterse, 2009).

Critical urban theory places emphasis on the malleable characteristic of urban space in response to relations of social power and spatial governance (Brenner, 2009:198). It involves the critique of current ideologies, structures of power, injustice and exploitation within cities (Brenner, 2009:198). Therefore, it extends to revealing possibilities embedded, yet suppressed

within society (Brenner, 2009:203). The focus on these important agents gives weight to their vital role in socio-economic transformation (Brenner, 2009:203) (Mosaine, 2021: 540). There is always possibility in a system to further perpetuate exclusion, however, by foregrounding the lifeworlds of marginalised and overlooked urban actors, this study shall reveal potentials to ensure maximum inclusisvity in urban development.

3.5 Situating the study within similar existing studies

To prove the relevance of the study to follow, two key relevant studies by Ndwandwe and Gumbo (2020) and Lucas (2010) have been selected by applicability and analysed in an integrated manner. This review shall critically investigate the similar studies to i) highlight the relevance of my study within the larger discourse through relevant themes identified, ii) determine any findings which may support my study and iii) identify gaps, within the studies, that my study can potentially address.

3.5.1 Relevant Themes

Transport-orientated development, exclusion, and inequality

Ndwandwe and Gumbo (2020: 988) investigate the premise of transport-orientated development and its effects on place-making and socio-economic transformation within Hatfield. Similarly, Lucas (2010), explores transport development and its perpetuation of social exclusion within Tshwane. The potential interconnection between a lack of transport accessibility and poverty is emphasised (Lucas, 2010:1).

The primary intention of Lucas's (2010) study is to reveal the transport difficulties that low-income socially disadvantaged populations encounter daily and their effect on broader opportunity accessibility. This approach can link to Ndwandwe and Gumbo's (2020:988) method of determining transport infrastructure's effectiveness of inclusion and socio-economic transformation by assessing the extent to which previously disadvantaged and the urban poor benefit from current transport developments.

Social exclusion and transport

The lens of social exclusion is the focus of Lucas' (2010: 5) study as it assists policymakers in recognizing the multi-dimensionality of the issue as it affects both individuals and larger processes and structures in wider society. Exclusion is considered relational as disadvantage is viewed in comparison to the "norm" (Lucas, 2010:5). This is much like my study, where comparison is necessary to highlight exclusion and inequality.

Lucas (2010) introduces the themes of "transport disadvantage" and "travel poverty" as a means of articulating exclusion with specific reference to mobility infrastructure.

Addressing historical exclusionary practices of Apartheid

After Lucas (2010:6), my study historically frames old apartheid settlement patterns as a key component perpetuating transport disadvantage in South Africa. This proves that the issue of "transport disadvantage" is not a new occurrence ,but, is deeply rooted in historical exclusion and segregation.

Apartheid planning cannot be reversed, however, innovative mitigative methods can be employed to further include the urban poor in socio-economic opportunity (Ndwandwe and Gumbo, 2020: 990). Regular, reliable transport that provides safe and affordable access to economic centres is an important objective to mitigate exclusion from economic zones such as Hatfield.

Stations as connective points for socio-economic transformation

Ndwandwe and Gumbo (2020:987) emphasise the potential of public transport infrastructure as "catalysts for economic growth and development." Through a mixed-method approach, Ndwandwe and Gumbo (2020) assess the impact of the recent Hatfield innovative urban transport systems' development, namely, the Gautrain and Areyeng stations compared to the Pretoria Central (Bosman) Gautrain and Areyeng stations. The aim is to interrogate the stations as connective points and assess their role in facilitating activities and creating innovative hubs for socio-economic vibrancy, fostering transformation and the strengthening of local economies (Ndwandwe and Gumbo, 2020).

This directly aligns with the approach of my study, which involves evaluating the extent to which public transport sites in Hatfield facilitate socio-economic transformation and support emergent networks.

Integration

Integration is an important consideration within Ndwandwe and Gumbo's (2020) study, as well as mine, as it allows transport infrastructure to extend into many sectors, modes, institutions, and operators. This, therefore, enhances the socio-economic benefits of transport infrastructure (Ndwandwe and Gumbo, 2020: 987). Integration of both public transport systems and surrounding emergent economies and sectors yields many larger economic benefits (Ndwandwe and Gumbo, 2020: 987).

3.5.2 Relevant Findings

Both studies reveal the integral role public transport plays in the lives of everyday users as well as it's potential for opportunity creation and the upliftment of associated networks.

Lucas's (2010:9) findings reveal the difficulties faced by low-income or marginalised public transport users.

Ndwandwe and Gumbo (2020:987) further this by interrogating the role of public transport infrastructure in the upliftment of said low-income or marginalised users and associated

networks. The stations' limited support of surrounding businesses, especially informal traders, and disadvantaged communities is revealed through a lack of consideration towards developing activity nodes around stations (Ndwandwe and Gumbo, 2020: 987).

Both studies, as well as mine, reveal opportunity and potential within their findings through various lenses. Lucas (2010:2) discusses the detrimental effect that a lack of transport has on the marginalised communities' abilities for socio-economic participation and access to opportunity. The majority of South African households have no access to a regular form of transport (Lucas, 2010:9). Additionally, many people are forced to travel long distances from their homes to access key needs such as employment and education due to the limited provision of social infrastructure in their residing areas (Lucas, 2010:9). This results in high public transport costs to access zones of economic opportunity (Lucas, 2010:14).

Whereas Ndwandwe and Gumbo's (2020: 990) study reveals the lack of support available for the informal economy in the planning and formation phase of innovative urban public transport systems. This frames the potential for stations to become environments where small-scale businesses can flourish and contribute to the local economy (Ndwandwe and Gumbo, 2020: 990). The informal economy has not benefitted from recent public transport developments within Hatfield, if anything, stricter policy has led to further limitations and restrictions (Ndwandwe and Gumbo, 2020: 987). An example of such includes the prohibition of the conduction of informal trade on the train or platforms. Ndwandwe and Gumbo (2020: 987) reveal that the current skewed public transport development results in minimal consideration of socio-economic vibrancy.

The findings of both above studies can further support and qualify similar results revealed in this study to follow.

3.5.3 Relevance & gaps

Gaps

My study places emphasis on the networks predominantly used by the urban poor, such as the Metrorail, which, despite their significance, remain understudied. Ndwandwe and Gumbo (2020:995) specifically highlight this gap as past research has been performed on the Gautrain station and Areyeng developments, however, limited knowledge exists concerning the Metrorail and taxis systems facilitation of socio-economic transformation in this region.

An additional gap is identified in the literature by Lucas (2010), whereby the spatial impacts of transport infrastructure on the lifeworld of commuters and connected networks has been understudied.

Within both studies, a deeper socio-spatial understanding of the themes outlined above proves necessary. There is no spatial translation of the data gathered by Lucas (2010) or Ndwandwe

and Gumbo (2020), making it difficult to interpret. This shall be addressed within my study through an in-depth lifeworld mapping and sketching analysis process.

Relevance

Lucas's (2010) study is relevant due to similarities in the approach of revealing transport difficulties of low-income populations. However, my study focuses on socio-spatially assessing the challenges and constraints posed by the Metrorail and taxi infrastructures, comparing them with the Gautrain and analysing their impact on users' lifeworlds.

Within Lucas's (2010) study, there is little consideration of transport infrastructure's role in the socio-economic facilitation of surrounding networks as well as it's positioning in relation to larger actors. Ndwandwe and Gumbo (2020) begin to address this, and my study shall build on similar approaches to assess stations' facilitative roles and their association with surrounding emergent networks.

Both studies have provided a strong foundation on which my study can build, while further articulating its' relevance.

4 Research questions and objectives

The following research questions and objectives shall guide the study to follow.

4.1 Research questions

Within the context of public transport infrastructure in Hatfield and its role in perpetuating inequality and exclusion, the following research questions shall be addressed:

- What are the patterns of hard and soft infrastructure interactions?
    - Sub-question 1: How do we more clearly define and distinguish between hard and soft transport infrastructure networks?
- What can these relationships tell us about issues of urban inequality?
    - Sub-question 2: What characteristics of urban inequalities does the study of the hard and soft infrastructural relationships reveal?
- How can architects and urban designers use this understanding to develop new transformative approaches to urban segregation?
    - Sub-question 3: How can a socio-spatial understanding of hard and soft infrastructure interfaces facilitate transformative approaches to urban infrastructure development?

4.2 Research aims

The data gathered aims to further understand the use and occupation of transport spaces.

The analysis shall critically assess the hard and soft infrastructure interactions resulting in spatial organizations or characteristics. The analysis process seeks to reveal characteristics

facilitating the operation of transport networks and the interactions either facilitating or limiting the accompanied socio-economic emergent networks.

Subsequently, this process then aims to uncover how infrastructure is used by existing powers to maintain authority and perpetuate exclusion and inequality.

The overall objective then becomes using this understanding to inform opportunities and potentials for transformation. Spatial practitioners and policy makers can, therefore, employ these considerations and criterion to facilitate the equitable development of transport infrastructure in the future.

4.3 Limitations and delimitations of the study

The study was delimited to specific infrastructures of observation within the context of Hatfield. As noted above, the study is limited to the Rissik Metrorail station in Hatfield and any associated emergent networks such as informal traders and the taxi network. This Metrorail station was chosen due to its potential for socio-economic integration as it already showcases the beginnings of the facilitation of emergent activities. The taxi network was studied as, along with the Metrorail, it is a popular affordable public transport option for commuters from marginalised areas.

As a point of comparison, it was necessary to analyse the Hatfield Gautrain station. Although not an area of focus, the Gautrain analysis aims to emphasise current instances of inequality and exclusion within Hatfield. In contrast to the Metrorail and taxis, the Gautrain is a higher cost public transport option yet offers more convenience and accessibility for users.

These delimitations were necessary due to the limitations of time for data collection and analysis. Time and access also proved limiting within the data collection, necessitating the use of observations in addition to interviews. Consequently, the research is then also confined to the information I could physically observe during specific times.

5 Theoretical framework

The theoretical context within which the methodology sits shall be defined below.

5.1 Research Paradigm

According to Kivunja and Kuyini (2017:26), a research paradigm compromises of 4 elements: epistemology, ontology, methodology and axiology.

Epistemology: Social constructivist

The social constructivist epistemology, within the realm of urban research, accentuates the social nature of human life, while simultaneously placing emphasis on the individuals' perspective and interpretation of urban spaces (UNISA, n.d.:67)(Jacobs and Manzi, 2010:36). This is relevant to this study as the process relies heavily on capturing and analysing how inhabitants use urban infrastructure and formulate a response to such. To attain such

information, interviews, informal conversation, and observation were chosen as the appropriate methods of data retrieval. Jacobs and Manzi (2010: 37) and Carlson (199:203), attest to these methods as appropriate within the social constructivist research context.

Additionally, the social constructivist approach focusses on understanding power relations in the urban realm (Jacobs and Manzi, 2010:40). This recognition and decoding of such complex organisational processes (Jacobs and Manzi, 2010:40) leads to the revelation of instances of "social exclusion" and "marginalisation", uncovering perspectives that may often go unnoticed in urban planning. This aligns with the critical urbanist approach to the study as well as the aim in revealing factors perpetuating inequality within Hatfield.

Ontology: Interpretivist

The grounded theory approach to the study follows an interpretivist ontological understanding of the essence of the social phenomenon being investigated (Allen and Davey, 2018:225) (Kivunja and Kuyini, 2017:27). The interpretivist ontology is often combined with the social constructivist worldview (Creswell, 2014: 26) and places emphasis in understanding the subjective world of the human experience (Kivunja and Kuyini, 2017:27). This is applicable to the approach to the study as it is aiming to understand individuals' subjective interactions with infrastructure and how that is revealing inequalities or exclusion. Significance therefore shifts to understanding the context and interactions from the subject's perspective, rather than an observer (Kivunja and Kuyini, 2017:33). It therefore aims at revealing the "lived experiences" or "lifeworld" of users through attempting to understand their everyday habits and patterns of occupation and interaction with space and infrastructure (Allen and Davey, 2018:222).

The interpretivist ontology also places emphasis on understanding through field research, mainly preceding theoretical exploration (Kivunja and Kuyini, 2017:33). Therefore, the analysis and collection of the data is consistent with the grounded theory approach within this ontology (Kivunja and Kuyini, 2017:33). Mapping and drawing can also link to the interpretivist ontology as it is inherently a subjective process (Dovey and Ristic, 2005: 3). The process of mapping can expose "lived experiences" by representing spaces "perceived, conceived and lived," (Lefebvre, 1991) (Dovey and Ristic, 2005: 26). Overall, the interpretivist ontology is a critical lens to understand individuals' subjectivity within a context.

Methodology: Grounded theory

The subsequent methodology shall broadly follow a grounded theory approach. It has, however, been tailored to better suite the study. Sutrisna and Setiawan (2016:241), further attest to this, as the grounded theory approach is adopted in research as a flexible set of principles that can vary in level of implementation.

The grounded theory methodology is relevant to this study, and similar studies within the built environment, as it assists in developing a rigorous understanding of the human experience

(Sutrisna and Setiawan, 2016:232). This rigorous understanding is achieved through the iterative comparative nature of the method, with constant exchange between the data collection and analysis process (Sutrisna and Setiawan, 2016:233). This results in findings rooted in the original source (Sutrisna and Setiawan, 2016:233). The circular process, resulting in themes and categories for each stage, continuously informs the following stage in the fieldwork process.

Axiology: Balanced axiology

Kivunja and Kuyini (2017:34) recommend the application of a balanced axiology within an interpretivist ontology. Axiology refers to the approach to decision making and ethical concerns to be noted when performing research.

As the study mainly focuses on the perspectives of “marginalised” or “disadvantaged” communities, it is imperative that the researcher remains aware of “othering” those that are part of the study. Therefore, within the balanced axiology, it is essential to prioritise an inclusive and empathetic approach to the research. The balanced axiology refers to a research outcome that, while reflecting the author’s values, ensures a holistic, balanced presentation of findings (Kivunja and Kuyini, 2017:33). The communication and acknowledgment of multiple perspectives, through the social constructivist approach is imperative. Additionally, it is crucial to respect those involved in interviews or observations by protecting their identities and obtaining their consent beforehand. Observation, therefore, becomes a significant method of data collection, while literature, social media, desktop studies and interview data are utilised to qualify these observations, aiming to minimise bias. This creates a research method which provides a holistic, balanced analysis that strives to avoid “othering” or “singling out” participants to the greatest extent possible.

Ethically, it is important to note, although researcher bias has attempted to be limited within this study by focussing on the subject’s interactions and perspectives, it cannot ultimately be eliminated from the study. The researcher, however, must remain cognizant of this throughout the process.

5.2 Research Design

This research shall mainly follow a qualitative perspective. Within the grounded theory approach, the method shall follow an iterative design with a focus on constant comparison to refine the study as it progresses (Tie, et al., 2019: Online).

It shall follow an inductive process whereby new concepts are revealed through the continual alternation between data capture and analysis. This results in a strong research foundation, grounded in the data collected (Allen and Davey, 2018:223).

The literature review process shall be continually performed throughout the study, assisting in” effective analytical thinking.” (Allen and Davey, 2018:224). The literature outlined in section 3

of this mini dissertation, is used to structure the iterative analysis of data as it is collected. Although, an initial scoping literature exploration may prove valuable to inform the preliminary fieldwork observations (Allen and Davey, 2018:224). Performing a literature review is an integral part in ensuring a balanced axiology as it addresses other perspectives within existing theory (Sutrisna and Setiawan, 2016:235).

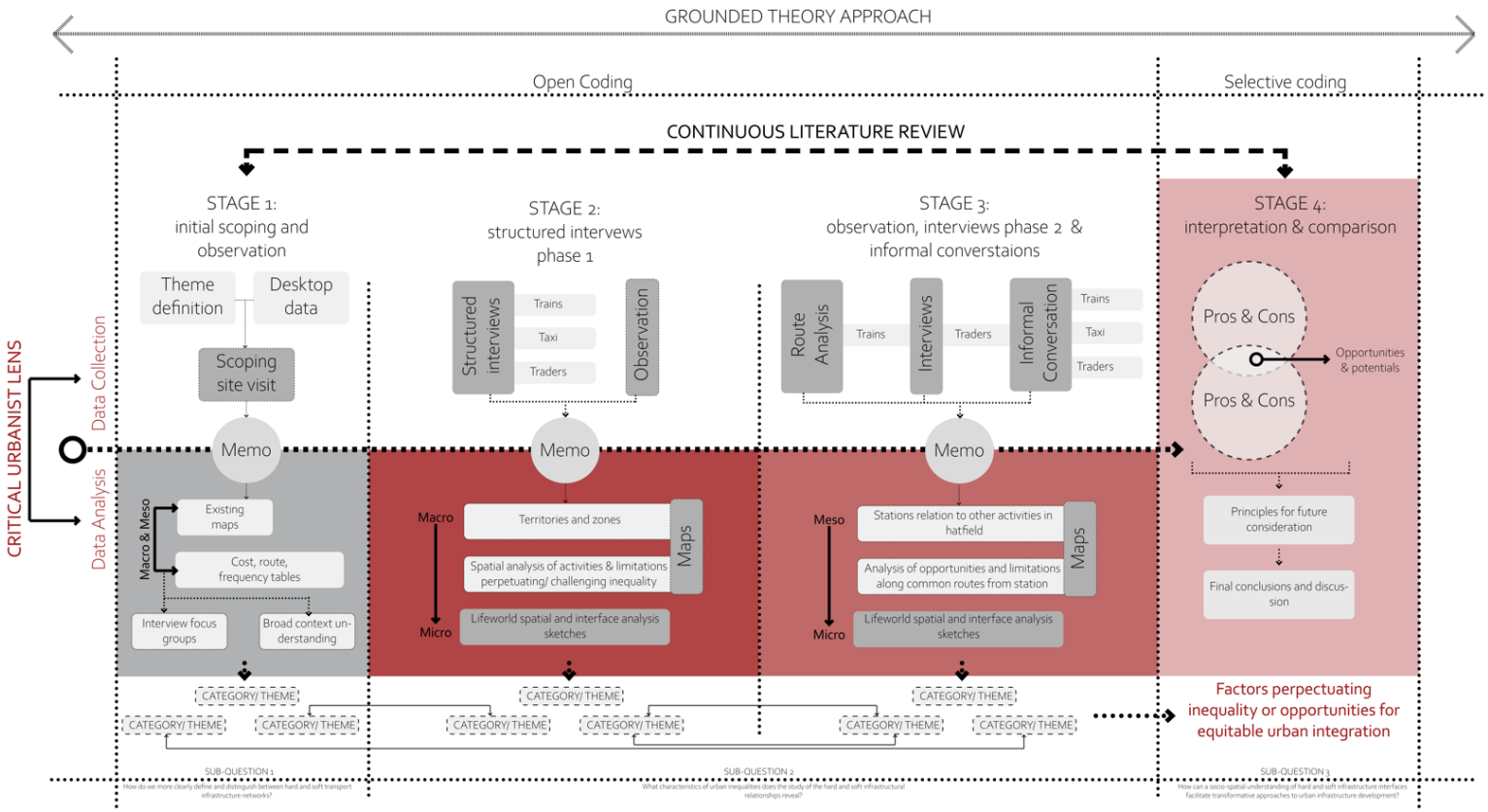

Figure 6: Infographic illustrating the study's methodological strategy (Author, 2023).

6 Research method

Within the overall grounded theory approach (Allen and Davey, 2018) (Sutrisna and Setiawan, 2016) (Carlson, 1999), this method adapts an iterative, layered multi-scalar approach to data collection and analysis. Figure 6 illustrates the overall method followed throughout the research process. The method has been divided into various stages with intervals of reflection and “memoing” after each (Devajit and Haradhan, 2022). The creation of the “memo” informs a critical link between interview and observational data and the extraction of core categories or themes for consideration (Devajit and Haradhan, 2022:6).

Theoretical sampling is employed throughout the process, wherein data analysis and collection are constantly interchanged. Continuous comparison and connections are drawn from the themes and concepts gathered (Allen and Davey, 2018:224).

The categories or themes identified act as a method of "coding" the data at regular intervals. The overall data analysis process shall follow a critical urbanist approach (Brenner, 2009), as described above, to reveal exclusion (and the resulting emergent methods) through a comprehensive understanding of hard and soft infrastructure interactions.

The study therefore follows two critical approaches: factors perpetuating exclusion and inequality and opportunities for equitable urban integration. Each stage consists of a data collection, "memoing", data analysis and category or theme identification stage.

This methodology, below, seeks to address the research aims and questions outlined above through the following process:

6.1 Outline of the group's approach and this study's positioning

Before further articulating this study's methodology, an overview of the research team's approach and involvement is necessary to contextualise this study within its larger research subject. The main group topic investigates urban infrastructure and its perpetuation of segregation and inequality with specific reference to public transport. This specific report then builds on this by further focusing on revealing instances of exclusion and inequality. It does so by assessing the extent to which the current railway infrastructure facilitates socio-economic upliftment for marginalised communities and the integration of associated emergent networks. Furthermore, potentialities and opportunities are revealed within this assessment which could inform future development.

Most of the interviews and initial desktop studies, especially for stage 1 and 2 of the process, were conducted as a group, creating a shared data pool accessible to all the researchers. This allowed for more efficient data collection in the interest of time. The researchers would then extract only the relevant data, pertaining to their focus, from the shared pool. Throughout the process, each team member remained cognisant of their area of focus which guided more intentional observations for the researcher and refinement with each site visit.

6.2 Initial scoping and observation

Stage 1 of the study was necessary to gain a broad understanding of the theoretical research context and the site context of Hatfield.

6.2.1 Preliminary Desktop study

A scoping data and theory search was performed, as a group, to understand what information is available for Hatfield and its transport infrastructure. These included maps of the various transport types, routes, land uses etc. as well as any other available data for all transport systems connecting to Hatfield. Specific data was then extracted from the shared data pool for this report. This data was, subsequently, understood from a macro & meso scale as defined within this study.

Exclusion, emergence & mobility: A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs.

6.2.2 Initial Observational scoping site exploration and group research structure

The research team then began by traversing Hatfield and the important transport nodes identified from the desktop data search. This allowed for a rough understanding of the activities surrounding the transport infrastructure to glean key areas of focus. The broader group research themes guided our initial observations and compilation of the interview questions further on in this process. Initial observations were recorded by each researcher, specific to their focus, and a "memo" was created.

6.2.3 Definition & delimitations

Individually, definition of key themes and focuses of the study were then important to limit the study. The specific approach to hard and soft infrastructure, in this study, was defined and the infrastructure of focus was identified. This initially included all rail infrastructure networks and the associated emergent networks (train and taxi). However, later in the study, the infrastructures of focus were further delimited to the Metrorail Rissik station, Gautrain as a point of comparison and the taxi and associated trading networks.

6.2.4 Identifying themes, metrics, and focus areas for the following stage

Metrics of focus were defined based on the information gathered through both the initial desktop study and observations. The metrics were defined through consultation of various sources as indicated in figure 7 below.

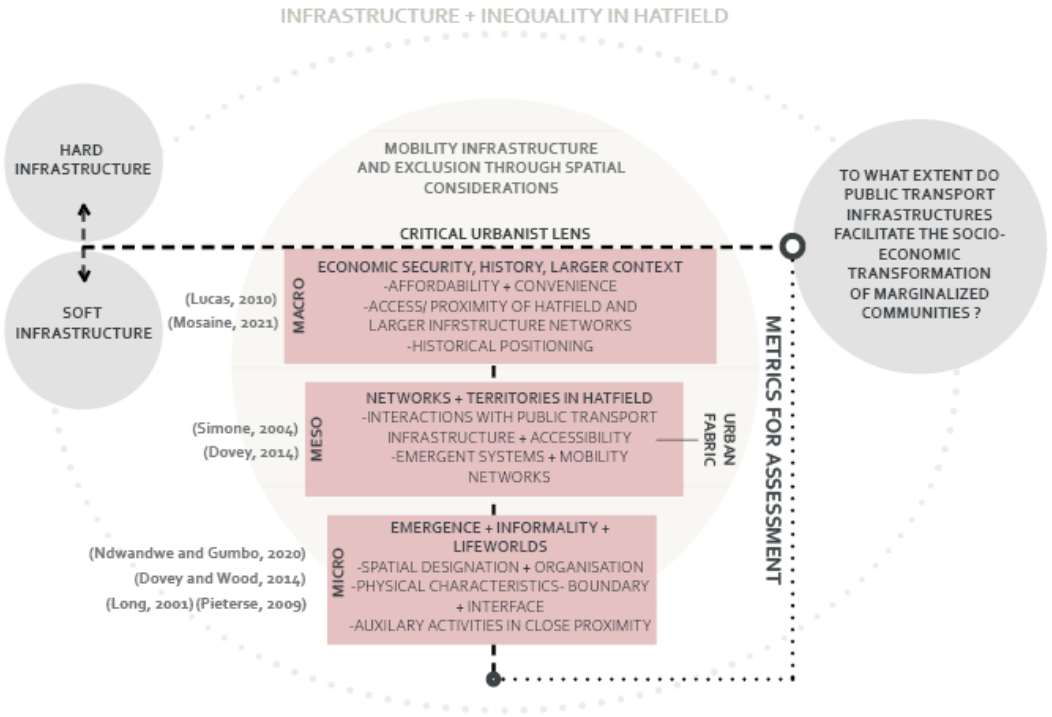

Figure 7: A diagram representing the overall approach and metrics of the study (Author:2023)

Preliminary categories and themes were identified from this initial scoping search with the aim of guiding the following interview stage.

To determine the relevant metrics each scale of analysis was defined.

A macro scale looks at concepts applicable on a larger general scale and positions Hatfield and the mobility networks within its larger context- physically, economically, and historically.

A meso-level analysis focuses on Hatfield and its urban fabric at a neighbourhood scale and provides a closer examination of the different mobility and emergent systems within Hatfield's networks.

The micro-scale examines the activities and spatial arrangements of networks that are in immediate proximity to the focal infrastructures, including both the physical layout and the organization of both hard and soft infrastructures.

Specific user groups for the next stage of interviews were also identified by the group, namely: transport users and operators (for both Metrorail, Gautrain, and taxis) and informal traders (associated with the transport infrastructures).

Overall, this stage aimed to answer sub-question one.

6.3 Data collection methods

6.3.1 Stage 2

The following stage included asking the previously identified groups a series of structured questions. All interviews were conducted using Epicollect as a data recording tool. For ethical reasons, responses were only recorded through text.

The interviews began with a general demographic introduction, followed by questions to further understand the commuter's movement, reasons for travel, reasons for using a specific type of transport and any limitations encountered using public transport. Vendors were asked similar questions, although additional questions were asked about their trading hours, what products they sell and where they source products.

The team was divided, and interviews were performed outside Rissik train station and on the train platform while waiting for the train. The team then took a train to Pretoria central and a taxi back to Hatfield to further understand the "lived experiences" of commuters departing from and arriving in Hatfield, in alignment with the interpretivist ontology (Kivunja and Kuyini, 2017). Interviews were additionally performed on the taxi, by the team, and, once returned, observations were recorded outside of Rissik station in alignment with each individual's focus. Interviews were also performed at the Metrorail Hartebeespruit station. Although, removed as the focus of this study, the interviews gathered at the station still provide broader insight into the commuter movements in and out of Hatfield.

6.3.2 Stage 3

Following the structured interviews, it was determined that an assessment of users' common routes from the stations were necessary to record to reveal what opportunities or limitations are encountered along the way. It also reveals the most popular reasons for arrival in Hatfield. The data collection process began with observations at the Gautrain station around peak morning times. Main streams of movement were noted through drawings on a map (appendix 18, 19, 20) and following the routes people took. Informal conversations and some interviews were recorded, by the group, to understand the movements of commuters. Informal conversation proved more successful as many commuters did not have the time for a full interview.

The same observational and informal conversation process was followed for Rissik station for this specific study. It was, once again, difficult to have full interviews with commuters and ask them to draw on maps as they did not want their journey disrupted. Following the prominent routes taken and having quick informal conversations along the way, proved sufficient. While following the popular routes, taxi network observations were noted as well as additional informal traders.

After analysis, these stages aimed to address sub- question two.

6.4 Method of "memoing"

After each data collection fieldwork day, a process of "memoing" (Devajit and Haradhan, 2022) was performed for this individual study. The "memoing" consisted of transferring rough written observations from a journal into an electronic table format as well as reflecting on the interview data gathered that day.

The memo, as seen in Appendix 1,2,3,4,5,6, is constructed according to date, time, method of data collection (observation, interview, or informal conversation), initial observations from that activity and any findings, interpretations, or reflections.

Any emerging themes, categories or trends were also be noted to inform the coding process. Finally, space was made to record any additional fieldwork or theoretical data that would still need to be captured. This allowed for the internalisation of the data collected as well as a preliminary analysis of the data, linking to the method of theoretical sampling (Allen and Dovey, 2018:224).

6.5 Data analysis methods

6.5.1 Mapping

For each stage, following the data collection and memo creation, a series of maps is produced to analyse the data collected. The maps range from a macro to micro scale depending on the stages of analysis and implication of the method of data collection. Mapping is necessary for

the study as it can be integrated with research to enable new ways of understanding mobility and revealing opportunities for transformation based on existing spatial arrangement (Dovey and Ristic, 2005: 17).

6.5.2 Lifeworld analytic sketches based of observations

The process of drawing involves active interpretation of the world around us (Dovey and Ristic, 2005: 16) (Devenish et al.,2022:3).

Within this study, drawings have been overlayed with images, highlighting site observations. The drawings are colour coded emphasising soft and hard infrastructural arrangements.

Additionally, an analysis of interfaces along popular routes and the transport station buildings themselves was conducted using the same drawing process. The interface interaction analysis followed the approach outlined by Dovey and Wood (2014:1) and revealed spatial facilitators either perpetuating or challenging exclusion or emergence.

The mapping and sketching methods consider built interface and urban systems that influence inhabitants' "lifeworld" experiences. The process of socio-spatial mapping and drawing, therefore, reveals soft-infrastructure scenarios (Devenish et al.,2022:3).

6.5.2.1 Interface interaction analysis

Dovey and Wood (2014:1) after Gehl's (1987) method of interface classification, derived a typology of interface assessment according to," access, setback, transparency, and mode of access." This shall be adopted as interface descriptors that are then sketched as a method of emphasis and revealing.

The interface types include:

- Impermeable or blank
- Direct/ opaque
- Direct/ transparent
- Pedestrian setback
- Car setback

These interfaces range from active (contributing to street life) to inactive (may even place public safety at risk) (Dovey and Wood, 2014:5).

Interface adaptations showcase the principles of micro-practices of power, controlling access and permeability (Dovey and Wood, 2014:11). They therefore shape socio-economic success and activity generation (Dovey and Wood, 2014:11).

6.6 Method of coding

6.6.1 Open coding

After the "memoing" process was performed, categories and emerging themes were identified from the data collected, describing the open coding process as a preliminary data analysis

(Sutrisna and Setiawan, 2016:236). These categories then informed the focuses for the following stages and became refined throughout the process.

6.6.2 Selective coding

Once the categories were identified throughout all the stages, linkages and relationships were drawn between them. The most linked or occurring stages were identified as main categories with relating phrases forming the sub-categories, as per the selective coding method (Sutrisna and Setiawan, 2016:236). These categories can then inform the areas of focus for the final data interpretation stage, while also considering the data analysis. The process of category definition is visualised as follows in figure 8 on the following page.

Exclusion, emergence & mobility: A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs.

6.7 Data interpretation from coding

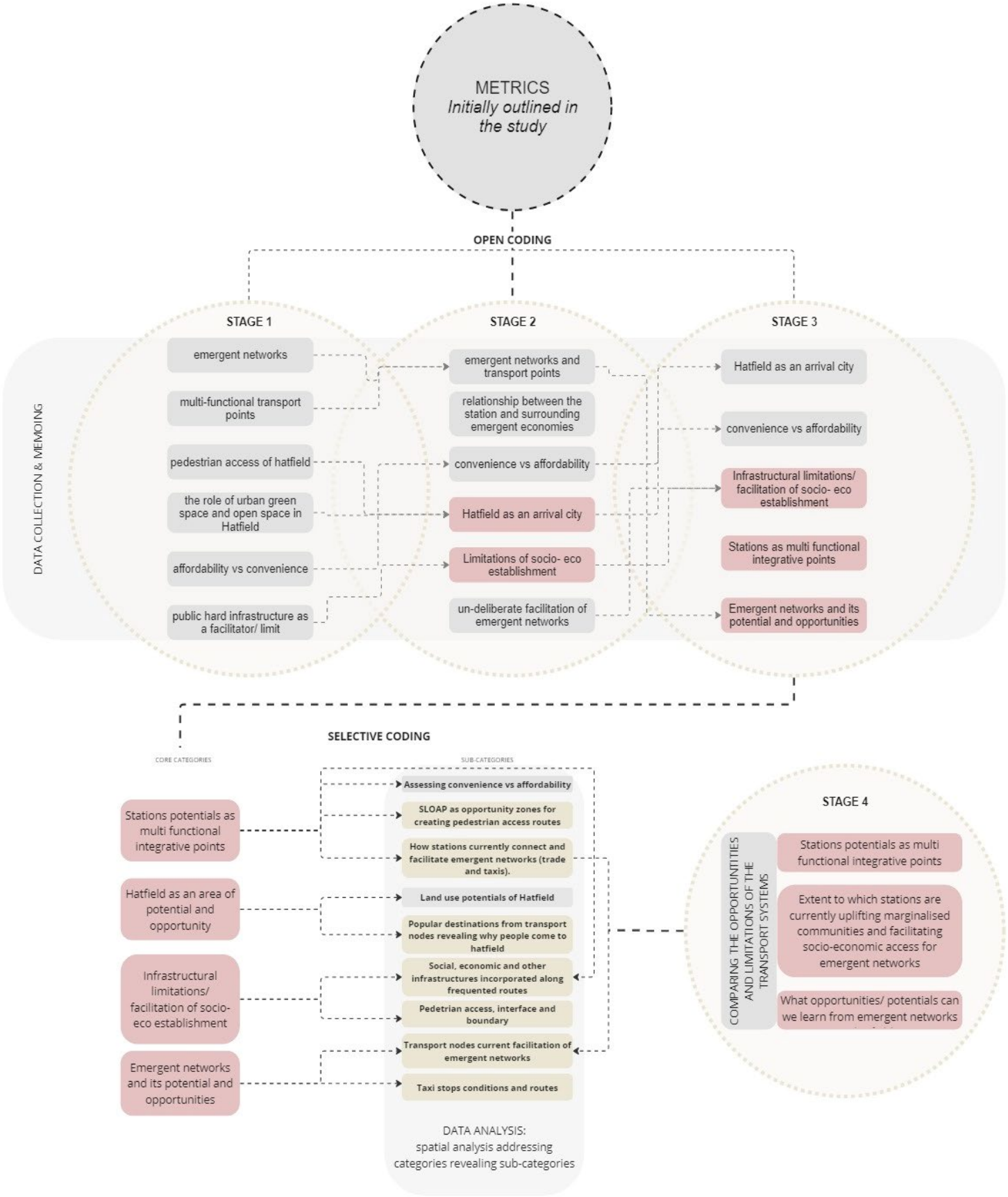

Figure 8: Diagram illustrating the coding approach to the study in relation to the various stages of the study (Author, 2023).

Exclusion, emergence & mobility: A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs.

From the themes identified above, the interpretation of the data can ensue within those focus areas. The overall limitations or opportunities of the chosen transport systems were identified above and compared within this portion of the study.

This comparison revealed the potentials of emergent systems, as well as future opportunities and potentials for transformation and integration. This presented employable spatial principles that could potentially facilitate transformative approaches to urban infrastructure development to challenge inequality and exclusion in the future.

7 Urban Sample: Combined data collection and analysis

The data collected from interviews, observations and informal conversation has been critically, socio-spatially analysed within this section of the report. The analysis is presented in two formats, namely, mapping, and critical “lifeworld” analytical sketches overlayed on images. The overall analysis ranges from a macro to micro scale.

7.1 Macro scale: Zones, Territories & Boundaries

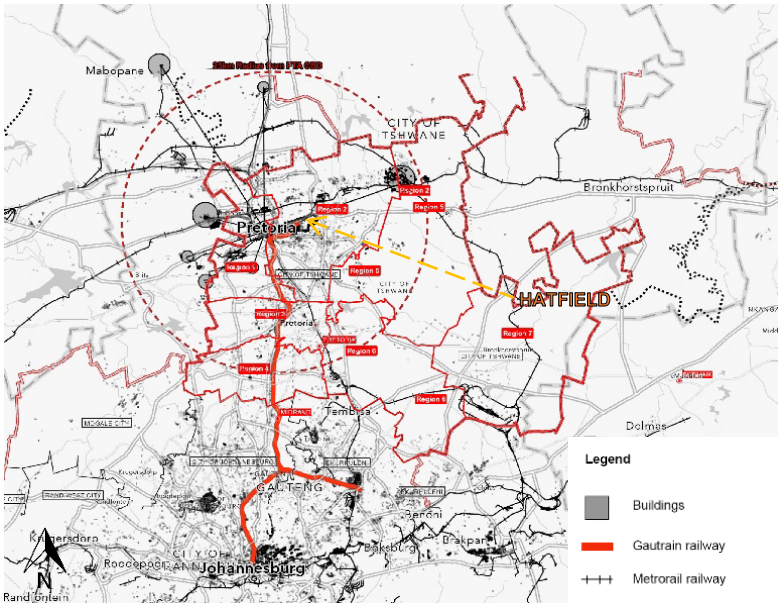

Figure 9: Map showing the railway connections from the peripheries to Pretoria (Author:2023)

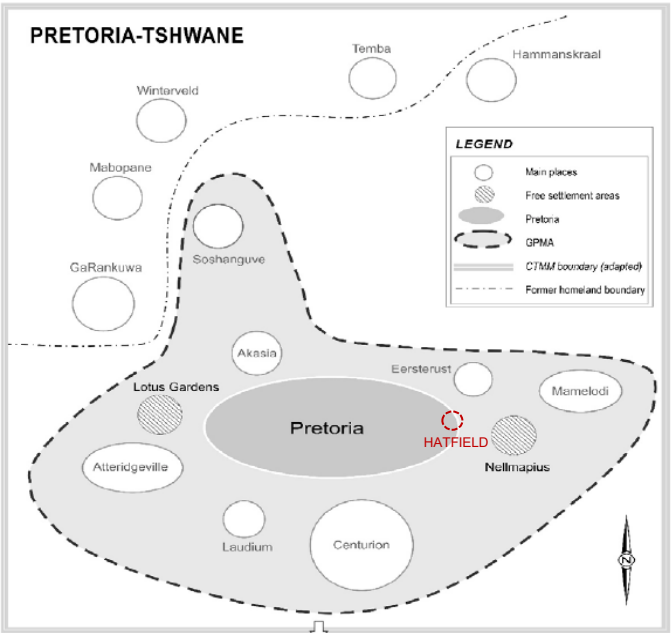

Figure 10: Diagram showing Pretoria in relation to the peripheral areas (Horn, 2011).

7.1.1 Apartheid organisation and boundaries

This study is focussed on the region of Hatfield. The Metrorail train stations serve as connector points from the peripheral regions often to the CBD of Pretoria (figure 9 & 10). However, from the interviews conducted (appendix 2,3,4), it was seen that many people also travel to Hatfield for work or studies using either the train or taxi from peripheral areas such as Mamelodi or Soshanguve.

These patterns of movement are still in close alignment with that of the Apartheid city (figure 11). Economic opportunity remains situated far from marginalized communities, creating a reliance on public transport and perpetuating exclusion and inequality. This can be seen in

figure 12, whereby higher income white areas are situated closer to central Pretoria and the peripheral areas are still of low income with a majority black population (Horn, 2011).

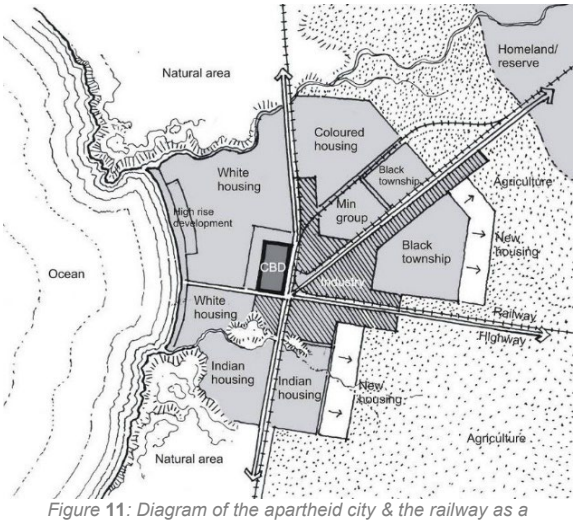

Figure 11: Diagram of the apartheid city & the railway as a segregating feature. Emphasising that marginalised groups were located away from the economic opportunities of the CBD (Schouland:2012)

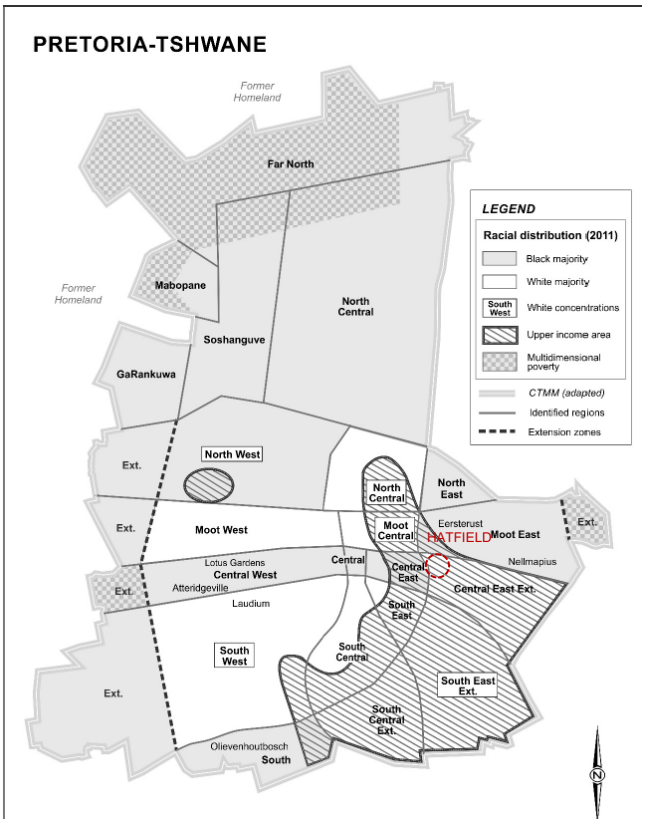

Figure 12: Racial and income distribution patterns of Tshwane as of 2011 (Horn, 2011).

7.1.2 Territories and zones of focus

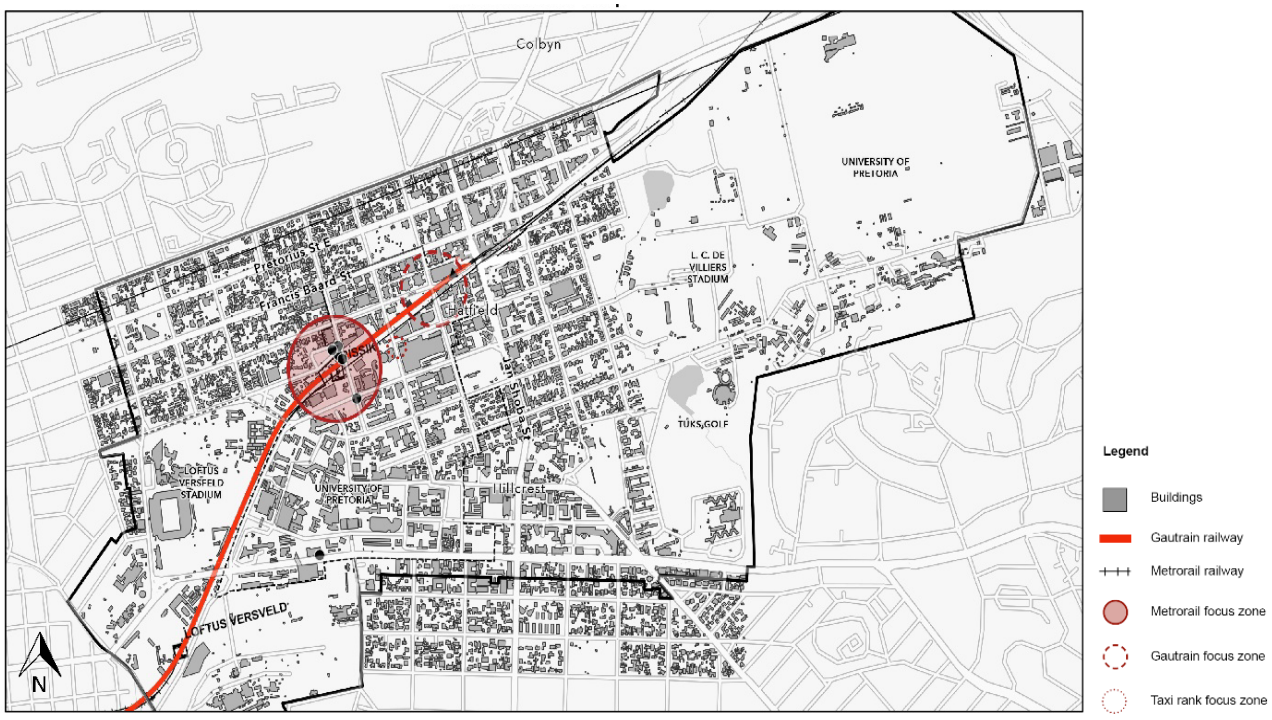

Figure 13: A map showing the zones of focus for this study within the region of Hatfield (Author:2023)

The territories or zone of focus for this study are centred around the Rissik Metrorail station in Hatfield (figure 13). The connected emergent networks to the Metrorail train stations become secondary territories of focus. This includes informal trade around the stations and the mini-bus taxi system. An indepth analysis of frequented pedestrian routes from the various transport points is also performed. A specific popular informal taxi rank in Hatfield was chosen for micro analysis as it was not possible to perform an analysis of all the taxi stops in Hatfield. The Gautrain has been referenced in this study as a point of comparison. The focus of this study remains on the Metrorail due to it's affordability for low-income users and its better connection to peripheral townships, like Mamelodi, historically designated for occupation by black people under apartheid.

7.1.3 Cost vs convenience

Frequency of public transport and running times for Hatfield based stations

	Weekdays				Weekends			
	Times		Frequency of trips		Times		Frequency of trips	
Public Transport System	Operating Hours*	Peak Times**	Peak times	Off-peak times	Operating Hours	Peak Times	Peak times	Off-peak times
Gautrain	05:08- 21:24	AM: 06:00- 08:00 PM: 16:00-18:30	Every 10 minutes	Every 20 minutes	Sat & Sun: 05:30- 20:30	09:00-16:00	Every 20 minutes	Every 30 minutes
Metrorail: Rissik	04:51 - 19: 36	AM: 05:53-08:53 PM: 15:58- 17:28	Every 45 minutes	Every 90 - 120 minutes	Sat: 05:22- 19:41	AM: 05:20- 07:19 PM: 15:59 - 19:41	Every 60 mins	Every 120 minutes
					Sun: 06:11- 19:19	No obvious peak times	Every 120 minutes	
Metrorail: Hartebeesspruit	04:49- 19:37	AM: 05:51 - 07:57 PM: 15:56 - 17: 26	Every 40 minutes	Every 90 - 120 minutes	Sat: 05:24- 19:43	AM: 05:24- 07:23 PM: 16:01- 19: 43	Every 60 minutes	Every 120 minutes
					Sun: 06:13- 19:21	No obvious peak times	Every 90- 120 minutes	
Areyeng Buses	05:00- 19:50	No specified peak times found	Every 10 minutes	Every 20 minutes	Sat: 05:20- 19:40	No obvious peak times	Every 30 minutes	
					Sun: 05:30- 19:50	No obvious peak times	Every 60 minutes	
Tshwane Buses	06:10- 18:10	AM: 06:40- 08:00 PM: 16:10- 17:10	Every 5- 15 minutes	Every 60-90 minutes	Sat: 06:30- 13:45	No obvious peak times	Every 60-120 minutes	
					No service			
UP Buses	06:40- 18:00	AM: 06:40- 9:00 PM: 13:40- 17:40	Every 20 minutes	Every 40 minutes	No service			
PUTCO Buses	There is lack of information for PUTCO buses and their schedules							
Taxis	Taxis are a flexible service, therefore, their frequency & times are variable							

*When not specified by service provider -operating hours were deduced from when the first and last train/ bus leaves the station/ bus stop
** If not specified by service provider - peak times were deduced from the variation in trip frequency

Figure 14: A table showing various public transports frequency (Author:2023)

Transport Type	Price	KM's (approx.)	Approx. Price/km (non-peak time)	Additional Card fee	Type of payment	Peak time increases	Discounts
Metrorail	R 10	5km	R 2	-	Cash	-	-
Gautrain	R32	5km	R6,4/km	R19	Cash/Card on to Gautrain card	Yes	-
A Re Yeng Bus	R11.50	7km	R1.65/km	R25	Point System on Connector card	-	Pensioners, scholars (below 19 years) people with disabilities
Tshwane Bus Services	R11	3km	R3.7/km	R25	Point System on Connector card	-	Pensioners, scholars (below 19 years) people with disabilities
Taxi	R20	5km	R4/km	-	Cash	-	-
UP Bus Services	R0	-	R0/km	-	Show student card	-	-

Figure 15: A table showing the pricing of various public transports (Summerton:2023)

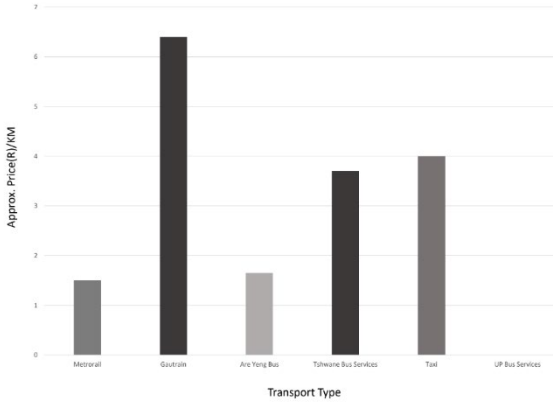

Figure 16: A graph showing the pricing of various public transports (Summerton:2023)

Another method of revealing exclusion and inequality is by comparing the affordability of public transport with its convenience (figure 14, 15, 16). After it's recent price increase, the Metrorail is the second most affordable option (after Areyeng), however, the Areyeng was not a preferred

mode of transport and is underutilised, therefore,was excluded from the study. Although affordable, the Metrorail, runs less frequently and is unreliable and unflexible, as proven through interviews and social media comments (appendix 8,11,12). In the interviews, many commuters chose the Metrorail as it was the cheapest known option despite the difficulties faced.

7.2 Meso scale: Patterns of infrastructure interactions

7.2.1 Hatfield's opportunities and potentials

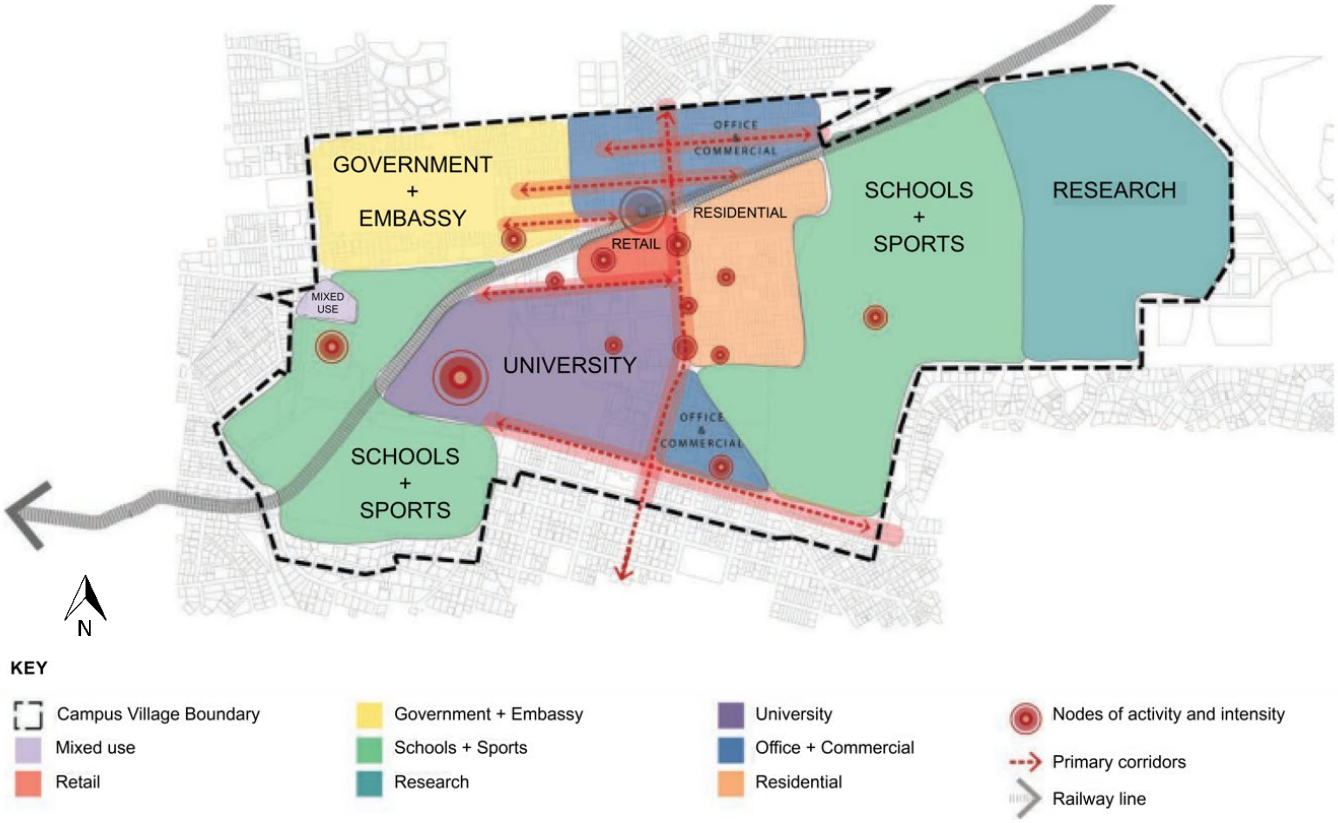

Figure 17: A map of Hatfield showing character zones, nodes and corridors (COT & Hatfield CID:2020).

The map above (figure 17), showcases at a meso scale, Hatfield's diversity of land use and the large institutions providing anchorage, attracting people to Hatfield. With a university, 2 schools, health care facilities, shopping, sports, and recreation areas many people from the wider context are drawn to Hatfield. The high number and variety of public transport facilities intersecting at Hatfield means that these opportunities can extend well beyond the bounds of Hatfield. A large population of commuters travel to Hatfield for work or studies and have a variety of transport options to choose from. However, the availability and reliability of these options is limited by income and location.

The map below (figure 18) illustrates, at a finer scale, the different land uses and activity nodes of Hatfield. Rissik train station is ideally located very close to many highly active socio-economic nodes of Hatfield, with Gautrain slightly more removed, however, both sites show a

very limited (or non-existent) interaction with the surrounding activities. Figure 18 has also been overlayed over the taxi-network (pink), this reveals how the taxi network interacts with zones of high activity and how it facilitates access to Hatfield's economic zones.

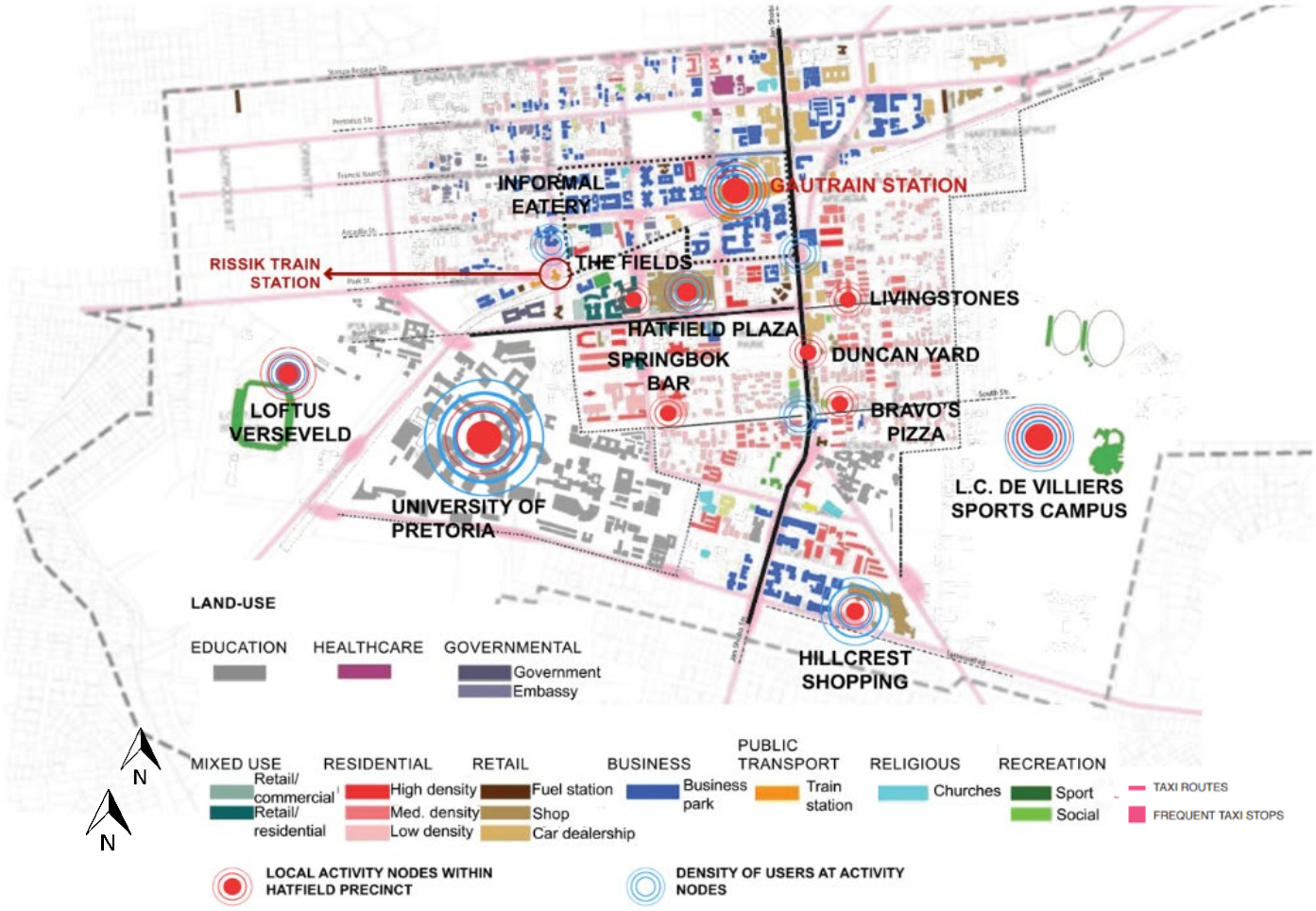

Figure 18: A map of Hatfield showing land use, local activities, and the taxi networks (Adapted from COT & Hatfield CID:2020)

7.2.2 *Mobility, inequality, and emergence*

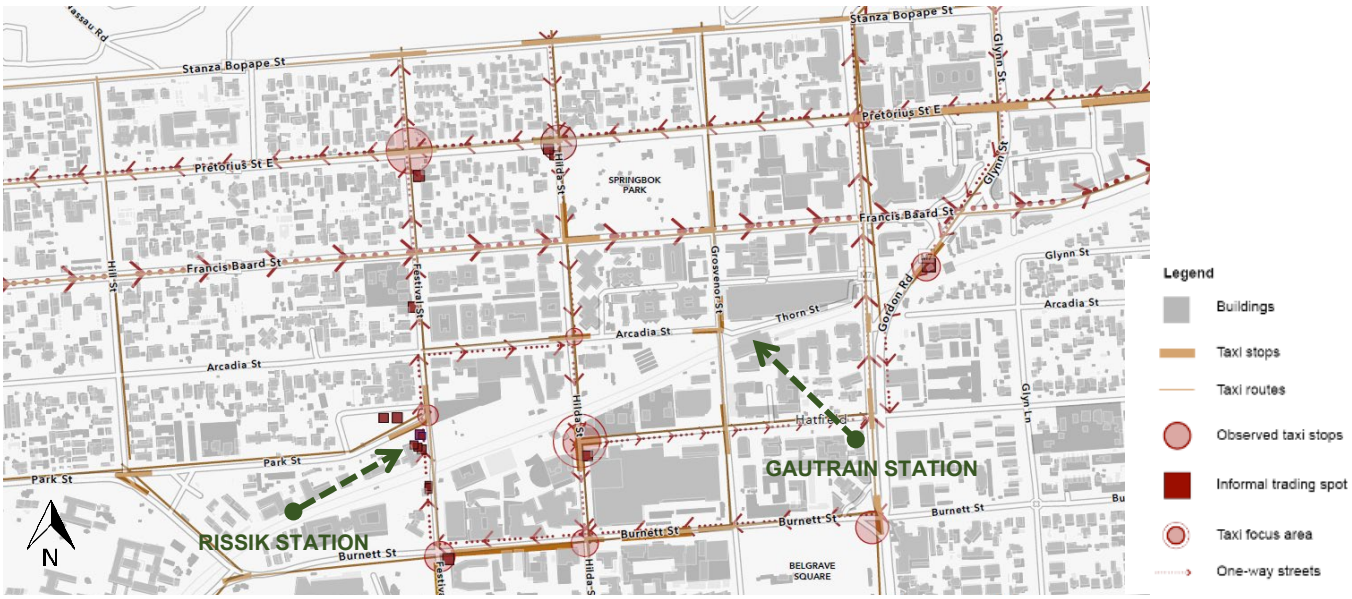

Figure 19: Map showing taxi routes and stops, observed stops, one ways and informal trade locations (Author, 2023).

Figure 19 above illustrates the taxi networks' routes and stops in relation to the one-way systems of Hatfield, as well as informal trade. Any taxi stop observed during the data collection process were also identified on this map. The taxis routes tend to link closely to the one-way systems, possibly due to convenience and ease of navigation.

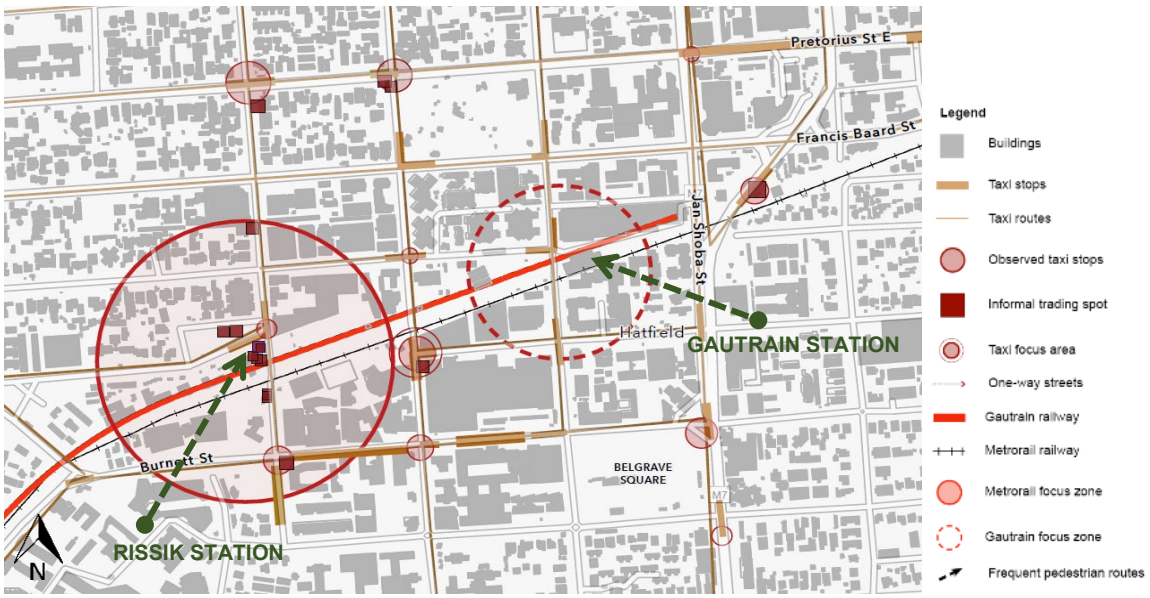

Figure **20***:A map of informal trade density, taxi stops, focus zones & open space (Author:2023)*

The map above (figure 20) illustrates the perceived density of informal trade in proximity to the stations, popular taxi stops and public open spaces. Informal trade (hard infrastructure) within Hatfield is limited and closely controlled spatially and legislatively (soft infrastructure). Our observations & interviews (appendix 2) confirmed this as informal traders mentioned fears of police arriving and forcing them to stop business in that location.

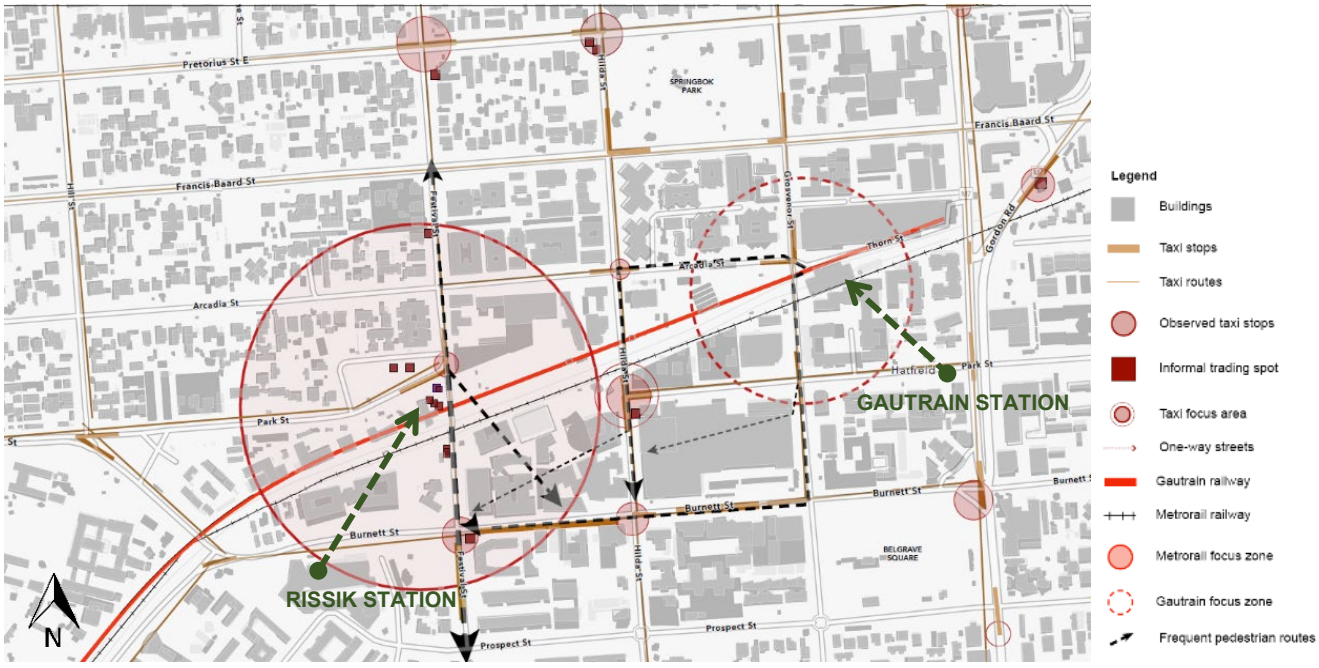

Figure **21***: A map showing pedestrian movement patterns from the railway stations (Author:2023)*

Most of the informal trade is centred around Rissik station, this could link to the fact that the area is surrounded by public open space (figure 20) where people feel more welcome to trade. Additionally, the observed directions users from the stations follow has been shown in figure 21. At this scale, one is able to extrapolate the destinations within Hatfield which seem common between the Metrorail and Gautrain. This could begin to indicate the most popular nodes of activity which people visit from public transport points. Commonality is also seen with the pedestrian movements of taxi users (figure 22). The university and Hatfield's "CBD" appear to be large anchor points drawing people towards them for work and studies, however, this is further unpacked in the following section. Overall one is able to see a definite overlap between frequented pedestrain routes from Rissik station, taxis stops and informal trader location. Consequently, these transport nodes become hosts for emergence and offer a small degree of socio-economic support for the informal sector (although mainly unintentional). Alternatively, this highlights the absence of facilitation and integration around the Gautrain station. This is presumably due to the strict policing and prohibition of trade by the Gautrain. These routes are further examined at a micro scale later in this report.

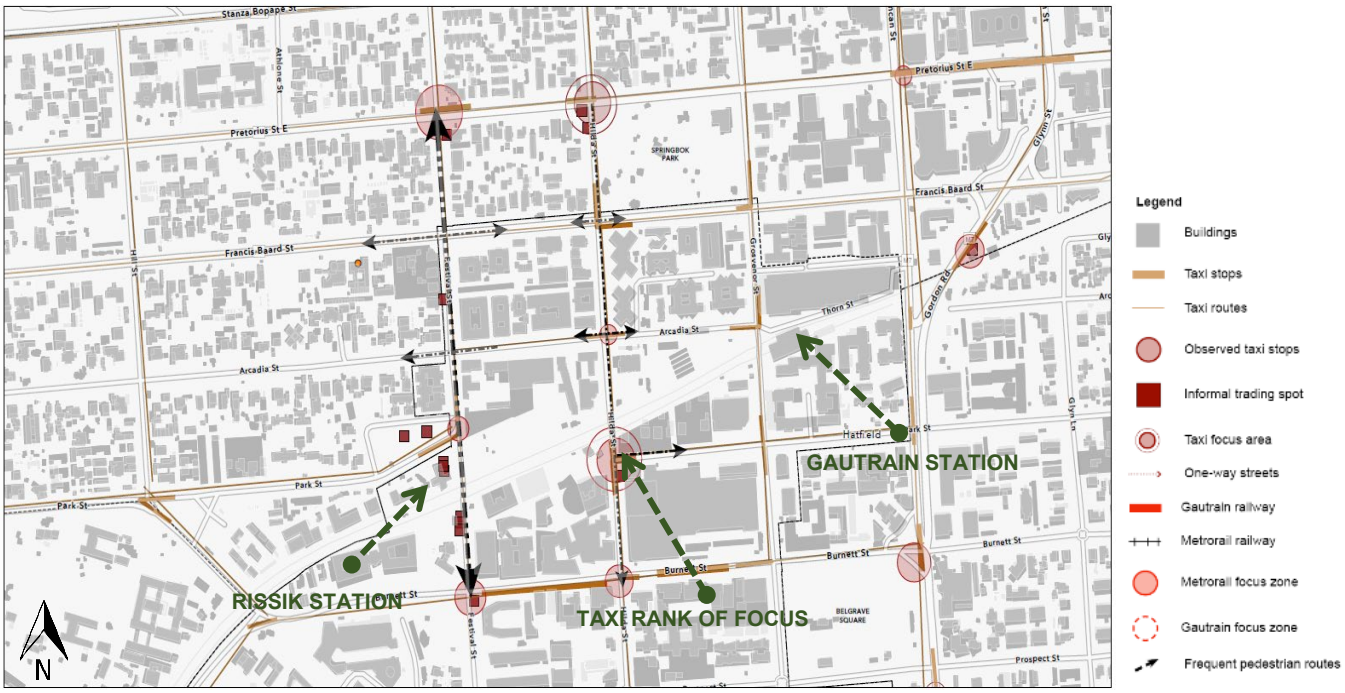

Figure 22: A map showing pedestrian movement patterns between taxi stops (Author, 2023).

7.2.3 Access and integration: Mobility infrastructures in relation to the larger actors of Hatfield

The following maps indicate the various prominent pedestrian routes taken from each transport location in relation to the large actors of Hatfield.

7.2.3.1 Rissik station

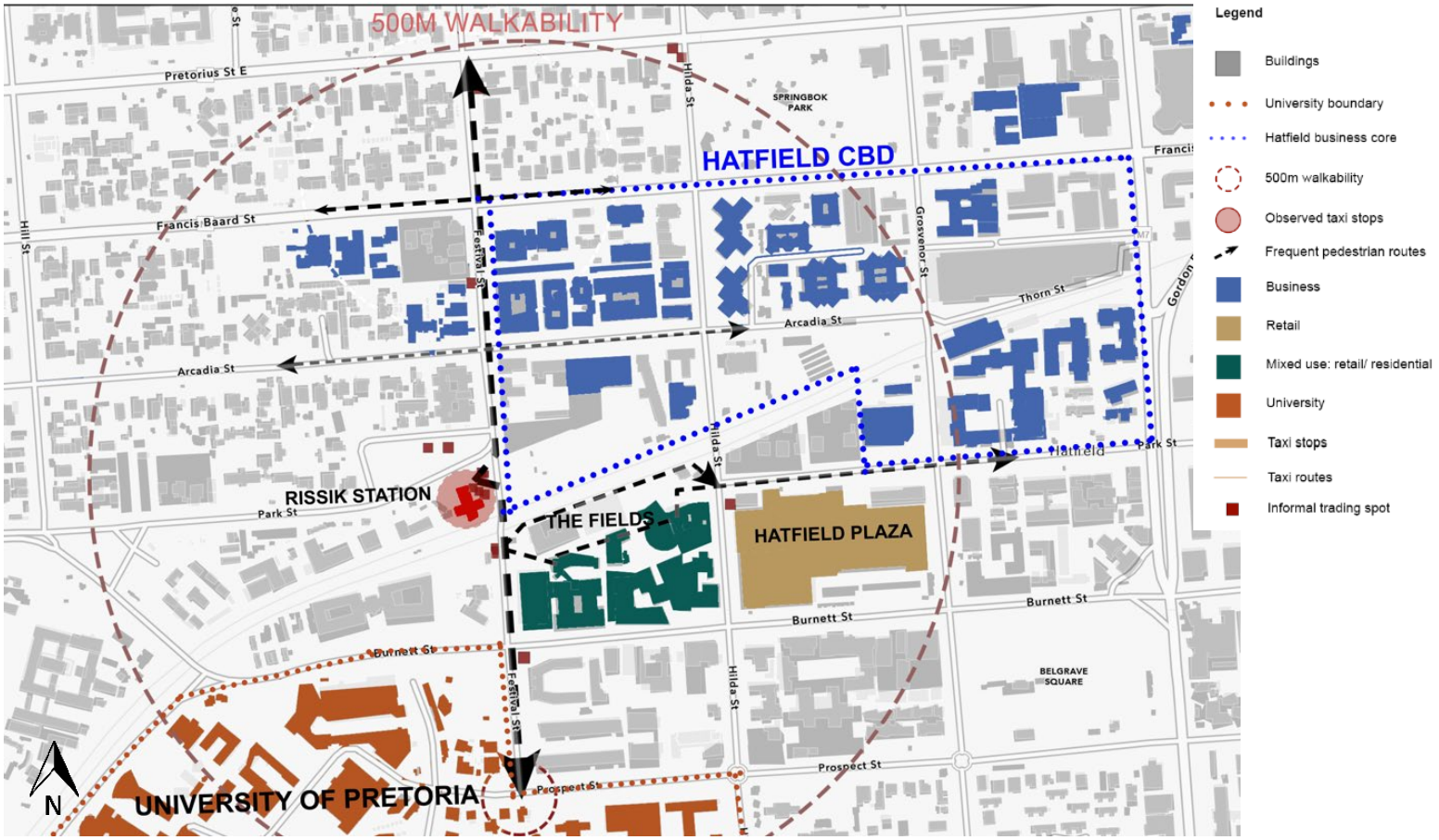

Figure 23: Rissik station in relation to larger actors of Hatfield and frequent pedestrian routes (Author, 2023).

7.2.3.2 Gautrain station

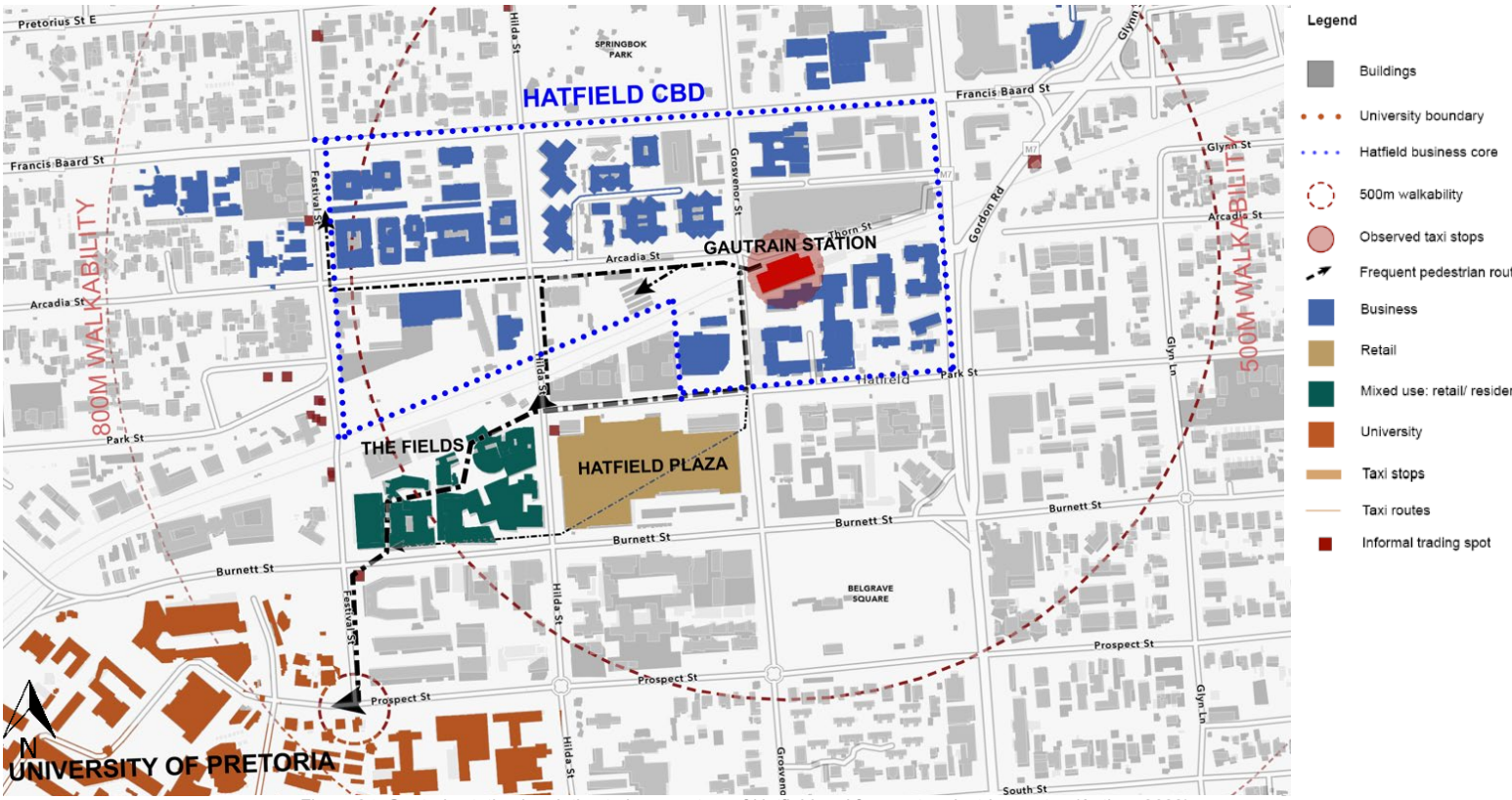

Figure 24: Gautrain station in relation to larger actors of Hatfield and frequent pedestrian routes (Author, 2023).

7.2.3.3 Taxi network

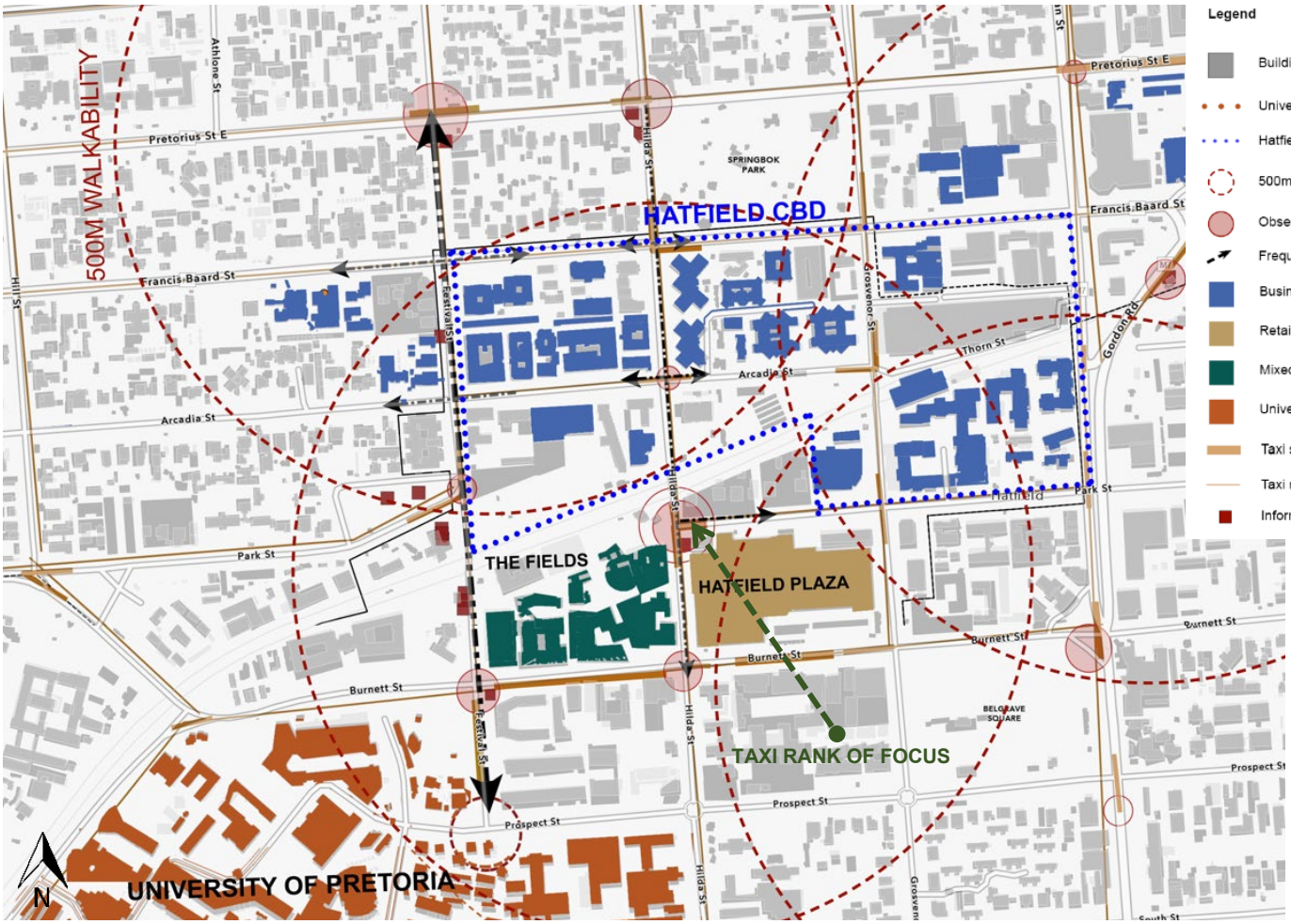

Figure 25: Taxi network in relation to larger actors of Hatfield and frequent pedestrian routes (Author, 2023).

Some commonalities, as mentioned before, can be drawn from the maps above (figure 23,24,25). The Field's appears to be a common thoroughfare point for the commuters of both Gautrain and the Metrorail as, based on interviews, it provides a safe pedestrian friendly environment.

Overall, it appears people travel to Hatfield for the same reasons: namely work or studies.

In terms of walkability, the taxi network provides the widest reach of walkable locations in Hatfield due to the flexibility and variety of location. The Metrorail is the second most convenient location in terms of reaching popular destinations through walking. Lastly, the Gautrain is slightly more distanced from the core activity area causing users to walk further or rely on other forms of transport to reach their destinations.

Exclusion, emergence & mobility: A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs.

7.3 Meso- micro route analysis

Any limitations, hindrances or opportunities along the frequented pedestrian routes are investigated below. They were analysed by considering the social, economic and other infrastructures existing along the routes and destinantions, as well as the how specific interfaces facilitate pedestrian or emergent activity.

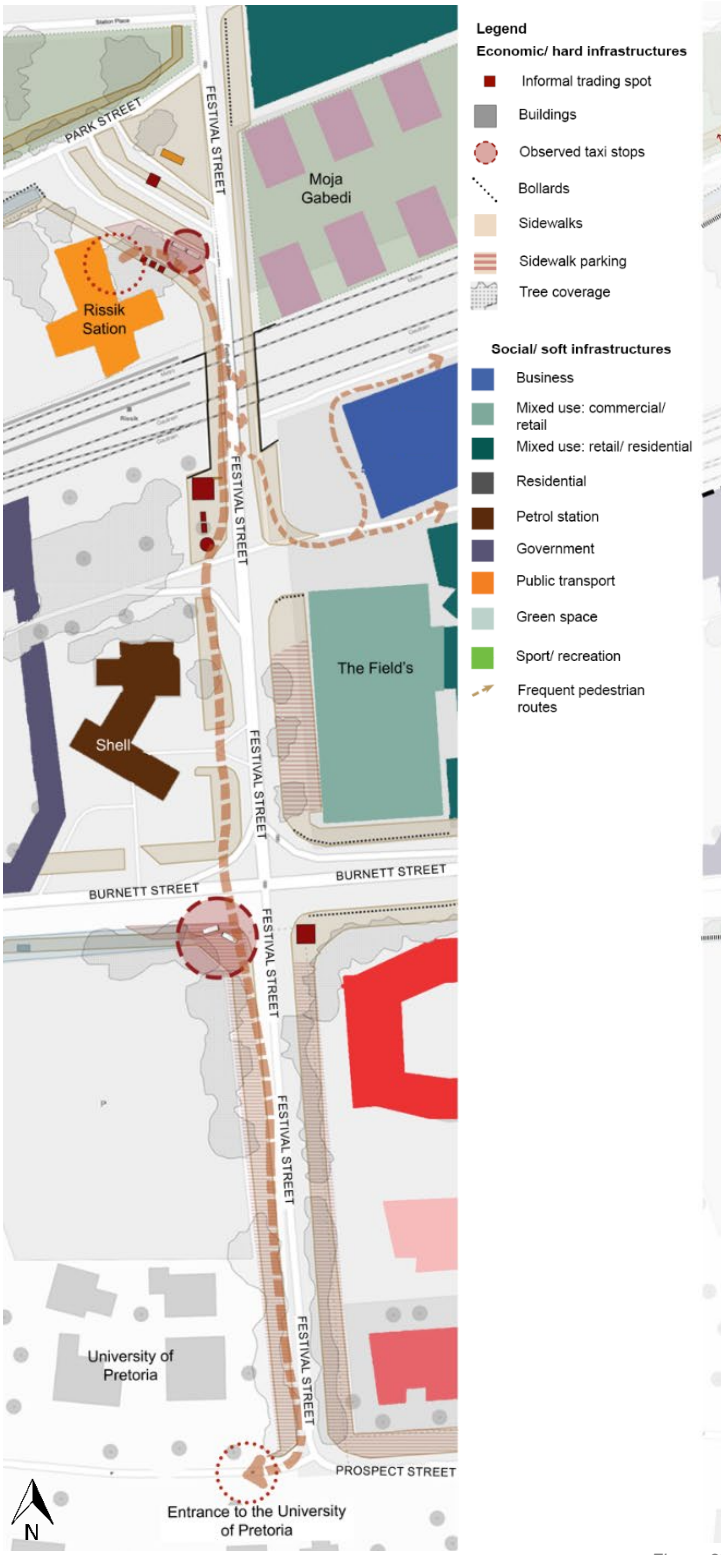

Figure 26: Map showing the pedestrian route from Rissik station to the university and the associated social and economic infrastructures along the way (Author, 2023).

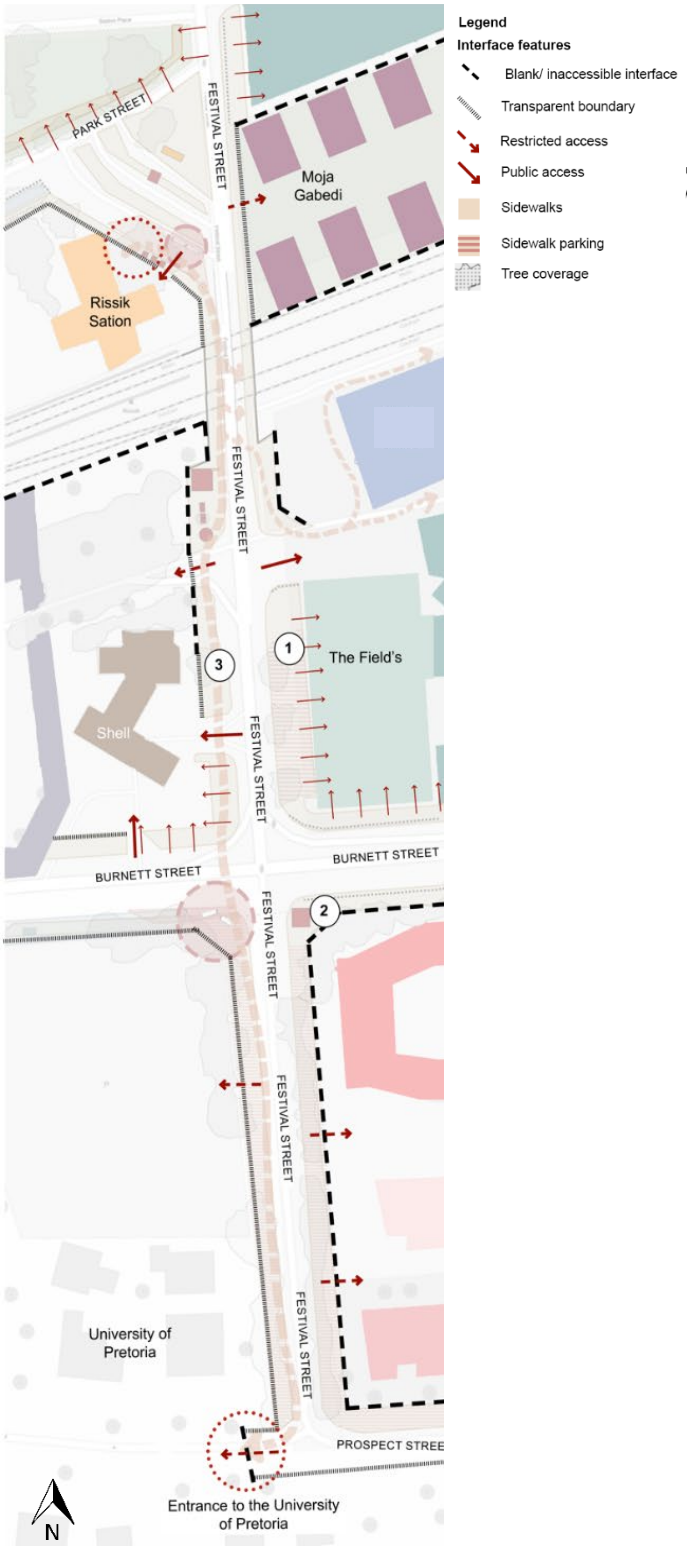

Figure 27: Map showing the surrounding interfaces along the route from Rissik station to the university (Author, 2023).

7.3.1 Rissik station

Route to university: social and economic infrastructures along route

Along this route (figure 26) various socio-economic infrastructures are encountered such as informal traders, a petrol station, and the stores by the Field's. From observation, the informal traders along this route attract a high number of customers in peak periods. There are also two taxi stops in close relation to the station. There are two main streams of people along this route: those that go towards the Fields and the most prominent stream, towards the university. There are sidewalks available for pedestrians to use, however, large parts are unshaded and exposed to the busy street.

Interfaces along route

Figure 2: Pedestrian interface of the Field's (Author, 2023).

Figure 29: Informal trader situated on open space on the sidewalk (Author, 2023).

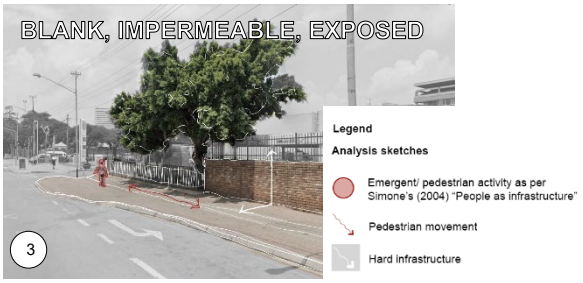

Figure 30: Exposed sidewalk with impermeable interface (Author, 2023).

From the above analysis one can view the role open space and permeability plays in emergence and pedestrian comfort (figure 27). Blank interfaces with open space, give opportunity for activities such as informal trade to arise, where policing and land ownership does not interfere (figure 29). Pedestrian setbacks promote movement through comfortable overhangs (figure 28). However, exposed sidewalks with harsh interfaces shaping them, lead to an uncomfortable pedestrian experience (figure 30). This creates dead spaces, facilitating no activity, which in turn creates a safety risk. Interfaces with visual access and permeability allow for integration with the street and surrounding activities. Obstacles such as bollards and uneven sidewalks tend to disrupt pedestrian activity.

Exclusion, emergence & mobility: A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs.

Route through the fields: social and economic infrastructures along route

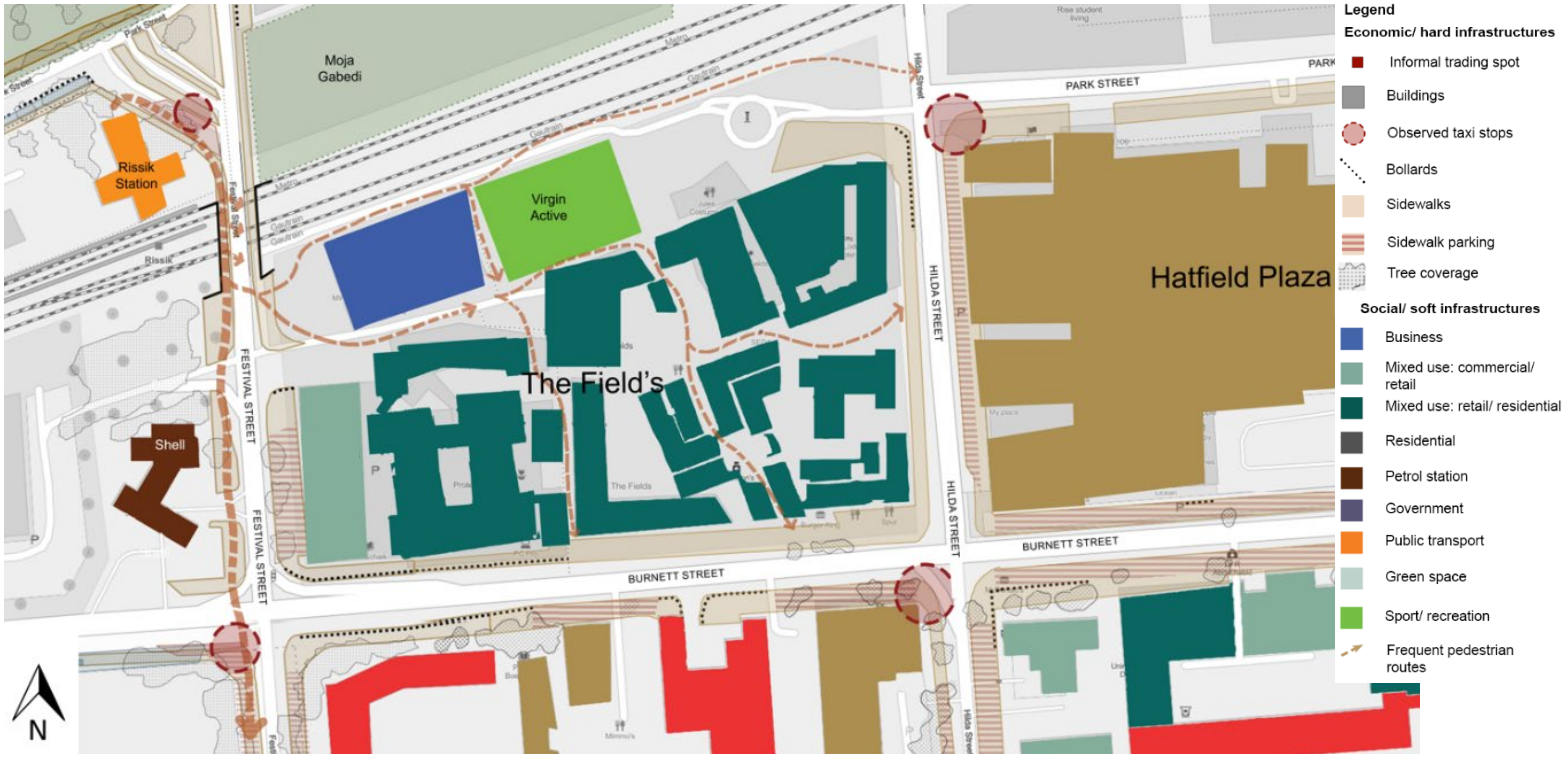

Figure 31: Map showing the various routes through the Field's from Rissik station and the associated social and economic infrastructures along the way (Author, 2023).

Once the commuters have left Rissik, they either move towards the Field's, branching off to various destinations or towards the university (figure 31). The Field's acts as a safe and pedestrian friendly thoroughfare. There are also a number of taxi stops in close proximity to the Field's, showing it may also be a popular destination for commuters from taxis. The permeability of the Field's facilitates pedestrian activity in a safe and comfortable environment and bridges Rissik station to the greater socio-economic infrastructures of Hatfield.

Exclusion, emergence & mobility: A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs.

Interfaces along route

Figure 32: Map showing the various interfaces along the route to the Field's from Rissik station (Author, 2023).

Figure 33: Interface leading into the Field's along Festival Street (Author, 2023).

Figure 34: Pedestrian's crossing Festival Street in the morning (Author, 2023).

Figure 35: Pergola framing pedestrian throughfare in the Field's (Author, 2023).

Figure 36: Green space, cafe and overhangs creating a pedestrian friendly environment in the Field's (Author, 2023).

The route people take through the parking lots creates a very uncomfortable interface with the street as seen in figure 33. Festival street also has no pedestrian crossing which poses a safety risk to the large numbers of people crossing (figure 34). Effective pedestrian crossings should, therefore, be placed on portions of the street where crowds tend to cross, as observed above. Overall, the Field's creates a pedestrian friendly environment through the provision of shelter, shade, and seating (figure 35, 36). This route contains many more pedestrian focussed building interfaces which entices more commuters from the station to utilise these spaces (figure 32).

Route to Hatfield CBD

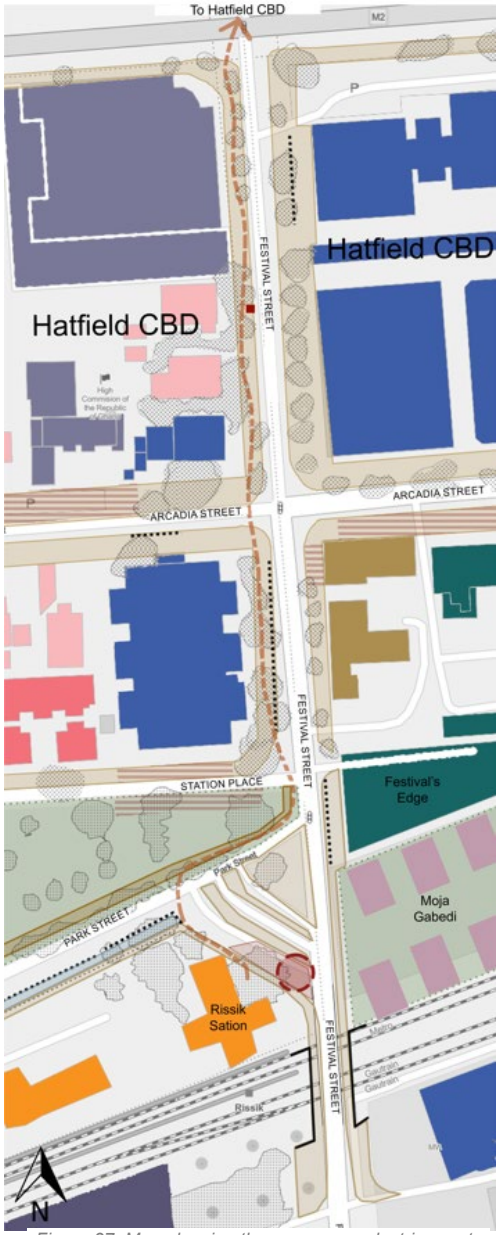

Figure 37: Map showing the common pedestrian route from Rissik station to Hatfield CBD and the associated social and economic infrastructures along the way

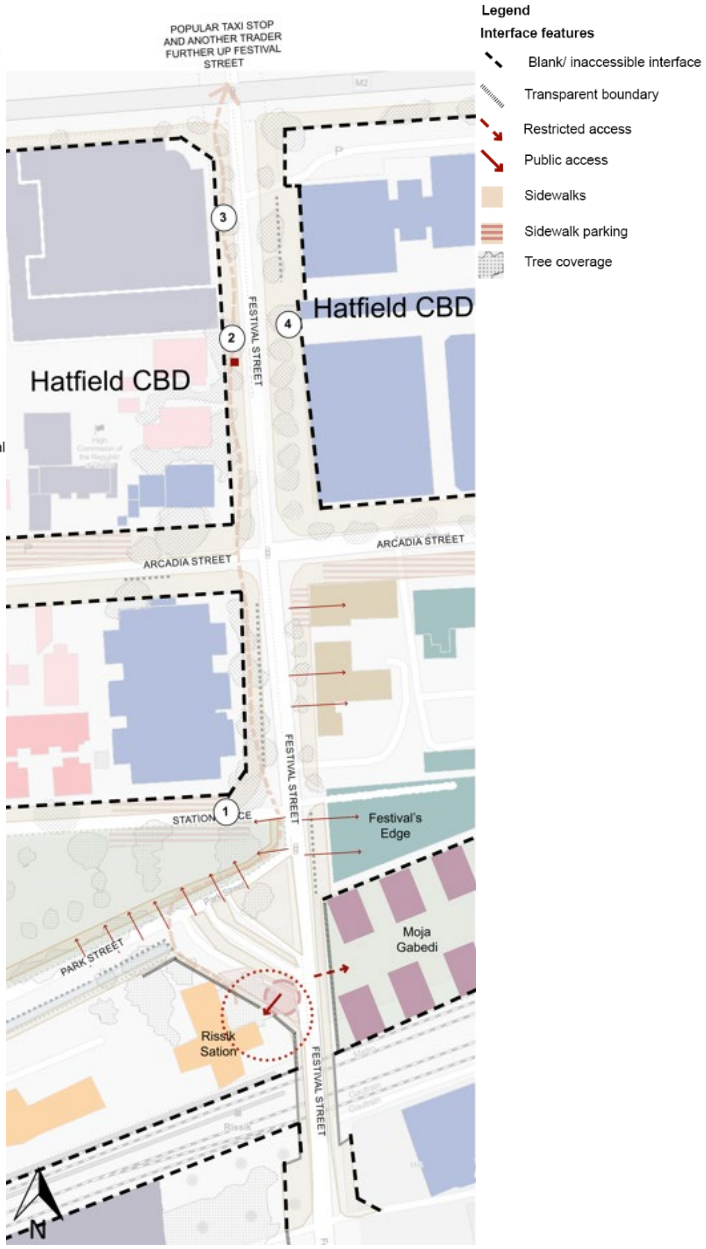

Figure 38: Map showing the interfaces encountered along the route towards the CBD (Author, 2023).

Social and economic infrastructures along route

The route towards Hatfield “CBD” begins pleasant as there is open green space and sufficient tree coverage, however, there is a lack of established socio-economic infrastructures further on (figure 37). There is some informal trade positioned on this route and one convenience store underneath the “Festivals edge” residence. However, that is the extent of socio-economic infrastructures available to the public along this route. The sidewalks are clear of street parking for easier movement.

Exclusion, emergence & mobility: A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs.

Interfaces along route

The interfaces encountered along the route become more impermeable with more exposed sidewalks as one progresses further from the station towards the “CBD” (figure 38). The sidewalk conditions near the station are also not ideal as space is allowed for dumping from the traders in the park (figure 39). Once again, setback sidewalks allow space for informal traders (figure 40). However, they are obstructing pedestrian movement. The blank interface supports the trader as it can structure and define the trade area. Vehicle setbacks, as seen in figure 41 and 42, allow little space for pedestrian activity by facilitating sidewalk parking.

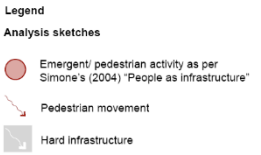

Figure 39: Dumping and sidewalk obstructions along framed by a blank interface (Author, 2023).

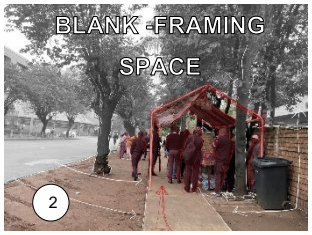

Figure 40: Blank interface along route framing space for informal traders to adapt (Author, 2023)

Figure 41: Vehicle setback interface obstructing pedestrian movement (Author, 2023)

Figure 42: Vehicle setback interface being used for sidewalk parking (Author, 2023).

7.3.2 Gautrain

Route to university: social and economic infrastructures along route

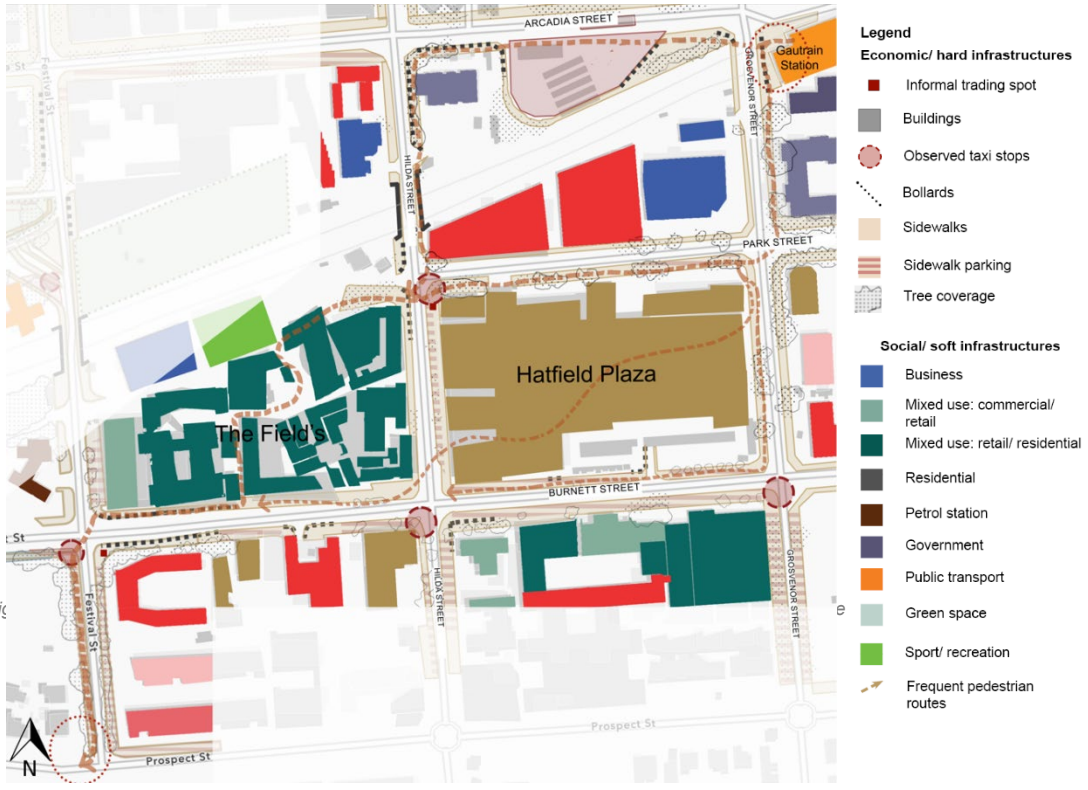

Figure 43: Map showing the various interfaces encountered along the route to the university (Author, 2023).

There were 2 major routes taken by commuters to reach the university (the most common destination) from the Gautrain station as seen in figure 43. From interviews, it was stated that the Field's is preferred as a thoroughfare point for safety reasons. Additionally, it provides socio-economic infrastructures for commuters such as stores and cafes. Hatfield Plaza is also used as a thoroughfare as it provides shelter during the rain. If the commuters chose to solely walk along the roads, they encounter a lack of shade and sidewalk parking which obstructs movement. Interviews also noted a lack of lighting along the routes creating unsafe environments.

Interface interaction analysis

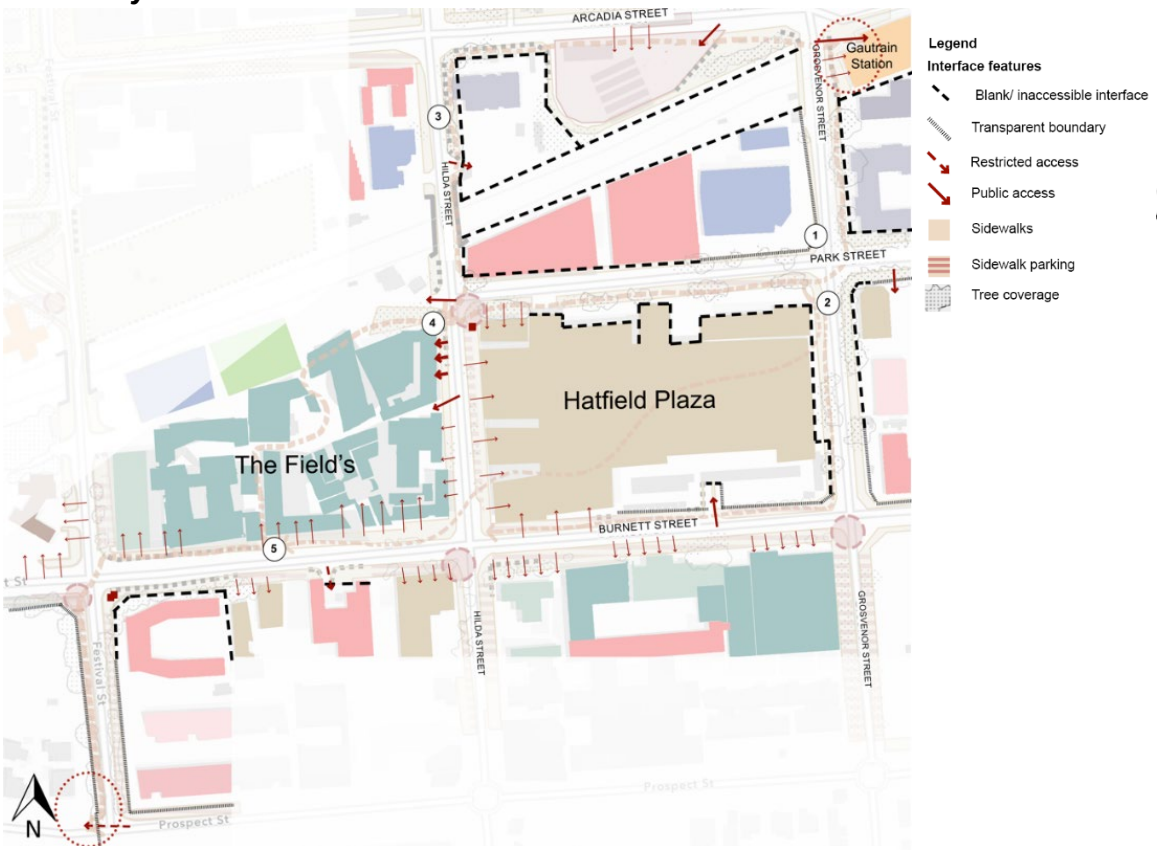

Figure 44: Map showing the various interfaces encountered along the route to the university (Author, 2023).

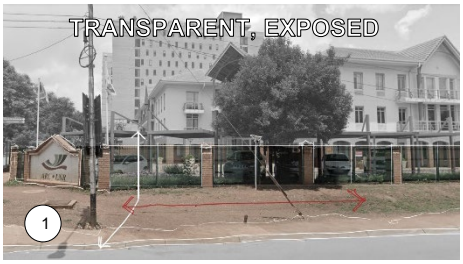

Figure 45: Uncomfortable sidewalk conditions (uneven and exposed to traffic) with lack of shading framed by a blank, transparent interface along Grosvenor Street (Author, 2023).

Figure 46: Pedestrian interface of Hatfield Plaza shopping centre (Author, 2023).

Figure 47: Sidewalk conditions along Hilda Street (Author, 2023).

Figure 48: Pedestrian interface leading into the Field's (Author, 2023).

Figure 49: Vehicle setback interface in front of the pedestrian interface along Burnett Street (Author, 2023).

The route down Grosvenor Street (figure 44) is not particularly pedestrian friendly, containing little socio-economic activities and harsh blank interfaces (figure 45). The interfaces do become more accommodating to pedestrians further down Hilda Street and along Burnett Street with pedestrian friendly, permeable interfaces (figure 47). Pedestrian setbacks allow for more inclusive environments that facilitate pedestrian activity (figure 46,48,49). The blank interfaces along Hilda Street, however, allow little interaction with the street, creating disconnect.

Route to Hatfield CBD: social and economic infrastructures along route

Figure 50: Pedestrian route taken from the Gautrain station towards Hatfield CBD and the associated social and economic infrastructures along the way (Author, 2023).

The route to the Hatfield CBD from the Gautrain station contains no socio-economic infrastructures that benefit pedestrian commuters walking to work as seen in figure 50. The station, therefore, becomes disconnected, with little socio-economic integration of the context. This creates a monofunctional environment with no evidence of emergence and vibrancy.

Interface interaction analysis

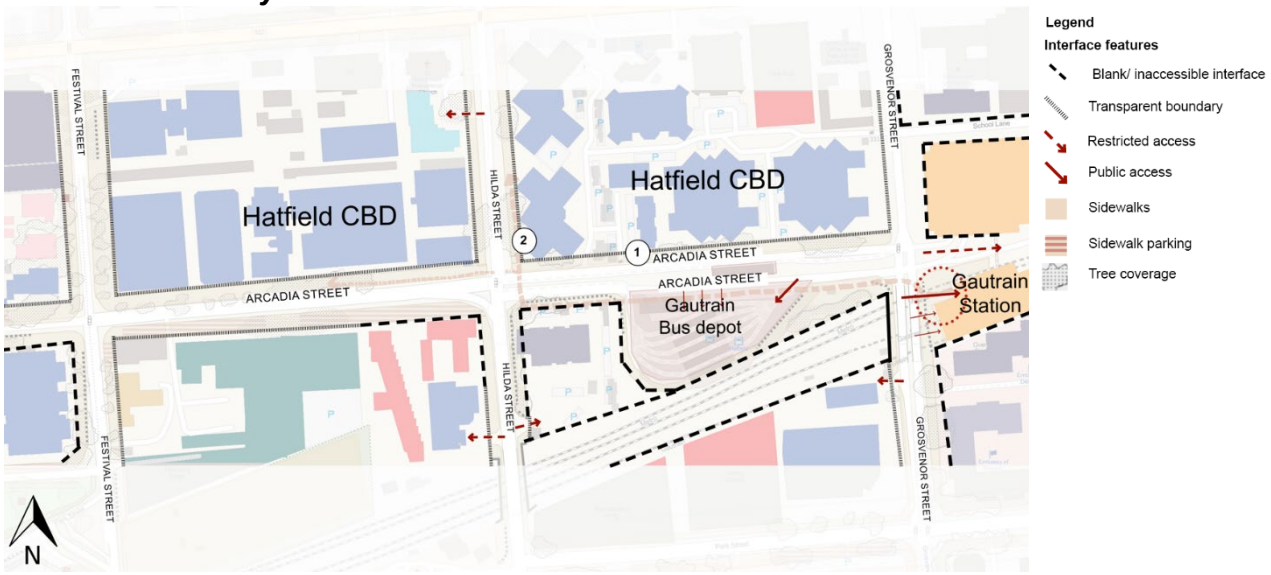

Figure 51: Map showing the interfaces encountered along the route towards Hatfield CBD (Author, 2023).

Although most of the surrounding buildings contain visually permeable interfaces (figure 51), there is still very little consideration for pedestrians and street interface. Infrastructure placed on sidewalks and uneven sidewalk conditions pose limitations for pedestrians (figure 52, 53). Additionally, the sidewalks are narrow, with few trees for shade. The Gautrain's restricted spaces and high security further exacerbate the lack of informal emergent networks and activity. Overall, the hard infrastructures along the route are not facilitating activity and accommodating socio-economic integration.

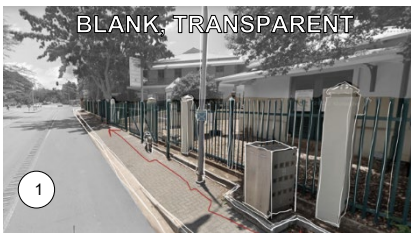

Figure 52: Obstructed sidewalk along Arcadia Street (Author, 2023).

Figure 53: Blank interface framing uncomfortable sidewalk conditions (Author, 2023).

Exclusion, emergence & mobility: A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs.

7.3.3 Taxi network

Social, economic, and other infrastructures along the frequented routes

Figure 54: A map showing the routes from various taxi stops and the associated social and economic infrastructures along the way (Author, 2023).

The taxi route analysis was performed at a slightly larger scale (figure 54) and was challenging to determine exact pedestrian routes due to the flexible nature of the taxi system and its users. Therefore, the routes between prominent taxi stops were extrapolated based off observations of the general direction commuters follow around peak times. Overall taxi stops are well situated near prominent socio-economic infrastructures of Hatfield. This allows its users to access an array of socio-economic opportunity without having to walk far. This notion emphasises the potential of integrating both informal and "mature" institutions as a roadmap for progressive urban development solutions (Koolhaas, 2007:708).

Users, however, only rely on word of mouth to determine the correct taxis to catch for the various destinations. This results in the information for the taxis being often difficult to access. The above map (figure 54) shows the direct correlation between taxi stops and open space. Informal trade is also closely linked to taxi stops and informal taxi ranks.

Interfaces encountered along the route

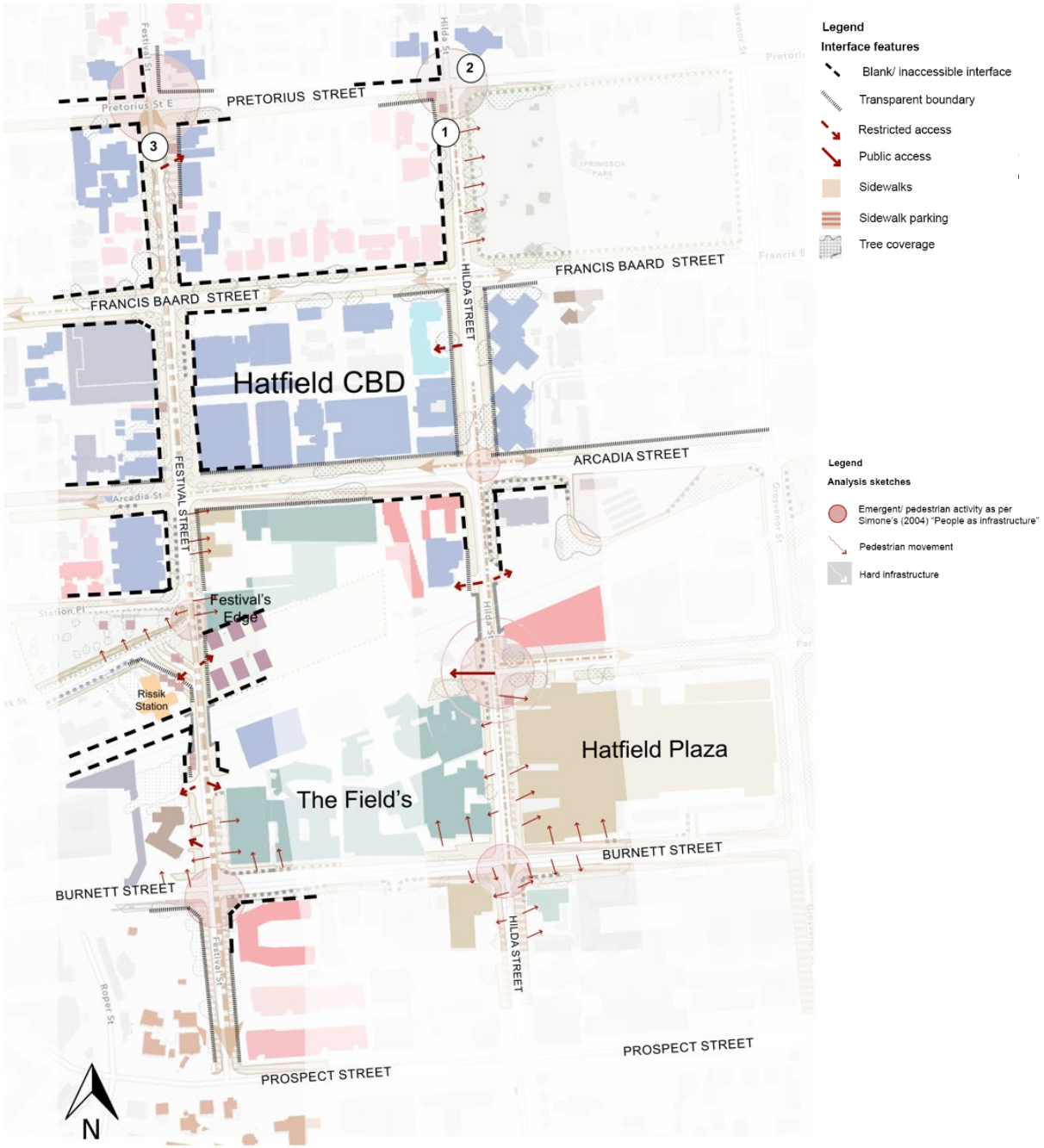

Figure 55: A map showing the various interfaces encountered along the routes (Author, 2023).

This interface analysis showcases in figure 55, the role open space plays in facilitating emergence and activity. The images below also showcase instances of appropriation and adaptation of hard infrastructure interfaces shaping users' lifeworld (figure 56, 57, 58). Steps and planters become seating, fencing becomes an informal storefronts and empty sidewalks

become taxi stops. This speaks to the ideas put forward in Rem Koolhaas's "Lagos" (2007:662) whereby public spaces are continuously reconceived, and life "thrives" on and around the streets. Pavements shape spaces which house a variety of entrepreneurial activities like hawkers, tailors, hairdressers, or mechanics (Koolhaas, 2007:662). A lack of formal consideration for these industries results in the occupation of any available spaces and infrastructures (Koolhaas, 2007:674). Organisation is often based on the maximisation of customer interaction through strategic placement of businesses and activities with high pedestrian activity (Koolhaas, 2007:685). Observations from this study support this idea, as informal traders are often found around taxi stops or stations to attract the most pedestrians.

Figure 56: Transparent interface being appropriated by an informal trader near a taxi stop (Author, 2023)..

Figure 57: Pedestrian setback framing pedestrian activity (Author, 2023).

Figure 58: Interface being adapted by commuters waiting for a taxi (Author, 2023).

7.4 Micro socio-spatial analysis

The aim of this analysis is to identify potential hard infrastructural conditions that could be developed to support micro trade and pedestrian access surrounding the various transport nodes. Furthermore, this section of the report emphasies the existing ways in which infrastructure has already bee adapted. This shall reveal the extent to which mobility infrastructure either intentionally or unintentionally acts as a facilitator of emergence. By doing so, missed opportunities can be revealed, uncovering the potential of public infrastructure for improved integration and inclusion.

7.4.1 Rissik station

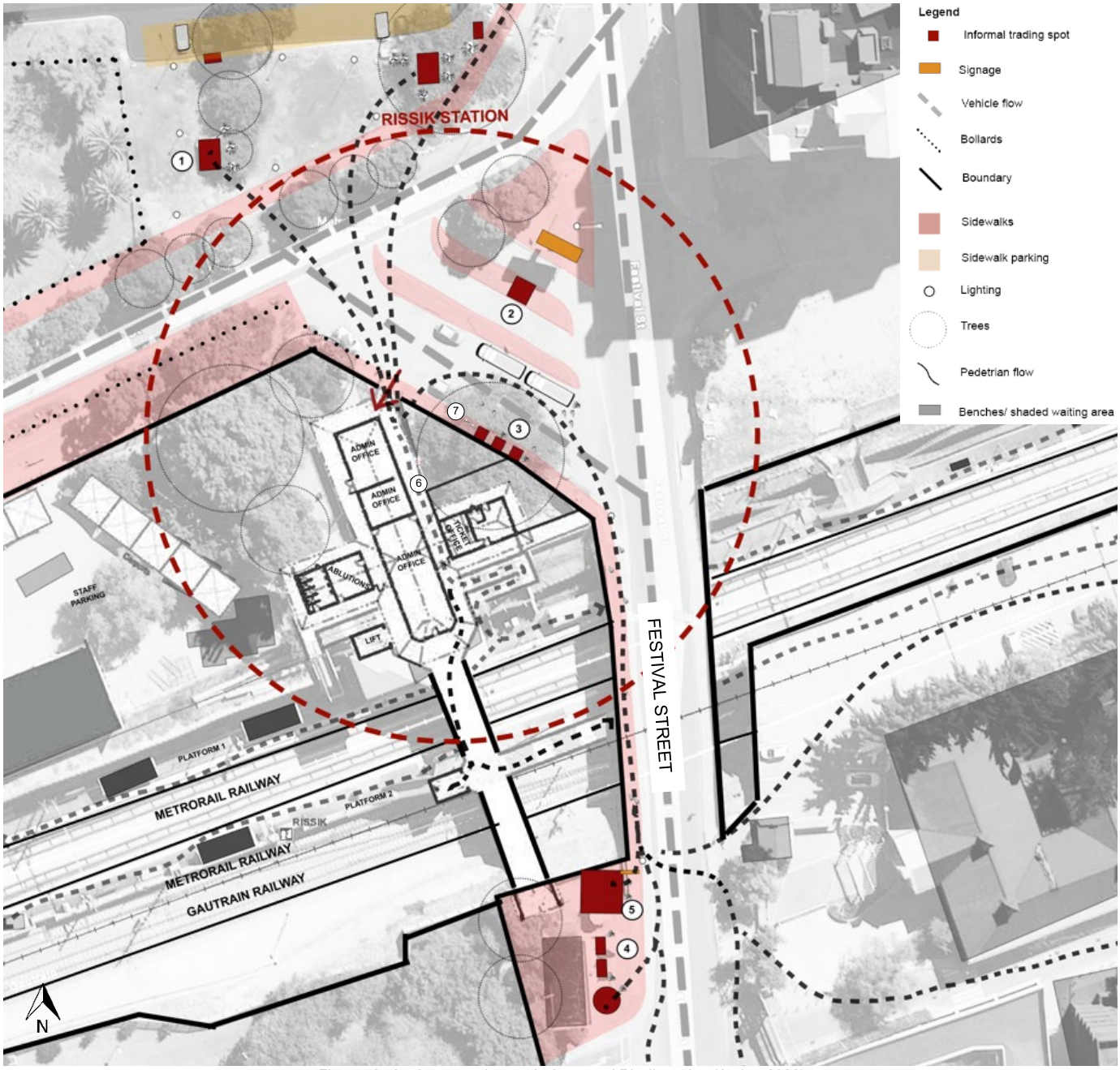

Figure **59**: *A micro mapping analysis around Rissik station (Author:2023)*

Figure **60**: *Permanent trading structures in the park (Author:2023)*

Figure **61**: *No waiting areas for taxis outside the station (Author:2023)*

Figure **62**: *The stations infrastructure supporting trade (Author:2023)*

In figure 59 above, the area surrounding the Rissik station has been assessed with regards to the spatial organisation of traders and their interactions with physical features. The most popular areas to trade are on open sidewalks to attract pedestrians passing by. Open public space becomes the preferred area of trade due to the harsh boundaries and control measures of Rissik station. This reveals the current constraining and non-facilitative role of the station. The fenced-off boundary condition restricts pedestrian movement for those entering and exiting the station, suppressing the user's ability to utilise the station comfortably (figure 62). The infrastructure of the station is currently being informally adapted to support the traders' structures and taxi stops (figure 61 and 62). However, they are limited with regards to sidewalk space, shelter storage and access to facilities. Flexible structures are situated around the station as they can be removed quickly, if necessary (figure 62), whereas the more permanent structures have been set up in the park (fees are paid to the city creating security) (figure 60).

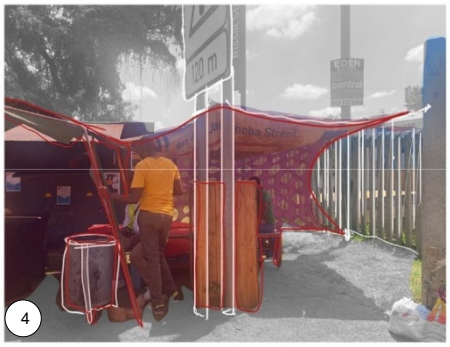

Figure 63: The stations infrastructure supporting trade (Author:2023)

Figure 64: Permanent and temporary structures on Festival Street (Author:2023)

Along Festival Street, there is a mixture of permanent and temporary structures. The permanent structures contain "Fortis Hotel" branding, this is suggestive of some form of partnership between vendors and the private sector (figure 63 and 64).

Figure 65: Informal traders using the train, transporting goods (Author:2023)

Figure 66:Informal trader packing goods into private vehicle (Author:2023)

The organisation of the traders around Rissik station can also be analysed (figure 67). The more permanent structures, such as in the park, are able to provide more "long-term" programmes as they have the facilities to cook meals and access to storage. From the interviews and observations, it appears that most traders who cook food have access to

private transportation or storage (figure 66). This is appears as a necessity for such businesses, as it is not possible to transport all goods and equipment using public transport. The stores that sell non- perishable, small items are also mainly temporary structures as it is easier to pack up and transport that stock at the ned of the day. There was no evidence of these smaller store owners owning private vehicles from observation. This suggests that these store owners are limited to selling these smaller convenience items for ease of transport on trains or taxis (figure 65).

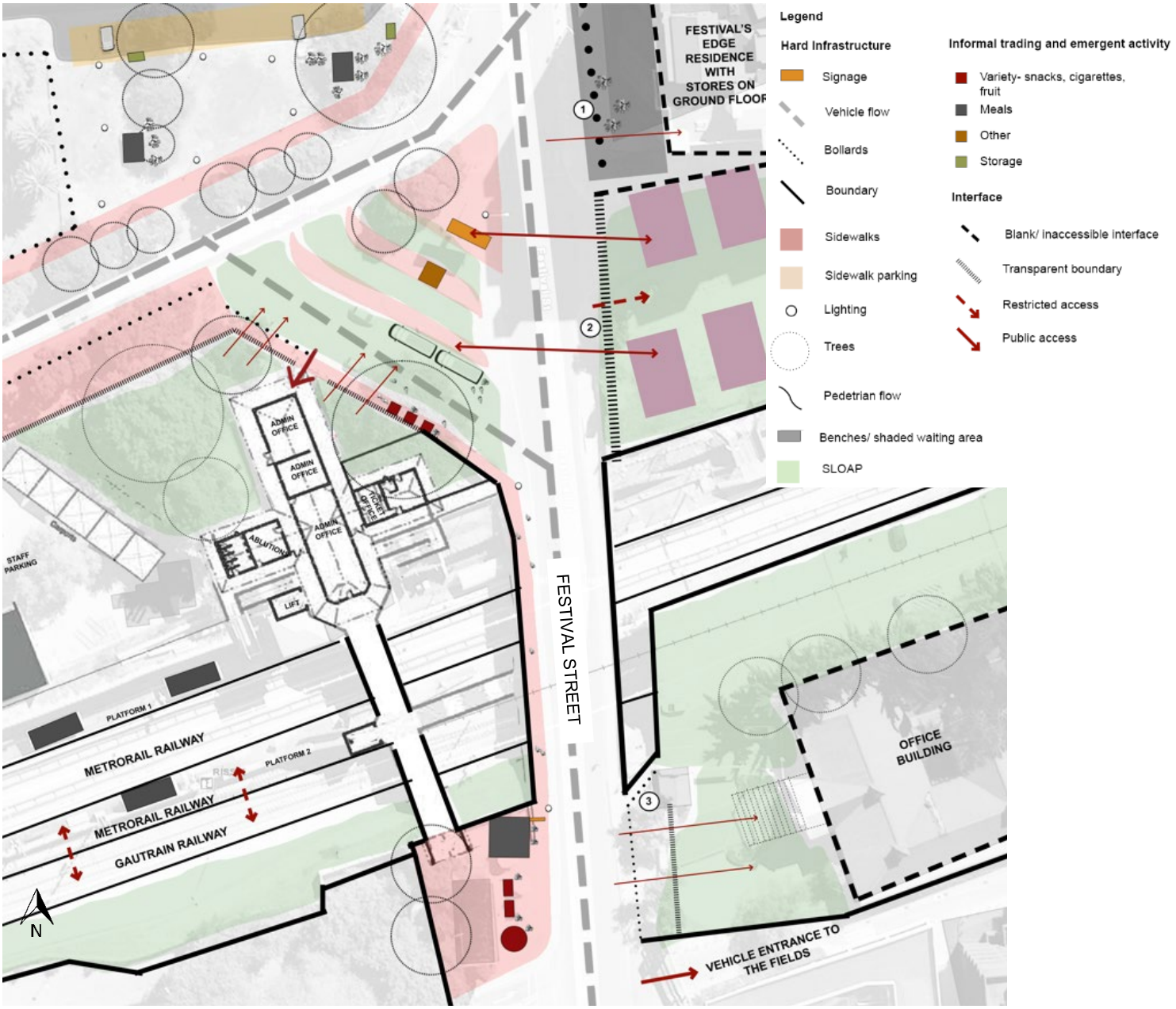

Figure 67:The organisation of the traders around Rissik station (Author:2023)

Figure 68: Pedestrian interface of store below the Festival's edge residence: interacting with the street (Author, 2023).

Figure 69: Transparent interface of Moja Gabedi (Author, 2023).

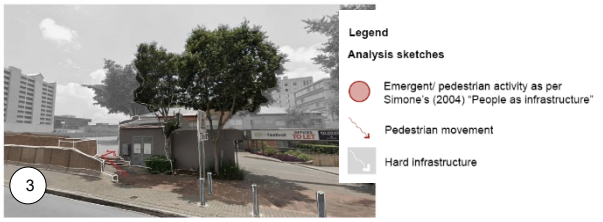

Figure 70: Uncomfortable pedestrian interface to the Field's (Author, 2023).

When looking at interface, there appears to be a disconnect between the station and it's surrounding activities. There is opportunity for interaction with the surrounding traders, stores and Moja Gabedi (a community food garden and waste upcycling centre) through the development of the SLOAP around the station (figure 68, 69, 70). This has the potential of creating multi-functional, transport orientated hubs which support a range of activities (figure 67).

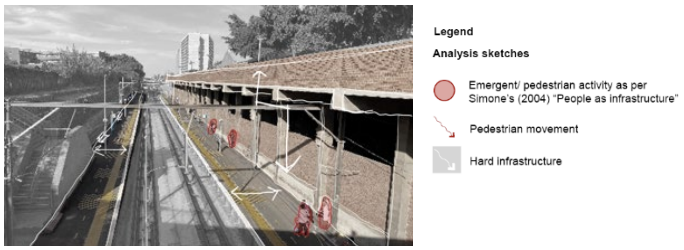

Figure 71: Lack of seating and shade for commuters of the Metrorail (Author:2023)

Finally, when assessing the actual train platforms and waiting areas, there is a lack of seating and shade for the commuters (figure 71). There also lies potential for integration with the Gautrain station through shared platforms and the development of SLOAP (figure 67).

Exclusion, emergence & mobility: A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs.

7.4.2 Gautrain station

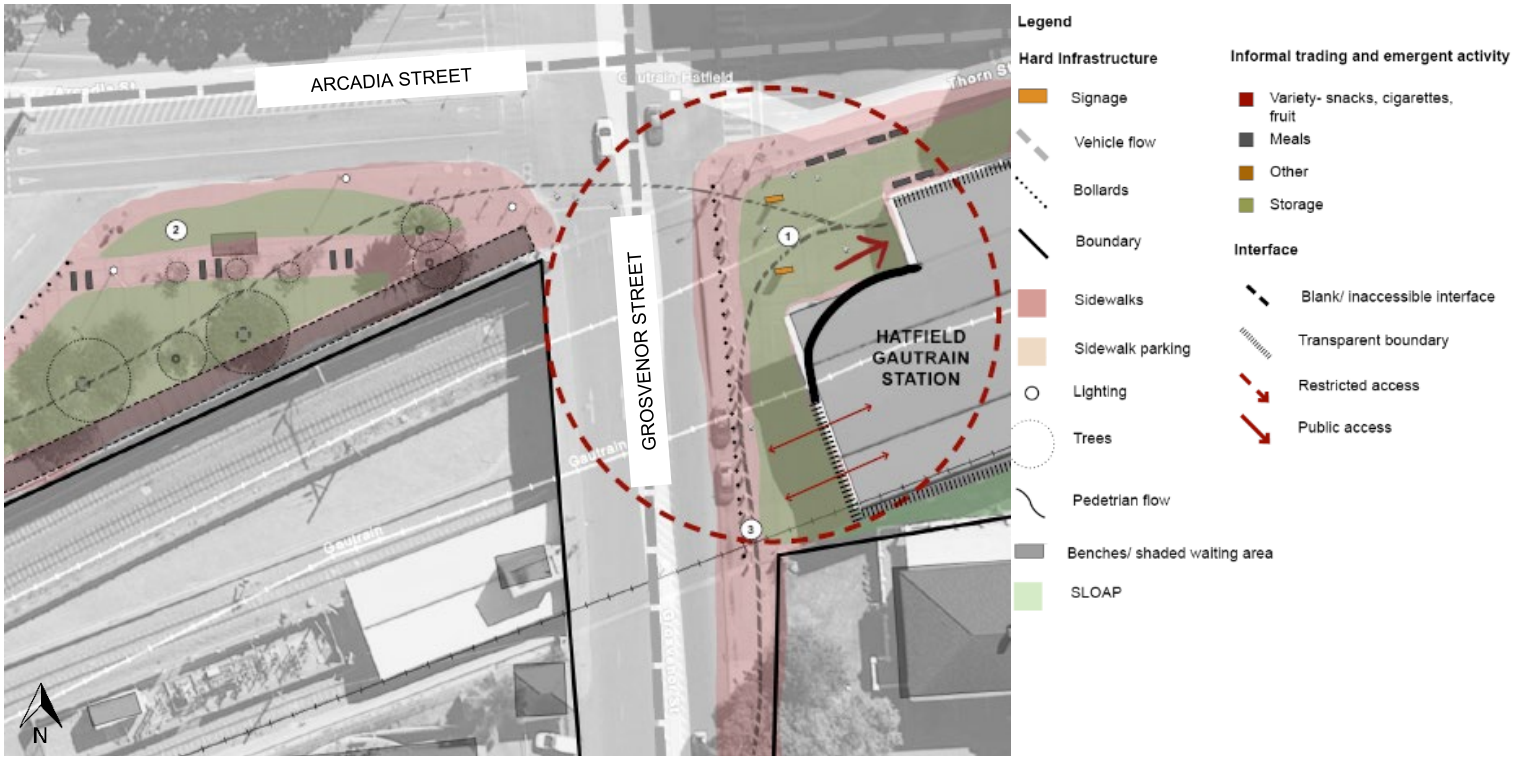

Figure 72: A micro mapping analysis of the Gautrain station (Author:2023)

Figure 73: A lack of activity surrounding the Gautrain station (Author:2023)

Figure 74: Ample space that is currently underutilised around the station (Author:2023)

Figure 75: Ample space that is currently underutilised around the station (Author:2023)

For comparison the Gautrain station's spatial organisation and physical features can also be analysed (figure 72). The Gautrain station's interface uses transparency (figure 75) to facilitate

Figure 76: Readily available information inside the Gautrain station (Author, 2023).

a connection to the street, however, the bollards and raised paving pysically disrupts this connection (figure 72).The Gautrain station's entrance has less of a harsh physical boundary, compared to Metrorail's palisade fencing. However, there is a stricter sense of control through the presence of bollards and a high security presence (figure 73). Around the Gautrain station, although ample space allows (figure 72), there is no vendor or commercial activity apparent (Ndwandwe and Gumbo, 2020:991) (figure 74).

The interior of the Gautrain station contains many assistive navigation systems that aid in commuter convenience. Payment is simple and convenient and there is substantial access to information at the stations (figure 76).

7.4.3 Typical "informal taxi rank"

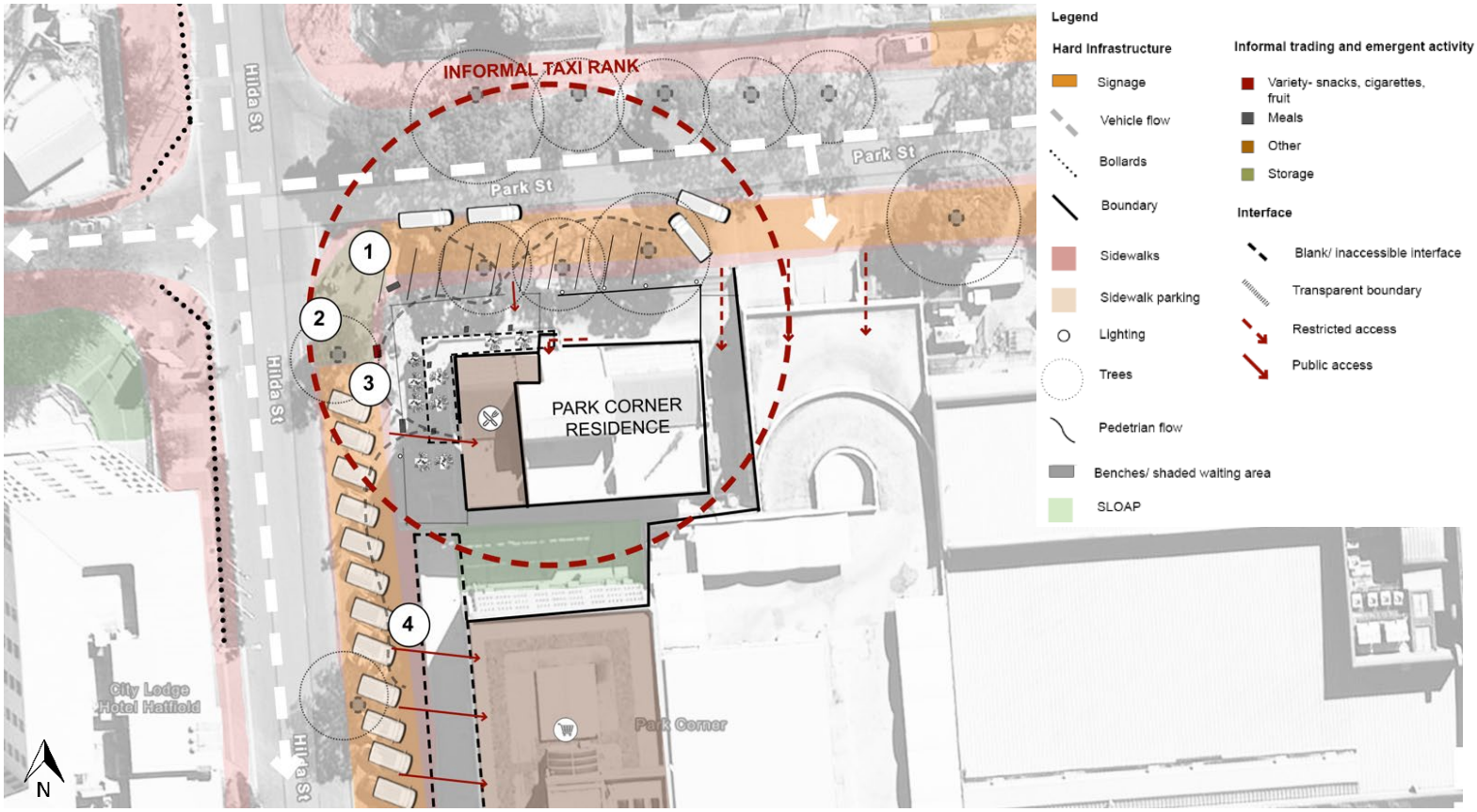

Figure 77: Micro spatial analysis around a typical taxi stop revealing hard and soft infrastructure interactions (Author, 2023).

Due to the time constraints of the study, a specific, popular informal taxi rank in Hatfield was chosen for analysis and shall be treated as a representation of the general conditions (figure 77).

Figure 78: Taxis appropriating open space near a popular eatery (Author, 2023).

Figure 79: Informal trader near the taxi stop (Author, 2023).

Figure 80: Informal trader appropriating a planter for his store (Author, 2023).

Figure 81: Pedestrian interface of Hatfield Plaza (Author, 2023).

The specific taxi rank is situated near a popular eatery and the Hatfield Plaza shopping centre (figure 78, 81). This demonstrates the interdependence of the two sectors on each other. Integration proves advantageous as taxi commuters gain access to the centre's facilities, and in turn, the centre benefits from the business generated by those commuters. The taxi rank also accommodates informal trade through the provision various hard infrastructures on site, such a trees or planters, for adaptation (figure 79,80).

The adjacent eatery's interface facilitates the range of activities occurring around it through an overhang framing the outdoor seating area with a subtle fence for spatial designation (figure 79). The tend to taxis stop and wait for passengers in the afternoons at this site, most likely due to the location's centrality, public socio-economic amenities, such as the eatery, available open space for parking and shade from trees. This analysis demonstrates the essential elements needed to promote socio-economic vibrancy and integration.

8 Data interpretation, discussion and findings: assessing opportunity and potential

8.1 Summary of findings

The summarised findings of this mini dissertation originate from a consistent set of categories and sub-categories that were established through prior coding and data analysis. The findings are based on the lifeworld perspectives of commuters and users of the associated emergent networks (traders), assessing the extent to which Hatfield's stations serve marginalised communities and revealing opportunities for emergence. The ultimate goal is to determine potential transformative approaches extrapolated from these findings. Overall, the findings were summarised, tabulated, cross-referenced, and categorised as either opportunities or limitations informing the potential for transformation (table 1,2,3).

8.1.1 Metrorail

Metrorail					
Scale	**Method and reason of analysis**	**Category**	**Subcategory**	**Summary of Findings**	**Cross-reference findings with sources**
Macro- meso	Desktop analysis of costing, frequency, and general opinions of the stations based on interviews, informal conversations, and social media	Arrival into Hatfield	Cost vs convenience	The Metrorail is the most affordable option of transport and therefore appears to be the most prominently utilised.	-Refer to figure 15: The cost analysis table. -Most interviewees mentioned cost as defining factor of use. -Trains and buses are viewed as preferable as they are the most affordable forms of transport (Lucas, 2010:14). -Trains are viewed as unreliable, and overcrowding is also an issue (Mosaine, 2022: 546).
				However, overcrowding, unreliability, and infrequency of the train results in low-income users' livelihoods being governed by these systems.	-Interviewees mentioned infrequency and unreliability of the train system as a large area of concern. -Social media comments express some improvement in overcrowding conditions and safety since the updates from yellow to blue trains. -However, commuters are still generally unsatisfied with the service (appendix 10,11). -Trains often result in commuters arriving to work late and limit the stock for informal traders (Mosaine, 2022: 546).
	Socio-spatial mapping analysis to reveal hard and soft infrastructural interactions (sub-question 1)		Social and economic activity along routes	There is a variety of public amenities along the frequent pedestrian routes from the station. The informal traders, and the stores beneath the Festival's edge offers convenient products en-route. The informal traders are far more utilised than the formal stores surrounding the station.	-Observations; refer to figure 68.
				The Field's is a large actor in the commuter's route as it provides a safe pedestrian environment with some convenient amenities, however, it appears to be mainly used as a thoroughfare as the lower-income users buy from traders as opposed to formal retail.	-Observations; refer to figure 31,32.
			Destinations within Hatfield and walkability	The 3 main routes people took from the stations were to places of work either through the Field's or towards Hatfield's CBD. The other option was to the university, whereby, majority of commuters appeared to be workers there, with, a few students. It appears that majority of the commuters travelled from Mamelodi.	-Observations; refer to figure 23.
				Rissik station is in a prime location, in a close walkable range to the main anchors of Hatfield and many social and economic infrastructures.	-Observations; refer to figure 23.
Meso- micro	Socio-spatial mapping & lifeworld analytical sketches of interfaces to determine the relationship between hard and soft infrastructure (sub-question 1+2)	Interface and mobility within Hatfield	Interfaces along frequent pedestrian commuter routes	Overall, some interfaces encountered near the station are pedestrian friendly such as the Field's or Festival's edge.	-Observations; refer to figure 38,44. -(Dovey and Wood, 2014).
				However, many hinderances are encountered along the way such as uncomfortable sidewalk conditions, impermeable interfaces creating unsafe conditions for pedestrians with a lack of lighting and shade.	-Observations; refer to figure 33,39,45. -Safety is a concern along these routes and people mentioned walking through shopping centres feels safer (Mosaine, 2022: 548).
				Interfaces which include shading and shelter on a pedestrian scale (of which are limited along the frequent routes) are far more comfortable than those that are either vehicle orientated (obstructive) or poorly maintained and impermeable (uncomfortable and unsafe).	-Observations; refer to figure 30. -(Dovey and Wood, 2014).
			How interfaces around Hatfield facilitate emergence (trade and taxis)	Along the prominent routes, informal traders can be encountered as they set up where the most pedestrians pass by. They often take advantage of open spaces (SLOAP).	-Observations; refer to figure 21. -(Simone, 2004). -(Dovey, 2014).
Micro	Socio-spatial mapping & lifeworld analytical sketches of conditions around transport sites to reveal the facilitation or perpetuation of inequality and exclusion of marginalised communities and emergent networks (sub-question 2)	Pedestrian interaction with transport points and their integration of surrounding networks	Station interface and the facilitation of emergence	Currently, there is little consideration for the provision of infrastructure for taxi systems outside of the station although informal appropriation of space occurs.	-Observations; refer to figure 61. -(Dovey and Wood, 2014).
				There appears to be no intention of the station's considerations for the integration of the surrounding informal traders. However, the analysis above revealed the emergent ways in which the traders are adopting space. Since the update to the blue trains all forms of trading have been prohibited on the trains and it is also legally not permitted at the station although it occurs	-Observations; refer to figure 62. -Interviewees mentioned the banning of trade since the train update. -Online video interview from 2022 (appendix 8,9)
				An interesting finding was that quite a few informal traders had access to private vehicles. This suggests that their success is possibly restricted using the train. Traders mentioned difficulties in having to use the train or taxis to transport their goods. There is either not enough space on the train or they would have to pay extra fares.	-Interviews with traders -Observations; refer to figure 66.
			SLOAP as space hosting emergence	Informal traders set up in the open spaces around the station such as sidewalks and the open green space adjacent to the station. The traders in the park have access to storage space for their products and equipment, however, the other traders must only carry what they can fit on trains and taxis or use a private vehicle.	-Observations; refer to figure 60, 62. -(Simone, 2004). -(Dovey, 2014).
				The taxis also make use of the open space in front of the station to stop and pick up commuters.	-Observations; refer to figure 61. -(Simone, 2004).
			Emergence organising around hard infrastructure	The infrastructure of the station is appropriated by the emergent networks (taxis and traders). This includes trees for shade, fencing and signage for structure and sidewalks for space.	-Observations; refer to figure 62,63. -(Simone, 2004). -(Dovey, 2014).
			Other activities near stations	Rissik station is in close proximity to a store on the ground floor of the Festival's edge residence as well as directly adjacent to Moja Gabedi.	-Observations; refer to figure 32.
				Spontaneous activities began to arise around the station that are more social and recreational. People are congregating around the traders' stalls and playing soccer around the station and in the park. This shows the potential of open space as well as how it is appropriated.	-Observations; refer to figure 62. -(Simone, 2004). -(Dovey, 2014).
			Analysis of the hard infrastructure of waiting areas	The waiting areas on the platforms of the station contain little shade and seating for commuters. With the long waiting times between the trains, this is essential for user's comfort. There is also limited availability of information.	-Observations; refer to figure 71.

Key	Opportunities/ positives	Neutral	Limitations/ hindrances/ difficulties

Table 1: Summary of findings for the Metrorail (Author, 2023).

8.1.1.1 Discussion

Overall, the Metrorail acts as a site of pedestrian activity and exhibits signs of hosting emergence through some evidence of trade and taxi activity. The Metrorail presents a significant opportunity to support lower income users, originating from contexts that were previously segregated from the socio-economic opportunities of cities. Although affordable, the current functioning of the Metrorail has restrictive effects on the socio-economic establishment of its user groups, as their livelihoods remain governed by this system.

Numerous users are forced to make sacrifices to compensate for the system's shortcomings. They must travel long distances from their homes to access key needs such as employment and education (Lucas, 2010:9). In this study, it was evident that many commuters and traders travel daily from the peripheral areas like Mamelodi, covering a significant distance (25 km from Hatfield), with some traders even originating from as far as Soshanguve (51 km from Hatfield). The reliance on public transport for the sustenance of their livelihoods is thus considerable. The significant distance from socio-economic opportunities highlights the perpetuation of exclusion and inequality for those residing in marginalized communities. This journey is made even more challenging through the train's unreliability and inconsistency.

Rissik station, ideally located in Hatfield, holds the potential to become integrated with surrounding public land and create multi-functional, vibrant "hubs" within Hatfield for commuters. However, current approaches employed by PRASA restrict informal trade, and the existing infrastructure does not adequately accommodate the associated networks such as trade and taxis. Informal traders who use the train are limited by what they can carry due to a lack of on-site storage space or other facilities. Furthermore, the station lacks proper facilities for bus or taxi stops and waiting areas for commuters.

Opportunities exists to further enhance these existing auxiliary activities by utilising the open space around the station or possibly integrating PRASA's offices, which adjoin the site yet remain fenced off and separated.

With its substantial user base, Rissik station has the potential to become a gateway into Hatfield, facilitating various socio-economic activities for the benefit of both commuters and associated networks like trade and taxis.

Updates to trains

Considering the recent train and station updates, few interviewees mentioned any significant changes noted after the Metrorail's new train update. However, it was mentioned that informal trade prohibition with trade now prohibited on the trains and the platforms since the update. This was corroborated by an interview performed by *The Times* in 2022 (appendix 7,9). This creates a significant restriction on the informal traders' customer base that was accessible to them in the past.

Social media comments and images suggest that the updates yielded some positive results in terms of security and reduced crowding. Nevertheless, concerns persist regarding the unreliability and lack of train availability on weekends (appendix 12).

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8.1.2 Gautrain

Gautrain					
Scale	**Method and reason of analysis**	**Category**	**Sub- category**	**Summary of Findings**	**Cross-reference findings with sources**
Macro- meso	Desktop analysis of costing, frequency, and general opinions of the stations based on interviews, informal conversations, and social media	Arrival into Hatfield	Cost vs convenience	The Gautrain provides a more comfortable spatial experience for the user, however, this comes at a higher cost.	-Observations; refer to figure 76. -Refer to cost analysis and frequency table figure 15.
	Socio-spatial mapping analysis to reveal hard and soft infrastructural interactions (sub-question 1)		Social and economic activity along routes	The Field's and Hatfield Plaza are the only two actors providing socio-economic amenities and services for pedestrians from the Gautrain station.	-Observations; refer to figure 43.
			Destinations within Hatfield and walkability	There are various routes that students use to reach the university, which is the most prominently used. The other two routes go towards the Gautrain bus depot and Hatfield CBD. Overall, the two main user groups of the Gautrain include students and businesspeople using the Gautrain bus service.	-Observations; refer to figure 24. -Interview data
				The Gautrain station is further removed from the social-economic abilities of Hatfield.	-Observations; refer to figure 24.
Meso- micro	Socio- spatial mapping & lifeworld analytical sketches of interfaces to determine the relationship between hard and soft infrastructure (sub-question 1+2)	Interface and mobility within Hatfield	Interfaces along frequent pedestrian commuter routes	The Field's and Hatfield Plaza are two thoroughfare options that commuters utilize as they are safe, convenient, and pedestrian friendly.	-Observations; refer to figure 44. -Interview data
				For majority of the frequent routes from the Gautrain, the street interfaces are uncomfortable and impermeable, with poor sidewalk conditions, little shade and lighting and feel unsafe.	-Observations; refer to figure 44. -(Dovey and Wood, 2014).
			How interfaces around Hatfield facilitate emergence (trade and taxis)	There is no evidence of emergent informal activities along the routes to the Gautrain	-Observations; refer to figure 73. -"Findings reveal limited improvement on business operations or formations, especially integration of small-scale entrepreneurs from previously disadvantaged communities and informal traders" (Ndwandwe and Gumbo, 2020:995).
Micro	Socio- spatial mapping & lifeworld analytical sketches of conditions around transport sites to reveal the facilitation or perpetuation of inequality and exclusion of marginalised communities and emergent networks (sub-question 2)	Pedestrian interaction with transport points and their integration of surrounding networks	Station interface and the facilitation of emergence and auxiliary networks	The lack of pedestrian activities and social infrastructure, as well as the high-security presence, creates a restrictive environment for the emergence of new systems to accommodate commuters.	-Observations; refer to figure 73.
				There is also no indication of integration of other transport systems, besides the Gautrain buses. Uber drivers struggle to service the station due to conflicts with the metered taxis. This leads to users having to walk further to catch Ubers as metered taxis are expensive and unpleasant.	-Observations; refer to figure 74. -Informal conversations with users
				The Are-Yeng station is in proximity as well as the efficient Gautrain bus service.	-Observations; refer to figure 72. -(Ndwandwe and Gumbo, 2020).
				The building itself contains a transparent interface which creates a stronger connection with the outside space.	-Observations; refer to figure 75. -(Dovey and Wood, 2014).
				Bollards and the raised sidewalk, however, create a disconnect from the street.	-Observations; refer to figure 73.
			SLOAP as space hosting emergence	The Gautrain station has ample space to facilitate emergence and integration which is underutilized.	-Observations; refer to figure 72, 74. -(Ndwandwe and Gumbo, 2020). -(Simone, 2004). -(Dovey, 2014).
			Emergence organising around hard infrastructure	There are no signs of facilitation of any informal traders surrounding the Gautrain station.	-Observations; refer to figure 73. -"The ample space available within the Hatfield station precinct represents a missed opportunity for a vibrant socio-economic node where small-scale entrepreneurs can trade and provide services to commuters and people living or working in the area." (Ndwandwe and Gumbo, 2020:991).
			Other activities near stations	There is a severe lack of public socio-economic activities and amenities for commuters adjacent to the station.	-"At the Hatfield station as there is ample space which is underutilized and could be used for a mixed-use zone or platform to create a vibrant, innovative socio-economic hub for small-scale business opportunities." (Ndwandwe and Gumbo, 2020:991).
				Stations should encourage the integration of other activities for the convenience of passengers- small purchases, eating, etc. However, these have been specifically excluded from the Gautrain station.	-Observations; refer to figure 43.
			Analysis of the hard infrastructure of the station's systems	The Gautrain is an easily navigable system, with information readily available and a convenient payment process.	-Observations; refer to figure 76.
				Sufficient benches, lighting, and a covered walkway is provided for users outside of the station and at the adjacent bus depot.	-Observations; refer to figure 72,73, 75. -(Ndwandwe and Gumbo, 2020).
				Although sufficient infrastructure is provided, it is underutilized due to the frequency of the buses and trains.	-Observations; refer to figure 73, 74. -(Ndwandwe and Gumbo, 2020).

Key	Opportunities/ positives	Neutral	Limitations/ hindrances/ difficulties

Table 2: Summary of findings for the Gautrain station (Author, 2023).

8.1.2.1 Discussion

The Gautrain serves as a counterpoint to Rissik station within this study. Overall, there is a lack of socio-economic activity serving commuters around the station, although ample space allows. Shade, seating, shelter, and lighting are available to users but remains underutilised. The strictly regulated environment, enforced through physical barriers and prominent security presence, creates a restriction that could explain the limited pedestrian activity.

The frequency of the trains and buses could also possibly account for the lack of activity. Users tend to occupy the station's space briefly upon entering and exiting, given the quick turnover between trains and buses. However, one could speculate, that the addition of more socio-economic amenities might attract more users and foster a vibrant mixed-use hub as another entry point into Hatfield. Some users do wait for their lifts (Ubers, taxis, private vehicles) in the afternoons, indicating that the inclusion of small-scale amenities could prove beneficial for those waiting.

Overall, the Gautrain provides a comfortable and efficient experience for users, however, it comes at a higher cost. This makes the Gautrain a more "elitist" service, restricting access to its benefits for a significant portion of the population. Furthermore, the Gautrain station, is less accessible from a walkability perspective to the main socio- economic infrastructures of Hatfield, such as the university. This highlights the importance of providing convenient facilities for commuters which encourage small- scale entrepreneurial support. One major advantage of the Gautrain is its integration with its bus network, offering convenient access areas surrounding Hatfield for commuters. The payment system is also straightforward, as users can use their bank cards to pay for the train or bus.

While the Gautrain presents many positive aspects for commuters, there are gaps in its integration of external sectors and networks, as well as the provision of socio-economic facilities for its users. These gaps present opportunities for transformation and improvement.

8.1.3 Mini-bus taxis

Mini-bus Taxi Stop					
Scale	**Method and reason of analysis**	**Category**	**Subcategory**	**Summary of Findings**	**Cross-reference findings with sources**
Macro- meso	Desktop analysis of costing, frequency and general opinions of the stations based off interviews, informal conversations, and social media	Arrival into Hatfield	Cost vs convenience	The commuter interviews confirmed that taxis are the second most popular form of public transport to travel from peripheral areas as they are flexible, more convenient, and taxi stops are easier to reach than train stations. Taxis also reach a far wider range of locations than the train.	-Interview data. -However, taxis are more convenient, but fares can double if transporting goods (Mosaine, 2022: 546).
				However, complaints of waiting for taxis to fill up, unsafe driving and difficulty carrying goods have been mentioned by both traders and commuters. They are also a less affordable form of transport, with many commuters complaining about the cost of taxis.	-Interview data. -Taxi fares are viewed as expensive to those in low-income populations (Lucas, 2010:14) (Mosaine, 2022: 546). -Safety concerns were also raised by users both in terms of crime concerns and in relation to the un-regulation of taxis. The interviewees noted being fearful of the drivers driving (Lucas, 2010:14) (Mosaine, 2022: 546).
	Socio-spatial mapping analysis to reveal hard and soft infrastructural interactions (sub-question 1)		Social and economic activity along routes	There is a strong correlation of the location traders set up and popular taxis stops and routes. This provides convenient amenities for commuters passing by.	-Observations; refer to figure 25,54.
				Taxi stops that are closer to socio-economic activities often appear to become longer-term informal taxi ranks which provide comfortable spaces for operators to wait for commuters. The provision of food, shade and parking space seem to promote this.	-Observations; refer to figure 54. -(Ndwandwe and Gumbo, 2020).
			Destinations within Hatfield and walkability	Taxi stop destinations allow ease of access to most of the main activity of Hatfield. Therefore, making it easy to travel around Hatfield and walk only a short distance to destinations.	-Observations; refer to figure 54.
				Most people who travel to Hatfield, do so for work. Upon informal conversations, it was revealed that most people work at large actors such as the Hatfield CBD, university, and shopping centres such as the Hatfield Plaza.	-Interview data -Observations; refer to figure 25.
				The taxis appear to carry people mainly to and from Mamelodi, however, each taxi stops has a different variety of origins and destination.	-Observations and word of mouth
Meso- micro	Socio- spatial mapping & lifeworld analytical sketches of interfaces to determine the relationship between hard and soft infrastructure (sub-question 1+2)	Interface and mobility within Hatfield	Interfaces along frequent pedestrian commuter routes	Interfaces within the Hatfield CBD are more impermeable and uncomfortable than those closer to the university such as along Burnett Street, the Fields, Park Corner etc.	-Observations; refer to figure 55.
				The Hatfield Plaza interface contains overhangs- framing pedestrian movement well.	-Observations; refer to figure 81. -(Dovey and Wood, 2014).
				However, sidewalk parking creates and obstruction of movement and diminishes the vibrant pedestrian interface.	-Observations; refer to figure 78. -(Dovey and Wood, 2014).
			How interfaces around Hatfield facilitate emergence (trade and taxis)	Setback interfaces allow space for emergent activities to happen such as trade and informal taxi stops and ranks. They also activate pedestrian activity and create more comfortable environments.	-Observations; refer to figure 78,81. -(Dovey and Wood, 2014).
				These interfaces then allow for people to sit and wait for taxis more comfortably, especially, if they include infrastructure that can become seating and shade.	-Observations; refer to figure 78. -(Ndwandwe and Gumbo, 2020). -(Dovey and Wood, 2014).
Micro	Socio- spatial mapping & lifeworld analytical sketches of conditions around transport sites to reveal the facilitation or perpetuation of inequality and exclusion of marginalised communities and emergent networks (sub-question 2)	Pedestrian interaction with transport points and their integration of surrounding networks	Typical taxi stop interface and the facilitation of emergence	The interface of the Park Corner residence and eatery provides a comfortable pedestrian environment for commuters and operators. The overhang provides shade with a small fence creating spatial division. The Park Corner "taxi rank" goes to Mamelodi, Silverton, Silver Oaks and Brooklyn.	-Observations; refer to figure 78,81. -(Dovey and Wood, 2014).
				The presence of taxis, however, although convenient, may have a negative impact on the user's experience of the eatery.	-Observations; refer to figure 78.
				The presence of the taxis also disrupts the traffic flow of the area as they often do not park completely out of the way of cars traveling along park street.	-Observations; refer to figure 78.
			SLOAP as space hosting emergence	Taxis have appropriated the open spaces around Park Corner, as well as the sidewalk parking provided. Although, unintentional, the presence of this open space has created an active environment for both taxis and pedestrians.	-Observations; refer to figure 78. -(Simone, 2004). -(Dovey, 2014).
			Emergence organising around hard infrastructure	An informal trader operates directly next to the taxi stop as this is where a large amount of pedestrian activity occurs. He attracts many customers getting onto taxis in the afternoons.	-Interview data. -Observations; refer to figure 79,80.
				He has appropriated a planter to store his stock, and this serves as the table which holds his products. He is positioned under the shade of a tree which makes a more comfortable spot for him to trade. This is an example of the permanent hard infrastructure being appropriated to allow for emergence.	-Observations; refer to figure 80.
				He is limited by the stock he can carry onto a taxi as there is nowhere for him to store his stock overnight.	-Interview data. -Observations; refer to figure 80. -(Mosaine, 2022: 546).
			Other activities near taxi stop	This specific taxi stop of analysis is in a convenient position for pedestrian commuters. It is situated directly adjacent to the Park corner eatery, Hatfield Plaza shopping centre and is directly across from a prominent entrance to the Field's. This provides many socio-economic activities for commuters along the way to this stop and makes it a good central location.	-A variety of public transport modes and activities in one location creates opportunity for the development of mixed activity hubs which have potential to accommodate small-scale enterprises (Ndwandwe and Gumbo, 2020: 991).
			Analysis of the hard infrastructure of waiting areas	Ample shade is provided for both operators and commuters waiting, there is seating available at the Park corner eatery and lighting is provided outside the eatery. There is also ample parking space for the taxis.	-Observations; refer to figure 78.
				Although informally adapted, no formal, intentional infrastructure has been by the municipality provided to accommodate the taxi commuters and operators.	-Observations; refer to figure 78.

Key			
	Opportunities/ positives	Neutral	Limitations/ hindrances/ difficulties

Table 3:Summary of findings for the taxi network (Author, 2023).

8.1.3.1 Discussion

The selected taxi stop for analysis is strategically located adjacent to a prominent shopping centre and an eatery, transforming into an "informal taxi rank" during the afternoons, where taxi operators wait for commuters heading home after work.

The mini- bus taxi network offers users a flexible, convenient experience; however, concerns persist regarding safety and cost. The utilisation of taxis reveals existing inequalities and exclusion, as their prevalence is partly a result of the failures within the formal railway system, which serves as the other low-cost public transport option.

Within Hatfield, the taxi network efficiently connects commuters to their destinations, with taxis making frequent stops at various central and prominent points. These taxi stops also provide an economic boost to informal traders who set up their businesses along these popular routes, ensuring access to a larger customer base. This mutually beneficial relationship between the two emergent networks reveals their interconnectedness.

Taxi stops in the area range from being quick stops to more extended “informal taxi ranks”, often accompanied by auxiliary socio-economic activities for the benefit of operators and commuters. This integration of multiple functions serves as an example for railway stations, illustrating what they should aim to achieve.

In general, the choice of taxi stop location is primarily driven by convenience, revealing principles that planners and developers should consider when designing such spaces. Essential elements can include the presence of open space, shade, shelter, opportunities for other activities, and sufficient lighting. Each of these criteria plays a crucial role in defining the appropriation of space and determining its potential. The more criteria the space fulfils, the greater its capacity to facilitate emergence and foster a dynamic environment.

Overall, the taxi network complements the formal railway system and effectively addresses the needs of commuters in Hatfield. By critically analysing the success of integration and activity at taxi stops, one can gain insight into the creation of similar spaces which promote socio-economic upliftment of various sectors and cater to the convenience of commuters. This understanding serves as a valuable informant for future developments and transformative approaches in urban planning, ensuring more accessible, inclusive, and vibrant public transportation hubs.

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8.2 Data interpretation

By comparing the various systems, one can reveal opportunities and potentials for integration and socio-economic transformation through a transport orientated development approach.

8.2.1 Rissik vs Gautrain

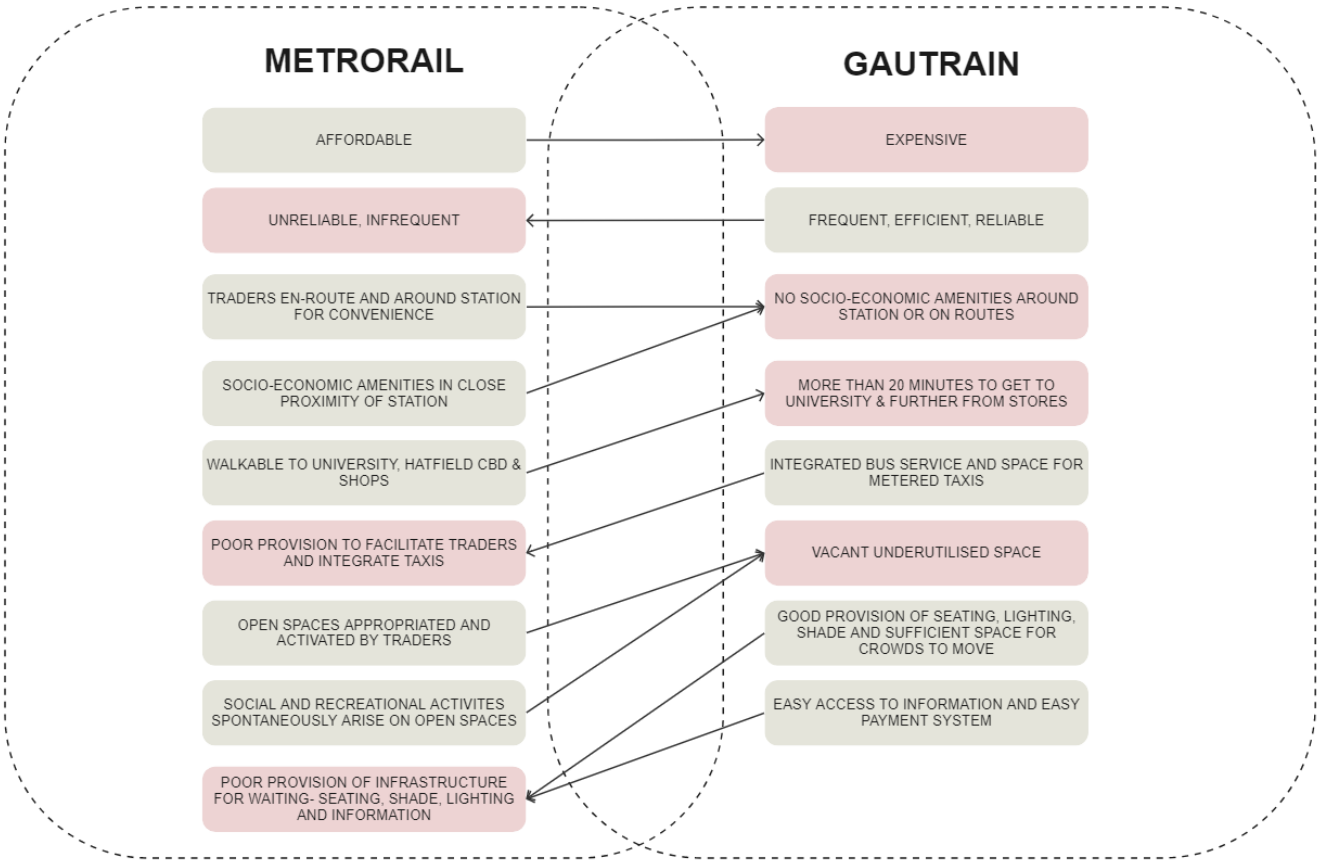

Figure 82: Infographic showcasing comparison of findings for Rissik station and Gautrain (Author, 2023).

Initial comparison of the findings from the socio-spatial analysis of Rissik station and the Gautrain station, not only reveals instances of exclusion and inequality, but also opportunities and potentials, as seen in figure 82 above. Integrating these these systems could effectively address existing gaps and inform approaches to consider for socio-economic transformation and inclusive transport-oriented development.

The metrorail can be regarded as an “inclusive” system due to its affordability; however, its infrequent train service makes it inconvenient to use. While Rissik station fosters limited vibrancy and pedestrian activity as part of its soft infrastructure, poor provision of adequate hard infrastructure limits the socio-economic growth of both commuters and associated emergent networks like informal traders and taxis. These networks have informally appropriated open spaces to provide services to commuters, showcasing their value to the station and its commuters.

Contrastingly, the Gautrain offers a comfortable and reliable commuter experience but remains unaffordable for many. This clearly highlights the inequality between the two systems, as

lower-income commuters are excluded from accessing the opportunities provided by the Gautrain.

However, despite having ample space, the Gautrain fails to accommodate any auxiliary socio-economic activities. This puts its commuters at a disadvantage, as they lack the convenience of accessing trade en-route. Additionally, emergent urban activities, such as informal trade, are excluded from the potential customers from the Gautrain due to the strict controlled environments and deliberate infrastructural boundaries (hard infrastructure) that restrict their activities (soft infrastructure), perpetuating exclusion.

The comparative analysis of Rissik station and the Gautrain station emphasises the need for integrated TOD approaches that address issues of affordability, convenience, and socio-economic growth.

Recommendations

Integration of the two systems can promote an inclusive, multi-functional transport system that accommodates diverse sectors and user groups, harnessing the positive potentials from both systems effectively.

One opportunity between the systems lies in the potential for shared platforms at the stations, as the railways run adjacent to one another. This could also encourage an integrated payment method between the two systems, enhancing the commuting experience for users of both the Metrorail and the Gautrain. .

Additionally, there is ample space around the Gautrain and Rissik stations that can be utilised to intentionally and adequatly faciliate emergence. Developing dedicated and comfortable taxi and bus stops near the stations could further enhance connectivity and accessibility. This would not only benefit the commuters but could also encourage support for the surrounding small-scale businesses. Development of these opportunities, can create a vibrant transportation system that addresses a variety of needs in the community.

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8.2.2 Rissik vs Gautrain vs Taxis

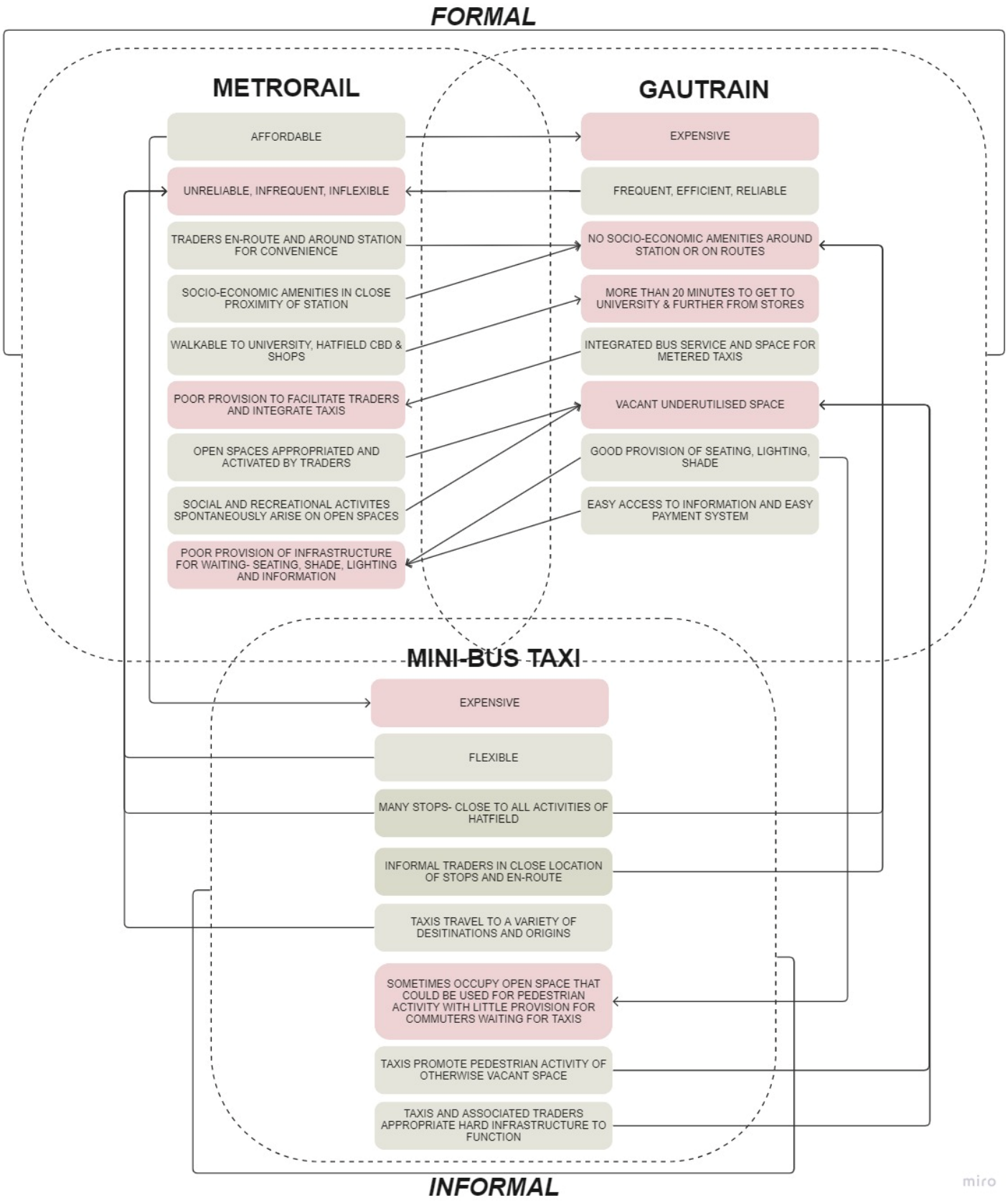

Figure 83: Infographic showcasing comparison of findings for Rissik station, Gautrain, and the taxi network (Author, 2023).

Conducting a socio-spatial analysis on the taxi networks of Hatfield reveals emergent opportunities within the informal nature of this system, which could facilitate integration and inclusivity for commuters and associated socio-economic networks such as traders (figure 83). The taxi network offers a more flexible system compared to formal railway transport, with convenient stopping positions that enable people to reach their destinations easily. However, the flexibility of the schedule could lead to navigational challenges, highlighting the need to address the gap in access to information, of which the Gautrain addresses well.

Taxis occupy left over open urban spaces (hard infrastructure), which creates vibrancy and pedestrian activity, in turn opening opportunities for informal traders (soft infrastructure). These spaces are often linked or located in areas with existing socio- economic activities, presenting an opportunity for integration between transport networks (taxis) and surrounding sectors (trade and formal retail), an aspect which the formal railway system lacks.

At taxi stops one can observe many informal methods of appropriating hard infrastructures. These can be simple, but, essential elements such as trees (hard infrastructure) framing trade (soft infrastructure) and waiting spaces; fences or planters (hard infrastructure) being used as trading space (soft infrastructure); or as mentioned above, open space (hard infrastructure) as informal taxi stops (soft infrastructure). These hard and soft interactions reveal nuanced methods of innovation to circumvent service provision shortcomings. This not only reveals instances of inequality and exclusion, but, also frames opportunities for transformation.

Interfaces (hard infrastructure) which are set back often unintentionally frame spaces for emergence and activity (soft infrastructure) to occur. However, this generally results in taxis occupying open spaces which can obstruct both pedestrian and vehicular movement.

Recommendations

A more conscious effort to provide adequate hard infrastructure for taxis and associated users shall create a more comfortable and inclusive environment for commuters and users.

Integrating both formal and informal transport sectors, along with trade, can offer opportunities to address gaps in the inflexible formal network and the difficult-to-navigate informal network. This integration could create a larger customer base for both sectors, facilitating mutual socio-economic growth. The fluidity and adaptability of the taxi network should also be emulated within the rigid formal train system in order to enhance it's resillience to maximise it's potential as a socio-economic transformation catalyst.

8.3 Principles to consider for future development

This comparison above, revealed the potentials of emergent systems as well as future opportunities for transformation and integration. In summation, principles of consideration can be defined for future transport-oriented developments in architecture and urban design to maximise inclusivity and equitability. These include:

- Maximising existing SLOAP for the development of auxiliary socio-economic activities.
- Multi- functionality of program and socio-economic activity surrounding transport nodes.
- Support and integration of surrounding small-scale enterprises.
- Integration of various modes of transport and sectors by providing adequate facilities. Both spatially and through integrated payment systems.
- Allow flexible public spaces for the emergence of activities such as informal trade.
- Employ pedestrian friendly interfaces that activate spaces.
- Ensure sufficient information is provided to facilitate convenient navigation and maximum utilisation of systems.
- Provide safe, comfortable waiting spaces for commuters and transport operators.
- Consider the impact of the development at an urban, connective scale. How can the TOD facilitate the activation of the surrounding context?

9 Conclusions

9.1 Shortcomings

This study was intended to offer spatial practitioners a glimpse into the lived experiences (lifeworld) and everyday challenges of marginalised public transport users within Hatfield. The limitations within their experiences were socio-spatially understood through mapping and sketches. This method was not intended to be a rigid quantitative analysis of data as this would not be feasible with the small sample sizes of the interviews conducted and the semi-structured nature of the observational data. The maps and information assembled in the urban sample are, likewise, not viewed as static and frozen in time in their conclusions and interpretation. This project can, however, serve as a guide for future in-depth quantitative analysis and begin to bridge the gap between planning policy and actuality.

9.2 Recommendations for future research

As mentioned above, railways can have an enabling effect in the development of urban areas by increasing their reach and accessibility, possessing significant potential for transformation. Further research and future studies could be performed to investigate the locations people are commuting from to establish the overall urban reach and potential of Hatfield within its larger urban context. Additionally, this can facilitate a detailed investigation into the extent to which Hatfield's socio-economic opportunities are distanced from marginalised communities, a topic briefly addressed in this report.

An in-depth case study analysis approach can also be adopted in subsequent research to showcase the successful implementation of the principles mentioned above. This shall further

inform spatial practitioners on the realistic applications of these principles and reveal the levels of success in real-world implementation. Globally many examples exist where transport infrastructure provides affordable and integrated access to the socio-economic opportunities of cities.

9.3 Counterpoint and addressing reflexivity

To ensure authenticity and credibility of this report, exploring alternative viewpoints is essential. Although this report reveals the shortcomings of public transport infrastructure, some commuters expressed no dissatisfaction with the Metrorail system, despite its seemingly obvious weaknesses. It is important to acknowledge that as an outsider, I recognize the system's shortcomings, such as overcrowding and unreliability. However, some commuters may not be fully aware of its potential. Reflexivity is crucial to be mindful and reflect on how my own experiences and background as a white female from a middle-class upbringing may influence the interpretations of this research, especially when addressing the daily challenges low-income commuters face. For future research, maintaining consideration of multiple perspectives while acknowledging the researcher's subjectivity remains critical. The conclusions and recommendations presented within this report can be applied to similar contexts, yet, considering the ways of engagement and conducting research is also imperative. Given the limitations of time constraints and access, it is crucial to recognize the potential gaps in understanding the full extent of the daily challenges faced by low-income commuters using the Metrorail and taxis through brief interviews and observations. Future studies could adopt a more immersive approach by extending the research time frame, expanding observation zones to include commuters' points of origin, and spending more time utilizing the various transport services personally. This could provide a more comprehensive and nuanced understanding of the contexts and challenges faced by commuters, enhancing the validity and depth of future research in this area.

9.4 Overall conclusion

Overall, this study has been valuable in revealing instances of inequality and exclusion through a socio-spatial analysis of various transport systems in Hatfield from a hard and soft infrastructural interaction perspective. It was revealed that the Metrorail does not fully support the socio-economic development of both its users and associated networks. However, within the informal adaptation of hard infrastructures around the station, potential areas of focus for transformation were revealed. Through comparison with the Gautrain, one could determine gaps in each of the systems and where potential integration could lie. The analysis of the taxi network revealed the opportunities present within emergent informal systems that could be adopted into the formal transport sector.

A more conscious effort must be made in future transport-oriented developments to facilitate emergence, integration, vibrancy and multi-functionality. This ensures the system's role as an inclusive, multi-faceted point of socio-economic contribution.

Final content word count: 15 156

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11 Appendices

The following appendix contains any tables or images referred to in the report as additional information. Any maps or diagrams which need to be viewed at a larger scale have also been included.

Memo's

The following "memo's" represent the rough and initial observations and important points for each site visit.

Memo for day 1

Date	Time	Location	Activities performed	Initial observations	Initial findings/ interpretation/ reflection	Any emerging themes, categories, trends etc	To do in future?
08/03/2023	Around 13:00-15:00	Around Hatfield	Initial scoping observational walk around Hatfield	Taxis seem to stop longer at the corner of Burnett and festival	The lane is dedicated for buses but is also used by taxis	Multi- functional transport spaces	Analyse taxi movements
		Rissik station		Metrorail is popular	Large streams of people leave the Metrorail	Na	Interviews on Metrorail
				Informal traders are set up along festival and Rissik station	Traders set up where there is the most pedestrian activity More vendors in afternoon vs morning- some start packing up around 14:00	Emergent networks	Interview traders
				Informal eatery in park next to Rissik	Popular around lunch time	Informality & spatial arrangement	Look at arrangement of the restaurants and traders. Why are some temporary vs permanent
				Taxis stop outside Rissik	There is a reliance on auxiliary forms of transport- train is limiting	Multi- functional transport spaces	Look at taxis around Hatfield
		Park street		Cycle route is obstructed and not used	Very little support for cyclists around Hatfield. The existing route is disjointed and reaches almost a dead end	Pedestrian friendliness of Hatfield	Assess pedestrian accessibility around station
		Moja Gabedi		Urban oasis	Empty, underutilised, no public interface	Urban green space	Na
		Springbok Park		Unsafe	Empty besides homeless people occupying spaces	Space occupation	Na
		Gautrain station		Expensive to use Runs more often and is easier to use	The Gautrain has a lot more information available and is more reliable	Affordability vs convenience	Analyse Gautrain as counter point for comparison

				There is a Gautrain bus service available	There is a consideration to an extent- of the users "last mile".	Transport integration	
				Public amenities are available	Benches, seating, some covered walkway, but, underutilized	Public hard infrastructure	

Appendix 1: Memo from day 1 (Author, 2023).

Memo for day 2

Date	Time	Location	Activities performed	Initial observations	Initial findings/ interpretation/ reflection	Any emerging themes, categories, trends etc	To do in future?
22/03/2023	Around 07:30:00	Outside Rissik station	5x interviewing traders	All interviewees were female around 30 yrs. old	N/A	Emergent economies	How does this data inform the research topic?
				All black	N/A		
				Coming from a range of place	N/A		
				Most PT common was either taxi or private vehicle	Difficulties carrying stock or finding safe storage.	Ease of commute	
					Private vehicles are ideal however taxis are easier than train		
					Public transport limits the opportunities of the traders		
				Most set up early and stay for the day	N/A	Emergent economies	
				Many have been in the same place for 10+ years	N/A		
				Station infrastructure is used to support traders' stalls. Fear police taking stock from them.	Although the facilities are generally limiting towards traders- there is a reliance on its infrastructure to support the traders	Relationship between the station and surrounding emergent economies	Map the arrangement of traders around station and the infrastructural interaction
	Around 08:30	Inside Rissik station	Taking the train to Pretoria central	Lack of information on train times	Not easy to navigate the train system	Convenience	N/A
				The ticket scanning system is not operational			
				Information boards on platforms aren't working			
				Mamelodi platform looked busy	Many people travel to Hatfield for work from peripheries	Migration of people to Hatfield	Analyse the movement of people into Hatfield and for what reason?
				People are waiting in sun	Poor conditions for commuters waiting	Convenience	N/A
				Large amount of people of working age stepped off the train	People are travelling to Hatfield for work	Migration of people to Hatfield	N/A
	Around 08:00	Rissik station platform	2 train user interviews	Both were travelling to Hatfield for work	Hatfield offers employment opportunity for people	Migration of people to Hatfield	N/A
				Both from Mamelodi			N/A

			Long waiting times between 30mins to an hour	Compared to Gautrain which is around every 15 minutes		Compare Gautrain and Metrorail
			Taxis were preferred	Taxis are more flexible however more expensive therefore the train is used.	Convenience vs affordability	N/A
				Cost and time delays were concerns raised	Convenience vs affordability	N/A
				Both purchase form the informal traders outside the station	Emergent economies supported by commuters	N/A
Around: 09:30	Pretoria CBD to Hatfield	2 taxi user interviews	Taxi stopped on festival street	We got off with other university students		N/A
			Interviewed a student and someone travelling to Hatfield for work	Hatfield hosts a range of programs for people to utilise	Hatfield as an arrival city	What are all the opportunities of Hatfield?
			Taxis are generally more accessible	Waiting time for taxis is sometimes also an issue as they wait for them to be filled	Convenience vs affordability	N/A
Around 10	Hatfield Areyeng bus stop	1 interview of woman at bus stop	She was travelling by train to look for a job	Noted that taxis were expensive	Convenience vs affordability	N/A
					Hatfield as an arrival city	N/A
Around 14:30	Hatfield observational visit	Observed traders outside Rissik station	There was a higher number of traders in the afternoon	The traders who served meals were also very busy for lunch time	Urban activity	Map which traders sell what
			In the park the ladies selling meals were cleaning up	They arrive early in the morning and start packing up after lunch		Activity in relation to open space
				There were still people sitting outside the eatery on the seating and tables provided		Activity in relation to open space
			2 taxis stopped to pick up a group of people waiting outside Rissik station	This seems to be a place to stop for taxis in the afternoons vs no taxis were observed in the mornings	Connected emergent networks to the train station	Map taxi activities
Around 15:00		Observations inside the station	There was an informal trader carrying buckets onto the train	Prasa has specifically stopped trading on trains, and it is difficult to carry all that stock on a busy train	Pt limits to traders	Limitations of infrastructure on traders
Around 15:30		Observations from park next to Rissik	Taxi stopped and picked up a group of people waiting at Rissik station	This was apparently arranged by the university to take up staff back to Mamelodi	Connected emergent networks to the train station	Where else do the taxis go?
Around 16:00		Observations of Rissik platforms	The train is beginning to become busy with people leaving Hatfield	Many people are waiting in uncomfortable conditions with no shading and seating	Convenience vs affordability	Compare to Gautrain (however the Gautrain infrastructure is barely used due to its efficiency).
Around 16:30		Observations from park next to Rissik	People playing soccer	Activities are beginning to arise around the station that are more social and recreational. People are congregating around the traders still at Rissik and playing soccer around the station and in the park.	Recreational and social facilitation	What is the stations' role in this?
Around 16:30		Observations walking back to varsity	Burnett taxi stop is very busy	It appears the taxis are waiting to be filled before taking commuters back to their homes.	Multi-functional transport spaces	Analyse taxi movements

Appendix 2: Memo from day 2 (Author, 2023).

Exclusion, emergence & mobility: A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs.

Memo for day 3

Date	Time	Location	Activities performed	Initial observations	Initial findings/ interpretation/ reflection	Any emerging themes, categories, trends etc	More to do in future?
27/03/2023	Around 13:30	Hatfield-Park Corner	Observations at taxi stop	Many taxis stay there for the day	They are surrounded by restaurants, informal trade, there is open space to stop and shade.	Emergent networks	Where do the taxis go to?
					It provides many amenities for both users and commuters	Integration	Spatially analyse this stop
	Around 14:00	Gautrain station	Observations at station	Lack of pedestrian activity	High security presence prevents other activities besides the commuters using the train	Limitations to socio- eco establishment of other networks	Compare Rissik and Gautrain
				Feels in accessible even though the building is transparent and the public square in front is available.	Bollards, raised sidewalk, there is no gradual threshold and activities enticing people in.		Spatial analysis of Gautrain
				No auxiliary activities surrounding station	There are no stores around the station, however, there is an Areyeng bus stop that is underutilised	TOD and stations as integration points	Map surrounding activities and compare
			Observations inside the station	Readily available signage	All train times and navigation signage are easily accessible	Convenience vs affordability	N/A
				Easy payment system	Can either tap card or load money onto cards at self service station- long ques are generally avoided.		N/A
				Higher prices for travel	This limits the stations customer reach, although the user experience is easier		N/A
	Around 15:00	Hartebespruit Metrorail station	6x interviews of commuters	Most were leaving Hatfield back to Mamelodi after working in Hatfield	Hatfield hosts many economic opportunities for commuters from peripheries	Hatfield as an arrival city	What are all the opportunities of Hatfield?
				Long and unreliable waiting times were noted by most	The Metrorail is generally unreliable	Convenience vs affordability	N/A
				Taxis were the alternative transport	Some people take taxis in the mornings and train in afternoon.		N/A
					The train is cheaper; however, the taxis are more reliable and convenient.		N/A
				Many people have been utilising the train for over 10 years.	It has been a reliable long-term option, not much mention of buses at all	N/A	N/A
			1x interviewer with trader	Only one trader outside station	He sits at the end of the pedestrian bridge going to station- to catch all pedestrian traffic. Positioned on sidewalk under billboard against railing.	Opportunity & reliance on infrastructure	Spatially assess his infrastructure interactions
				Very busy- many people come to him when leaving or arriving at the station.	His positioning allows for his establishment; however, the station is by no way assisting this.	Space occupation	N/A
				No buses available for Mamelodi therefore train and taxi is the preferred options	He has on site storage- therefore- he can use public transport easier	N/A	N/A
			Observations around station	Strict signs stating no hawking	Prasa deliberately limits emergent networks through policy and physical bollards (taxis) etc.	Limitations of socio- eco establishment	Spatially assess boundaries and limiting factors

				Taxis stop outside station	There is underutilised open space allowing for such	Un-deliberate facilitation of emergent networks	Assess SLOAP

Appendix 3: Memo from day 3 (Author, 2023).

Memo for the first half of day 4

Date	Time	Location	Activities performed	Initial observations	Initial findings/ interpretation/ reflection	Any emerging themes, categories, trends etc	What more to do?
17/05/2023	06:30	Gautrain station	Observation of people movement routes from the station (following routes and seeing how people move)	From the station there are 2 main streams of movement- arcadia street or down Grosvenor Street	Destinations: university by students, the Gautrain bus by school kids and businesspeople or Hatfield's "business core" by businessmen	Hatfield as an arrival city	Activities around Gautrain seems limited- explore?
				University students tend to cut through the fields	It is perceived as safer and more pedestrian friendly	Pedestrian "friendliness" of Hatfield	Look at the Field's layout (common point between Rissik and Hatfield)
				The station and the Gautrain bus station is very busy with a fluctuating stream as the train comes and go	The train runs more regularly in conjunction with the bus service (however it was noted in interviews that the buses are often late)	N/A	N/A
				The public amenities- seating, shade etc. Are underutilised	This may be because the short timeframes between buses and trains coming and going	Convenience vs affordability	N/A
				Pretoria boys high school kids utilised the Brooklyn bus route	N/A	N/A	N/A
				With businesspeople utilising Menlyn or Brooklyn, less utilised Lynwood or arcadia	These are often more business associated districts	Hatfield as an arrival city	People come to Hatfield and then go off to other suburbs with Gautrain vs Rissik they are arriving for Hatfield's offering
				6:30- 8:30 seemed to have the most pedestrian movement	School, university, and business	Potentials/ opportunities of Hatfield	N/A
				Lots of Pretoria girls' high commuters	Walk along arcadia street	Hatfield as an arrival city	N/A
			Interviews with commuters	In general, the walkability of the route seems sufficient	Not too far of a route (shortest routes are taken)	Pedestrian "friendliness" of Hatfield	N/A
				The fields and Hatfield Plaza are important actors	Commuters feel safer, protected from the elements and it offers some services such as cafes	N/A	N/A
				Lighting is lacking	Lack of lighting results in an unsafe feeling early morning and at night	N/A	N/A
				Shortest routes are taken	The users only choose routes based on time- there are no elements which make them pause, or spend time	N/A	N/A
				Safety was a concern	Beggars on Burnett- main reason why people cut through fields	N/A	N/A
	Around 8:00	Corner of arcadia & Hilda	Informal conversation / interview with 2 businessmen	Travelling to Loftus- had to catch an uber far from station	The Gautrain bus doesn't travel far enough to Loftus	Hatfield as an arrival city	N/A
					Metred taxis outside are more expensive than uber- and a more unpleasant experience	N/A	N/A

		Taxi stop corner Arcadia and Pretorius	Interview with informal trader	Travels far from Soshanguve daily	N/A	Hatfield as an arrival city	N/A
				Uses taxi now because car is being fixed	The car is much preferable. He spends R300 on taxis daily (he must pay for an extra seat for goods). Vs R200 for petrol for his car	Convenience vs affordability	N/A
				Has safety concerns about taxis	Their driving, and they don't take the most direct route- they want to fill up the taxis		N/A
				Doesn't consider trains and buses- they are unreliable	Taxis at least can be taken any time	Limitations of socio-eco establishment	N/A
			Observations of taxi stop	Stopping very often, bringing people from Mamelodi for work in Hatfield	Most popular route appears to be Mamelodi	Hatfield as an arrival city	Compare to other data: overall Mamelodi seems to be most commonplace people come from
				Shops and eateries close by stops	Auxiliary programs for support	Multi- functional transport spaces	Map the taxi stops visited
			Informal conversation / interview with 2 businessmen	Other guy trading behind the fence travels from town on his bike	He can only sell what he can fit on his bicycle- behind fence for protection?	Opportunity & reliance on infrastructure	Visit the other taxi stops still
				Both shops were popular with taxi users	The man interviewed selling baked goods was almost sold out by 8	N/A	N/A
				Traders start their day early to catch the early commuters	He started trading from 4:30- which could support the observations that lower income users start their days earlier	Convenience vs affordability	N/A

Appendix 4: Memo from day 4a (Author,2023).

Memo for the second half of day 4

Date	Time	Location	Activities performed	Initial observations	Initial findings/ interpretation/ reflection	Any emerging themes, categories, trends etc	More to do in future?
17/05/2023	06:00	Barcelos- Burnett Street	Observation: taxi stopping	Still dark outside- dropping off commuters early on	Lower income users start days a lot earlier- is this to counteract the in productivity of the transport systems available to them?	Convenience vs affordability	Where are they coming from/ going? Mamelodi, Menlyn etc.
	06:27	Outside prasa- taxi stop	Observation: taxi stopping	People who hopped off taxi went straight to the informal trader who is very busy	There is a strong relation between these 2 informal systems	Emergence and integration	Visit more taxi stops- where are they going
		Festival street- university	Observing routes	3 main streams- from Rissik to- university, through fields and then branch off and up festival to business district. The smaller stream down park street is there but can maybe be disregarded- seemed to be school kids mainly.	Very strong stream of people to university, however, it was mainly people of working age.	Un-deliberate facilitation of emergent networks	Look at the Fields layout (common point between Rissik and Hatfield), where are people going from Rissik? And map from where and to

		Informal conversation along uni route	Most users were of working age	A man told me that they are coming from Mamelodi and employed by the university who is a very large institution and contributes largely to employment	Hatfield as an arrival city	N/A
06:51		Observing routes	Very large group of people arriving	Many businesspeople arriving in Hatfield at this time. The traders then also get a lot of business from these people	Hatfield as an arrival city	Map routes through fields
08:00		Observing routes	Activity coming into Hatfield has slowed down already	Lower income people seem to begin their days earlier	Convenience vs affordability	Compare to Gautrain times
06:34	Shop across from Rissik	Informal interview with shop worker (didn't speak much English)	He has only worked at the store for 2 months and comes from Bangladesh	He lives in Sunnyside and takes a taxi daily to store to open around 6am	Hatfield as an arrival city	Go back and speak to owner of shop
			Main customer base is students	It seems the commuters are much more familiar with the informal traders	Emergence and its potential and opportunities	Link to the place where fire truck and worker pulled the car over to get food from the trader. They could just as easily go to a formal store. What *edge* informal traders have- convenience, price, social aspect
07:24	Trader outside of Ghana high commission and MSc business college	Observation	This trader was extremely busy in the morning	Situated close to a popular taxi rank where people step off from Mamelodi to work in Hatfield (they walk towards Hatfield's business core)	Hatfield as an arrival city	Go back and interview, why is he so busy?
			People stopped driving to visit this trader	People are going out of the way for this trader	Limitations of socio- eco establishment	N/A
			Obstructs sidewalk	Forces people going from taxis to Hatfield to interact	Opportunity & reliance on infrastructure	N/A
	Trader in parking lot of stress institute	Informal conversation and observation	He is also situated close to a taxi stop	N/A	Emergence	Go back and interview, why does he choose his location?
07:41	Rissik station	Observation	A new trader has set up selling old clothing	This trader was not seen in the afternoon- therefore they seem to only set up for a short amount of time	Opportunity & reliance on infrastructure	Go back and interview maybe, where do they come from?

Notes: it was difficult to track everyone'smovements,s so trends and assumptions have been made. The waves have much larger streams of people- trains run less often- a constant stream like the Gautrain could be better for traders as they can only serve so many people who are already in a rush. Quite a few people move from the taxi stops at the top of festival into Hatfield. Dark in the early mornings and difficult to cross to the fields.

Appendix 5: Memo from day 4b (Author, 2023).

Exclusion, emergence & mobility: A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs.

Memo for day 5

Date	Time	Location	Activities performed	Initial observations	Initial findings/ interpretation/ reflection	Any emerging themes, categories, trends etc.	More to do?
19/05/2023	15:45	Barcelos Burnett street	Observation	These taxis wait on their corner for longer periods in the afternoon for the taxi to full up.	The taxis who wait longer are often in sites which contain open space to park, have another auxiliary function near- eating	Multi- functional transport spaces	
	15:49	Burnett and festival	Observation	Taxi stopping to pick up people- quick stop	The person was of working age leaving Hatfield	Hatfield as an arrival city	
	15:53	Rissik station	Observation	New trader has set up selling old clothes- most traders were still present outside the station.	These traders are especially busy in the mornings with people coming into Hatfield. However, we were not there to view exactly when a train was leaving, so it was difficult to know. They get a more dramatic stream of customers with a train arriving.	Emergence	
	16:04	Along Festival Street	Observation	Most of the stores were closed at this time. However, there is only 1 convenience store. These stores all provide specialised programs.	The traders provide the convenience aspect which is subsequently lacking. Upon conversation with the store owner- his main customer base was students- not commuters. Commuters all make use of traders.		
		Shell- Burnett Street	Informal conversation	He walks from Sunnyside to Hatfield for work. No changes that he noticed about the change- however, he was aware of it.	He stated that taxis from Burnett Street go towards Pretoria (town). And Bosman Street (this is a changeover point). The taxis also go to Menlyn.	Emergence	
	16:10	Trader on festival street	Structured interview	Travels from Soshanguve at 3am in the morning	People tend to travel from all over to trade in Hatfield. He says he situates himself in Hatfield CBD to catch the most foot traffic. Hatfield obviously presents opportunity for the traders.	Hatfield as an arrival city	
				He only uses taxis.	The train is unreliable and too far for him to get to where he stays. Spends about R200 on taxis a day.		
				He does not know too much about the train as he prefers not t use it	However, he did say he knows when the switch from yellow to blue trains occurred- traders were no longer allowed to operate on the trains.	Limitations of socio-eco establishment	
	16:30	Park corner taxi stop	Observation and informal conversation	Taxis stop for long periods of time here. It is a vibrant busy spot with restaurants in close location	Amenities are provided to assist the stop- shade, food, space. Therefore, it caters more to that.		
					The taxis for here got to Mamelodi, Silverton, Silver oaks and Brooklyn		
					Most of the taxis take commuters further away. Brooklyn being the exception.		
	16:38	Rissik train platform	Observation	People are waiting on the platform to go home after work	They are using anything as a seat	Convenience vs affordability	
	16:45	Festival street	Observation	Buses also stop outside PRASA where the traders are located	The traders are also able to pick up customers from there	Opportunity & reliance on infrastructure	

Appendix 6: Memo from day 5 (Author,2023).

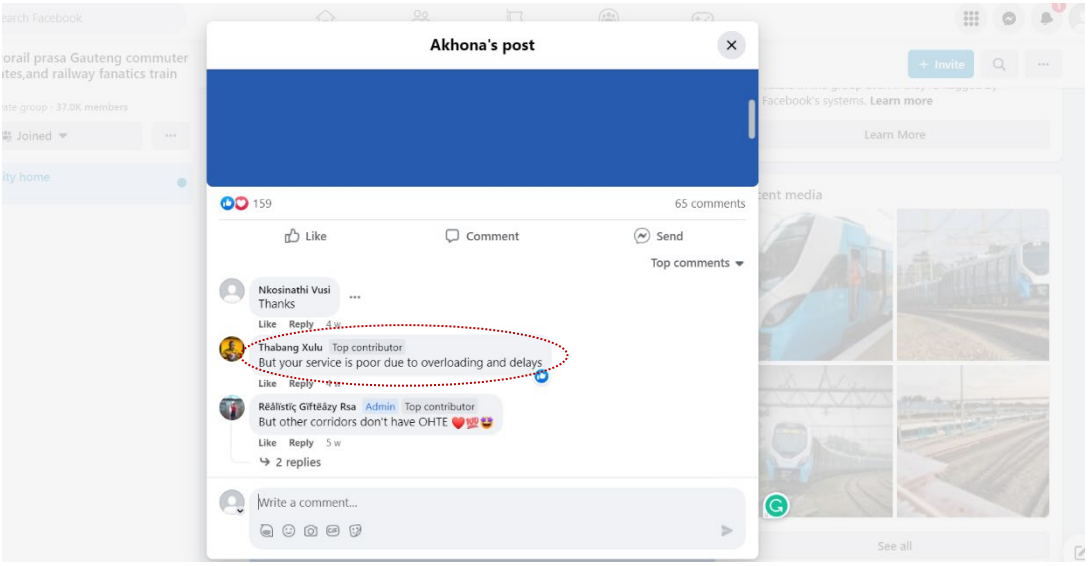
Exclusion, emergence & mobility: A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs.

Opinions and information found on social media

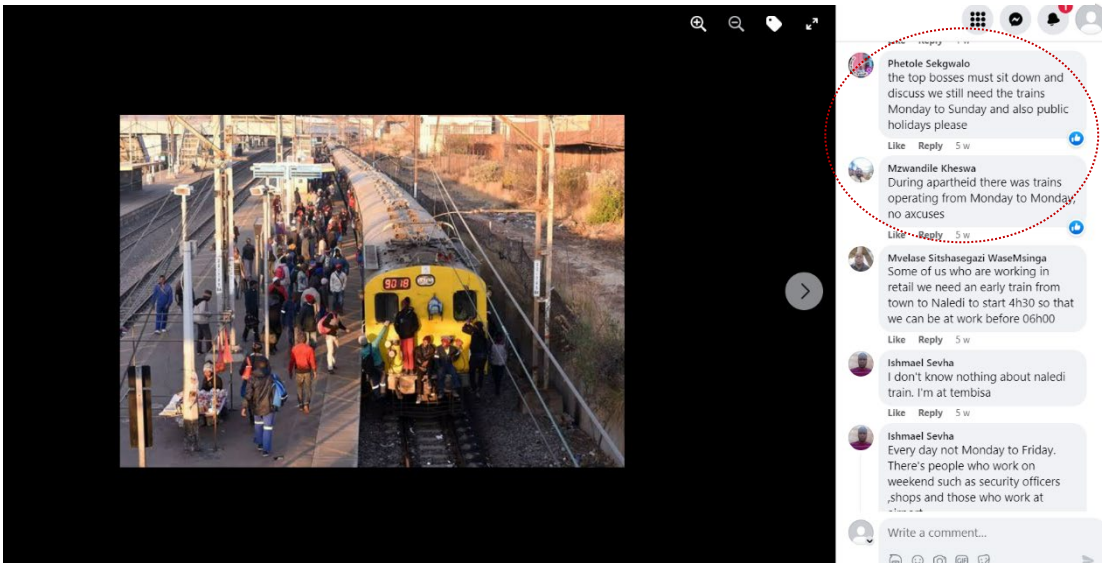
Appendix 7: Trader requests PRASA to build stalls for them in an interview (Times,2022).

Appendix 8: Social media complaints about the trains service (Facebook, March:2023).

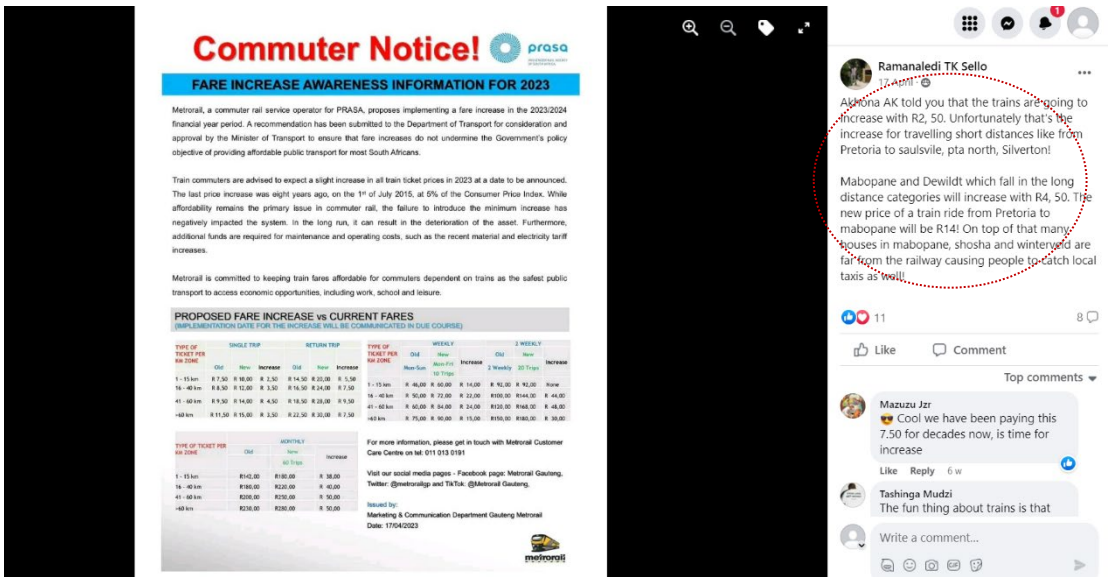
Appendix 9: Trader complains about not being able to sell products on the new trains in an interview (Times, 2022).



Appendix 10: Social media complaints about service and delays (Facebook, May:2023).

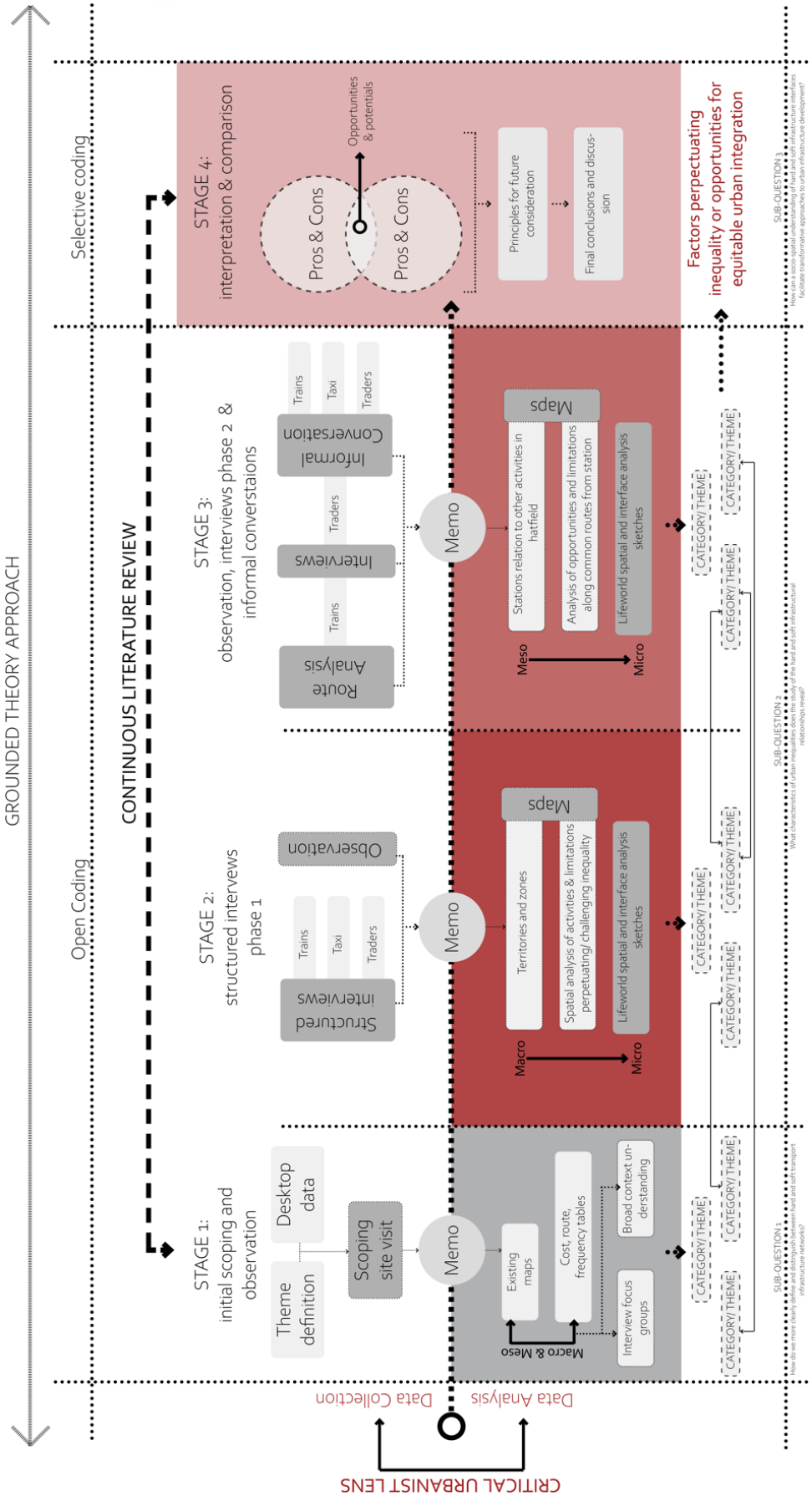


Appendix 11: Social media complaints about no running trains on the weekends (Facebook, May:2023)



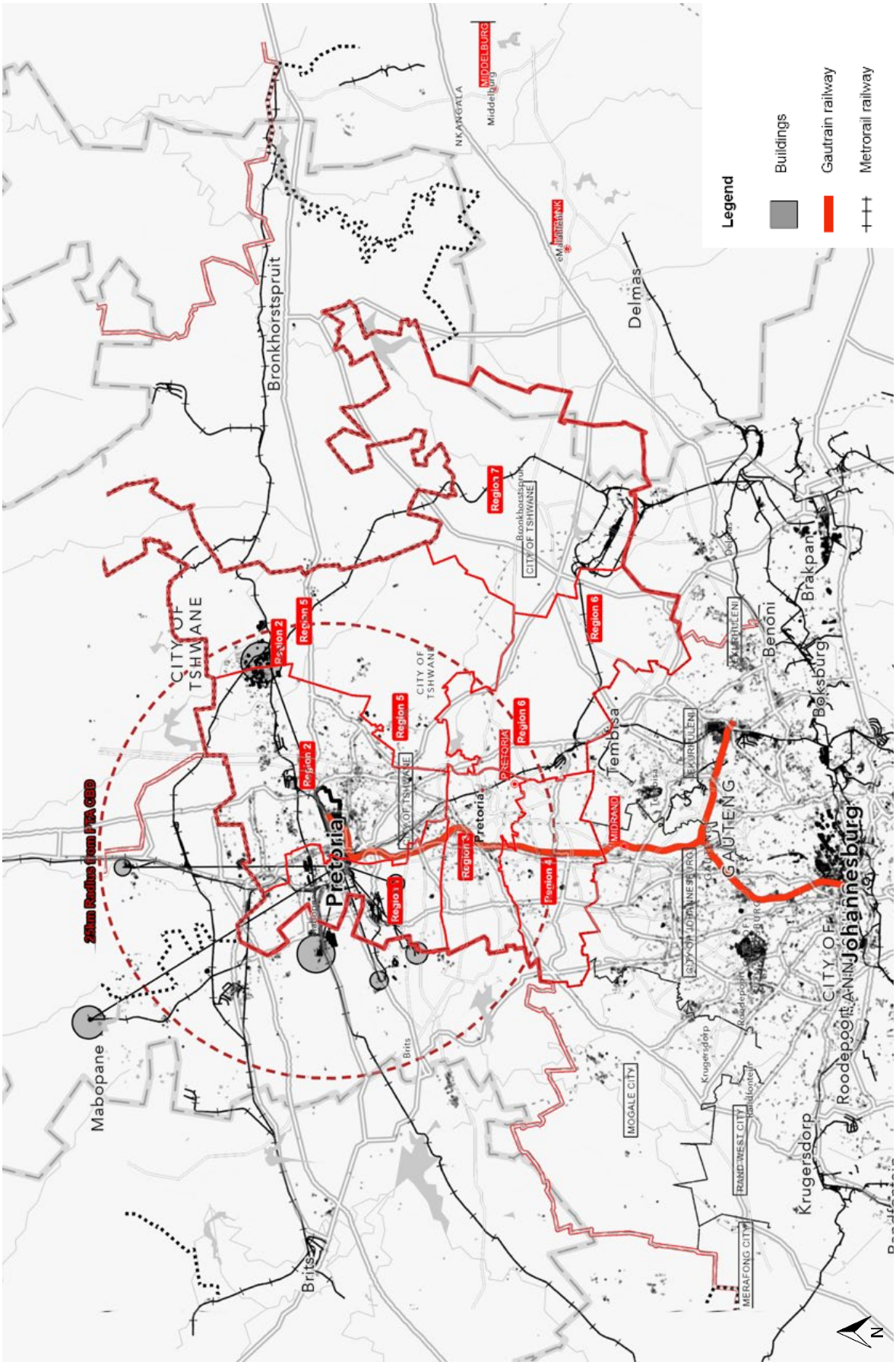
Appendix 12:. Social media notice about price increase (Facebook, April:2023).

Exclusion, emergence & mobility: A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs.



Appendix 13: Methodology diagram (Author, 2023).

Exclusion, emergence & mobility: A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs.



Appendix 14: Map showing the railway connections from the peripheries to Pretoria (Author:2023).

Exclusion, emergence & mobility: A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs.

Summary of Findings Tables

Table 1

Metrorail					
Scale	**Method and reason of analysis**	**Category**	**Subcategory**	**Summary of Findings**	**Cross-reference findings with sources**
Macro- meso	Desktop analysis of costing, frequency, and general opinions of the stations based on interviews, informal conversations, and social media	Arrival into Hatfield	Cost vs convenience	The Metrorail is the most affordable option of transport and therefore appears to be the most prominently utilised.	-Refer to figure 15: The cost analysis table. -Most interviewees mentioned cost as defining factor of use. -Trains and buses are viewed as preferable as they are the most affordable forms of transport (Lucas, 2010:14). -Trains are viewed as unreliable, and overcrowding is also an issue (Mosaine, 2022: 546).
				However, overcrowding, unreliability, and infrequency of the train results in low-income users' livelihoods being governed by these systems.	-Interviewees mentioned infrequency and unreliability of the train system as a large area of concern. -Social media comments express some improvement in overcrowding conditions and safety since the updates from yellow to blue trains. -However, commuters are still generally unsatisfied with the service (appendix 10,11). -Trains often result in commuters arriving to work late and limit the stock for informal traders (Mosaine, 2022: 546).
	Socio-spatial mapping analysis to reveal hard and soft infrastructural interactions (sub-question 1)		Social and economic activity along routes	There is a variety of public amenities along the frequent pedestrian routes from the station. The informal traders, and the stores beneath the Festival's edge offers convenient products en-route. The informal traders are far more utilised than the formal stores surrounding the station.	-Observations; refer to figure 68.
				The Field's is a large actor in the commuter's route as it provides a safe pedestrian environment with some convenient amenities, however, it appears to be mainly used as a thoroughfare as the lower-income users buy from traders as opposed to formal retail.	-Observations; refer to figure 31,32.
			Destinations within Hatfield and walkability	The 3 main routes people took from the stations were to places of work either through the Field's or towards Hatfield's CBD. The other option was to the university, whereby, majority of commuters appeared to be workers there, with, a few students. It appears that majority of the commuters travelled from Mamelodi.	-Observations; refer to figure 23.
				Rissik station is in a prime location, in a close walkable range to the main anchors of Hatfield and many social and economic infrastructures.	-Observations; refer to figure 23.
Meso- micro	Socio-spatial mapping & lifeworld analytical sketches of interfaces to determine the relationship between hard and soft infrastructure (sub-question 1+2)	Interface and mobility within Hatfield	Interfaces along frequent pedestrian commuter routes	Overall, some interfaces encountered near the station are pedestrian friendly such as the Field's or Festival's edge.	-Observations; refer to figure 38,44. -(Dovey and Wood, 2014).
				However, many hinderances are encountered along the way such as uncomfortable sidewalk conditions, impermeable interfaces creating unsafe conditions for pedestrians with a lack of lighting and shade.	-Observations; refer to figure 33,39,45. -Safety is a concern along these routes and people mentioned walking through shopping centres feels safer (Mosaine, 2022: 548).
				Interfaces which include shading and shelter on a pedestrian scale (of which are limited along the frequent routes) are far more comfortable than those that are either vehicle orientated (obstructive) or poorly maintained and impermeable (uncomfortable and unsafe).	-Observations; refer to figure 30. -(Dovey and Wood, 2014).
			How interfaces around Hatfield facilitate emergence	Along the prominent routes, informal traders can be encountered as they set up where the most pedestrians pass by. They often take advantage of open spaces (SLOAP).	-Observations; refer to figure 21. -(Simone, 2004). -(Dovey, 2014).

			(trade and taxis)		
Micro	Socio-spatial mapping & lifeworld analytical sketches of conditions around transport sites to reveal the facilitation or perpetuation of inequality and exclusion of marginalised communities and emergent networks (sub-question 2)	Pedestrian interaction with transport points and their integration of surrounding networks	Station interface and the facilitation of emergence	Currently, there is little consideration for the provision of infrastructure for taxi systems outside of the station although informal appropriation of space occurs.	-Observations; refer to figure 61. -(Dovey and Wood, 2014).
				There appears to be no intention of the station's considerations for the integration of the surrounding informal traders. However, the analysis above revealed the emergent ways in which the traders are adopting space. Since the update to the blue trains all forms of trading have been prohibited on the trains and it is also legally not permitted at the station although it occurs	-Observations; refer to figure 62. -Interviewees mentioned the banning of trade since the train update. -Online video interview from 2022 (appendix 8,9)
				An interesting finding was that quite a few informal traders had access to private vehicles. This suggests that their success is possibly restricted using the train. Traders mentioned difficulties in having to use the train or taxis to transport their goods. There is either not enough space on the train or they would have to pay extra fares.	-Interviews with traders -Observations; refer to figure 66.
			SLOAP as space hosting emergence	Informal traders set up in the open spaces around the station such as sidewalks and the open green space adjacent to the station. The traders in the park have access to storage space for their products and equipment, however, the other traders must only carry what they can fit on trains and taxis or use a private vehicle.	-Observations; refer to figure 60, 62. -(Simone, 2004). -(Dovey, 2014).
				The taxis also make use of the open space in front of the station to stop and pick up commuters.	-Observations; refer to figure 61. -(Simone, 2004).
			Emergence organising around hard infrastructure	The infrastructure of the station is appropriated by the emergent networks (taxis and traders). This includes trees for shade, fencing and signage for structure and sidewalks for space.	-Observations; refer to figure 62,63. -(Simone, 2004). -(Dovey, 2014).
			Other activities near stations	Rissik station is in close proximity to a store on the ground floor of the Festival's edge residence as well as directly adjacent to Moja Gabedi.	-Observations; refer to figure 32.
				Spontaneous activities began to arise around the station that are more social and recreational. People are congregating around the traders' stalls and playing soccer around the station and in the park. This shows the potential of open space as well as how it is appropriated.	-Observations; refer to figure 62. -(Simone, 2004). -(Dovey, 2014).
			Analysis of the hard infrastructure of waiting areas	The waiting areas on the platforms of the station contain little shade and seating for commuters. With the long waiting times between the trains, this is essential for user's comfort. There is also limited availability of information.	-Observations; refer to figure 71.

Key	Opportunities/ positives	Neutral	Limitations/ hindrances/ difficulties

Appendix 15: A table summarising the findings from the Metrorail (Author:2023).

Exclusion, emergence & mobility: A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs.

Table 2

Gautrain					
Scale	**Method and reason of analysis**	**Category**	**Sub-category**	**Summary of Findings**	**Cross-reference findings with sources**
Macro- meso	Desktop analysis of costing, frequency, and general opinions of the stations based on interviews, informal conversations, and social media	Arrival into Hatfield	Cost vs convenience	The Gautrain provides a more comfortable spatial experience for the user, however, this comes at a higher cost.	-Observations; refer to figure 76. -Refer to cost analysis and frequency table figure 15.
	Socio-spatial mapping analysis to reveal hard and soft infrastructural interactions (sub-question 1)		Social and economic activity along routes	The Field's and Hatfield Plaza are the only two actors providing socio-economic amenities and services for pedestrians from the Gautrain station.	-Observations; refer to figure 43.
			Destinations within Hatfield and walkability	There are various routes that students use to reach the university, which is the most prominently used. The other two routes go towards the Gautrain bus depot and Hatfield CBD. Overall, the two main user groups of the Gautrain include students and businesspeople using the Gautrain bus service.	-Observations; refer to figure 24. -Interview data
				The Gautrain station is further removed from the social- economic abilities of Hatfield.	-Observations; refer to figure 24.
Meso- micro	Socio- spatial mapping & lifeworld analytical sketches of interfaces to determine the relationship between hard and soft infrastructure (sub-question 1+2)	Interface and mobility within Hatfield	Interfaces along frequent pedestrian commuter routes	The Field's and Hatfield Plaza are two thoroughfare options that commuters utilize as they are safe, convenient, and pedestrian friendly.	-Observations; refer to figure 44. -Interview data
				For majority of the frequent routes from the Gautrain, the street interfaces are uncomfortable and impermeable, with poor sidewalk conditions, little shade and lighting and feel unsafe.	-Observations; refer to figure 44. -(Dovey and Wood, 2014).
			How interfaces around Hatfield facilitate emergence (trade and taxis)	There is no evidence of emergent informal activities along the routes to the Gautrain	-Observations; refer to figure 73. - "Findings reveal limited improvement on business operations or formations, especially integration of small-scale entrepreneurs from previously disadvantaged communities and informal traders" (Ndwandwe and Gumbo, 2020:995).
Micro	Socio- spatial mapping & lifeworld analytical sketches of conditions around transport sites to reveal the facilitation or perpetuation of inequality and exclusion of marginalised communities and emergent networks (sub-question 2)	Pedestrian interaction with transport points and their integration of surrounding networks	Station interface and the facilitation of emergence and auxiliary networks	The lack of pedestrian activities and social infrastructure, as well as the high-security presence, creates a restrictive environment for the emergence of new systems to accommodate commuters.	-Observations; refer to figure 73.
				There is also no indication of integration of other transport systems, besides the Gautrain buses. Uber drivers struggle to service the station due to conflicts with the metered taxis. This leads to users having to walk further to catch Ubers as metered taxis are expensive and unpleasant.	-Observations; refer to figure 74. -Informal conversations with users
				The Are-Yeng station is in proximity as well as the efficient Gautrain bus service.	-Observations; refer to figure 72. -(Ndwandwe and Gumbo, 2020).
				The building itself contains a transparent interface which creates a stronger connection with the outside space.	-Observations; refer to figure 75. -(Dovey and Wood, 2014).
				Bollards and the raised sidewalk, however, create a disconnect from the street.	-Observations; refer to figure 73.
			SLOAP as space hosting emergence	The Gautrain station has ample space to facilitate emergence and integration which is underutilized.	-Observations; refer to figure 72, 74. -(Ndwandwe and Gumbo, 2020). -(Simone, 2004). -(Dovey, 2014).
			Emergence organising	There are no signs of facilitation of any informal traders surrounding the Gautrain station.	-Observations; refer to figure 73. - "The ample space available within the Hatfield

			around hard infrastructure		station precinct represents a missed opportunity for a vibrant socio-economic node where small-scale entrepreneurs can trade and provide services to commuters and people living or working in the area." (Ndwandwe and Gumbo, 2020:991).
			Other activities near stations	There is a severe lack of public socio-economic activities and amenities for commuters adjacent to the station.	- "At the Hatfield station as there is ample space which is underutilized and could be used for a mixed-use zone or platform to create a vibrant, innovative socio-economic hub for small-scale business opportunities." (Ndwandwe and Gumbo, 2020:991).
				Stations should encourage the integration of other activities for the convenience of passengers- small purchases, eating, etc. However, these have been specifically excluded from the Gautrain station.	-Observations; refer to figure 43.
			Analysis of the hard infrastructure of the station's systems	The Gautrain is an easily navigable system, with information readily available and a convenient payment process.	-Observations; refer to figure 76.
				Sufficient benches, lighting, and a covered walkway is provided for users outside of the station and at the adjacent bus depot.	-Observations; refer to figure 72,73, 75. -(Ndwandwe and Gumbo, 2020).
				Although sufficient infrastructure is provided, it is underutilized due to the frequency of the buses and trains.	-Observations; refer to figure 73, 74. -(Ndwandwe and Gumbo, 2020).

Key	Opportunities/ positives	Neutral	Limitations/ hindrances/ difficulties

Appendix 16: A table summarising the findings from the Gautrain (Author:2023).

Table 3

Mini-bus Taxi Stop					
Scale	**Method and reason of analysis**	**Category**	**Subcategory**	**Summary of Findings**	**Cross-reference findings with sources**
Macro- meso	Desktop analysis of costing, frequency and general opinions of the stations based off interviews, informal conversations, and social media	Arrival into Hatfield	Cost vs convenience	The commuter interviews confirmed that taxis are the second most popular form of public transport to travel from peripheral areas as they are flexible, more convenient, and taxi stops are easier to reach than train stations. Taxis also reach a far wider range of locations than the train.	-Interview data. -However, taxis are more convenient, but fares can double if transporting goods (Mosaine, 2022: 546).
				However, complaints of waiting for taxis to fill up, unsafe driving and difficulty carrying goods have been mentioned by both traders and commuters. They are also a less affordable form of transport, with many commuters complaining about the cost of taxis.	-Interview data. -Taxi fares are viewed as expensive to those in low-income populations (Lucas, 2010:14) (Mosaine, 2022: 546). -Safety concerns were also raised by users both in terms of crime concerns and in relation to the un-regulation of taxis. The interviewees noted being fearful of the drivers driving (Lucas, 2010:14) (Mosaine, 2022: 546).
	Socio-spatial mapping analysis to reveal hard and soft infrastructural interactions (sub-question 1)		Social and economic activity along routes	There is a strong correlation of the location traders set up and popular taxis stops and routes. This provides convenient amenities for commuters passing by.	-Observations; refer to figure 25,54.
				Taxi stops that are closer to socio-economic activities often appear to become longer-term informal taxi ranks which provide comfortable spaces for operators to wait for commuters. The provision of food, shade and parking space seem to promote this.	-Observations; refer to figure 54. -(Ndwandwe and Gumbo, 2020).
			Destinations within Hatfield and walkability	Taxi stop destinations allow ease of access to most of the main activity of Hatfield. Therefore, making it easy to travel around Hatfield and walk only a short distance to destinations.	-Observations; refer to figure 54.
				Most people who travel to Hatfield, do so for work. Upon informal conversations, it was revealed that most people work at large actors such as the Hatfield CBD, university, and shopping centres such as the Hatfield Plaza.	-Interview data -Observations; refer to figure 25.
				The taxis appear to carry people mainly to and from Mamelodi, however, each taxi stops has a different variety of origins and destination.	-Observations and word of mouth
Meso- micro	Socio- spatial mapping & lifeworld analytical sketches of interfaces to determine the relationship between hard and soft infrastructure (sub-question 1+2)	Interface and mobility within Hatfield	Interfaces along frequent pedestrian commuter routes	Interfaces within the Hatfield CBD are more impermeable and uncomfortable than those closer to the university such as along Burnett Street, the Fields, Park Corner etc.	-Observations; refer to figure 55.
				The Hatfield Plaza interface contains overhangs- framing pedestrian movement well.	-Observations; refer to figure 81. -(Dovey and Wood, 2014).
				However, sidewalk parking creates and obstruction of movement and diminishes the vibrant pedestrian interface.	-Observations; refer to figure 78. -(Dovey and Wood, 2014).
			How interfaces around Hatfield facilitate emergence (trade and taxis)	Setback interfaces allow space for emergent activities to happen such as trade and informal taxi stops and ranks. They also activate pedestrian activity and create more comfortable environments.	-Observations; refer to figure 78,81. -(Dovey and Wood, 2014).
				These interfaces then allow for people to sit and wait for taxis more comfortably, especially, if they include infrastructure that can become seating and shade.	-Observations; refer to figure 78. -(Ndwandwe and Gumbo, 2020). -(Dovey and Wood, 2014).
Micro	Socio- spatial mapping & lifeworld analytical sketches of conditions around transport sites to reveal the facilitation or perpetuation of inequality and exclusion of marginalised communities and emergent	Pedestrian interaction with transport points and their integration of surrounding networks	Typical taxi stop interface and the facilitation of emergence	The interface of the Park Corner residence and eatery provides a comfortable pedestrian environment for commuters and operators. The overhang provides shade with a small fence creating spatial division. The Park Corner "taxi rank" goes to Mamelodi, Silverton, Silver Oaks and Brooklyn.	-Observations; refer to figure 78,81. -(Dovey and Wood, 2014).
				The presence of taxis, however, although convenient, may have a negative impact on the user's experience of the eatery.	-Observations; refer to figure 78.
				The presence of the taxis also disrupts the traffic flow of the area as they often do not park completely out of the way of cars traveling along park street.	-Observations; refer to figure 78.
			SLOAP as space hosting emergence	Taxis have appropriated the open spaces around Park Corner, as well as the sidewalk parking provided. Although, unintentional, the presence of this open space has created an active environment for both taxis and pedestrians.	-Observations; refer to figure 78. -(Simone, 2004). -(Dovey, 2014).

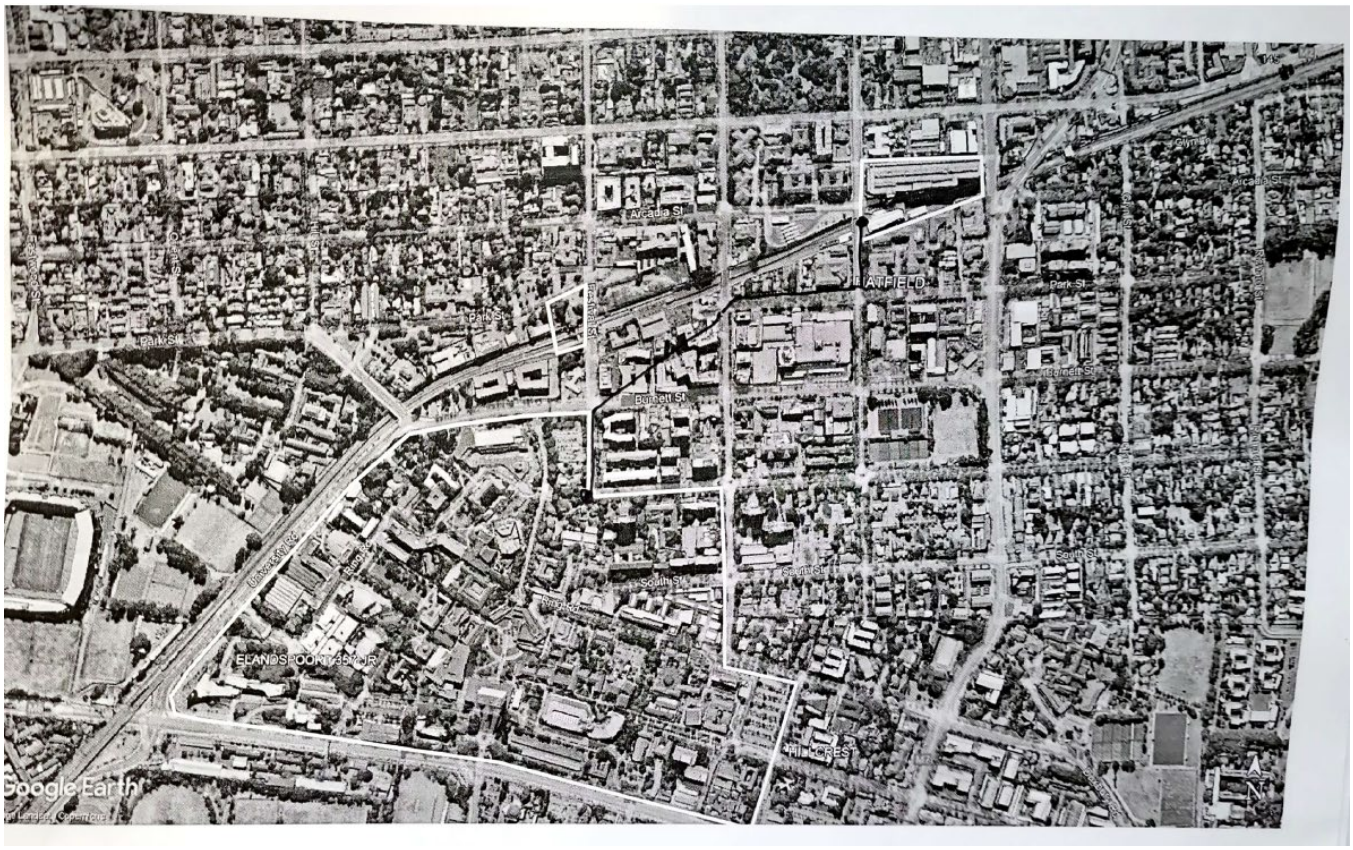
	networks (sub-question 2)		Emergence organising around hard infrastructure	An informal trader operates directly next to the taxi stop as this is where a large amount of pedestrian activity occurs. He attracts many customers getting onto taxis in the afternoons.	-Interview data. -Observations; refer to figure 79,80.
				He has appropriated a planter to store his stock, and this serves as the table which holds his products. He is positioned under the shade of a tree which makes a more comfortable spot for him to trade. This is an example of the permanent hard infrastructure being appropriated to allow for emergence.	-Observations; refer to figure 80.
				He is limited by the stock he can carry onto a taxi as there is nowhere for him to store his stock overnight.	-Interview data. -Observations; refer to figure 80. -(Mosaine, 2022: 546).
			Other activities near taxi stop	This specific taxi stop of analysis is in a convenient position for pedestrian commuters. It is situated directly adjacent to the Park corner eatery, Hatfield Plaza shopping centre and is directly across from a prominent entrance to the Field's. This provides many socio-economic activities for commuters along the way to this stop and makes it a good central location.	-A variety of public transport modes and activities in one location creates opportunity for the development of mixed activity hubs which have potential to accommodate small-scale enterprises (Ndwandwe and Gumbo, 2020: 991).
			Analysis of the hard infrastructure of waiting areas	Ample shade is provided for both operators and commuters waiting, there is seating available at the Park corner eatery and lighting is provided outside the eatery. There is also ample parking space for the taxis.	-Observations; refer to figure 78.
				Although informally adapted, no formal, intentional infrastructure has been by the municipality provided to accommodate the taxi commuters and operators.	-Observations; refer to figure 78.

Key	Opportunities/ positives	Neutral	Limitations/ hindrances/ difficulties

Appendix 17: A table summarising the findings from the taxi stop (Author:2023).

Gautrain interview route maps

Appendix 18: Map of common routes taken from the Gautrain station to the university as described by an interviewee (Summerton, 2023).



Appendix 19:Map of common routes taken from the Gautrain station to the university as described by an interviewee (Summerton, 2023).

Appendix 20: Map of common routes taken from the Gautrain station to the university as described by an interviewee (Summerton, 2023).

Exclusion, emergence & mobility: A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs.

Ethics documents

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Engineering, Built Environment and Information Technology
Fakulteit Ingenieurswese, Bou-omgewing en Inligtingtegnologie / Lefapha la Boetšenere, Tikologo ya Kago le Theknolotši ya Tshedimošo

16 March 2023

Reference number: EBIT/34/2023

Ms TJ Glazebrook
Department: Architecture
University of Pretoria
Pretoria
0083

Dear Ms TJ Glazebrook,

FACULTY COMMITTEE FOR RESEARCH ETHICS AND INTEGRITY

Your recent application to the EBIT Research Ethics Committee refers.

Conditional approval is granted.

This means that the research project entitled "Urban Infrastructure and Inequality" is approved under the strict conditions indicated below. If these conditions are not met, approval is withdrawn automatically.

Conditions for approval:

This approval is conditioned to the UP Survey Committee's approval. Submit the approval from UP Survey Committee once obtained under Docs Due Conditional Approval.

This approval does not imply that the researcher, student or lecturer is relieved of any accountability in terms of the Code of Ethics for Scholarly Activities of the University of Pretoria, or the Policy and Procedures for Responsible Research of the University of Pretoria. These documents are available on the website of the EBIT Ethics Committee.

If action is taken beyond the approved application, approval is withdrawn automatically.

According to the regulations, any relevant problem arising from the study or research methodology as well as any amendments or changes, must be brought to the attention of the EBIT Research Ethics Office.

The Committee must be notified on completion of the project.

The Committee wishes you every success with the research project.

Prof K.-Y. Chan
Chair: Faculty Committee for Research Ethics and Integrity
FACULTY OF ENGINEERING, BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY

Appendix 21:A copy of my ethics approval letter.

Exclusion, emergence & mobility: A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs.

Outline of interview questionnaire for transport users and operators

DIT 801: Ethical Clearance Interview Outline: Transport Users & operators

Preface:

As a group we will be conducting semi structured interviews for data collection for the research topic of Urban Infrastructure & Inequality under the supervision of Paul Devenish.

All researchers are students from the Department of Architecture at the University of Pretoria:

Christopher Thompson, 0780103887, u18080295@tuks.co.za

Tayla Summerton, 0736694853, u16027338@tuks.co.za

Taryn Glazebrook, 0826004697, u18130934@tuks.co.za

Thabiso Maja, 0812460101, u17160155@tuks.co.za

Research Topic: Urban Infrastructure and Inequality :

Prior to the interview we will introduce ourselves as students from the university of pretoria conducting research to gain an understanding of how different people use transport daily. Upon consent we will proceed to ask a series of short questions relating to the use of public transport. The answers shall be noted through text on our cell phones.

These are typical question examples we would ask in order to gain insight into the general movement patterns of commuters and the general demographics. Some questions will have a series of options to select from and others will be specific to the individual. The participants may be asked to draw their daily commute and other movements on a map. Data may also be collected in the form of an online survey. This list of questions serves as a guide the interview and will depend on how much time the interviewee has available:

Demographics

1. What is your:
    a. Gender? Female/Male/Other
    b. Age?
    c. Nationality?
    d. Race? Black/White/Coloured/Indian/Asian/Other
    e. Profession/occupation?
2. Do you have any dependents?
3. Do you have any impairments? (if applicable)
4. Do you have difficulties due to impairments? (if applicable)

Patterns of movement

5. What suburb do you live in?
6. Have you experienced any difficulties with using public transport?
7. What do you enjoy about using public transport?
8. To where and from where are you travelling?
9. What is the purpose and frequency of the journey?
10. Which mode of transport do you frequently use?
11. Is this form of transport easily accessible?
12. How long have you been commuting?
13. What other options of travelling are available? (public and private)
14. Why do you choose to use this/these modes of transport?
15. What is your daily estimated transport budget?
16. What do you do when you can't access this mode of transport?
17. What is the duration of your commute?
18. How far do you walk/ cycle (other) along your journey? (0-2km, 2-5km, 5-10km.)

General questions

19. What are the safety concerns and difficulties within your journey?
20. What services/ infrastructure or support facilities could you add to your route to make your experience more comfortable/ convenient?
21. What could make your journey safer?
22. Are there any sanitation issues on the public transport you take?
23. Were there any events that caused you to use public transport/ change the type of public transport?
24. What times do you generally use transport?
25. Why do you use transport at this time?
26. Did working online/remotely during the Covid pandemic relieve transportation related issues?

Neighbouring economy

27. Do you purchase at the stationed vendors?
28. What kinds of products do you purchase?
29. When do people buy from you most and what item is it?

Appendix 22: An example of the blank questionnaire for the transport users and operators.

Exclusion, emergence & mobility: A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs.

Outline of interview questionnaire for informal vendors

DIT 801: Ethical Clearance Interview Outline: Informal vendors

Preface:

As a group we will be conducting semi structured interviews for data collection for the research topic of Urban Infrastructure & Inequality under the supervision of Paul Devenish.

All researchers are students from the Department of Architecture at the University of Pretoria:

Christopher Thompson, 0780103887, u18080295@tuks.co.za

Tayla Summerton, 0736694853, u16027338@tuks.co.za

Taryn Glazebrook, 0826004697, u18130934@tuks.co.za

Thabiso Maja, 0812460101, u17160155@tuks.co.za

Research Topic: Urban Infrastructure and Inequality :

Prior to the interview we will introduce ourselves as students from the university of pretoria conducting research to gain an understanding of how different people use transport daily. Upon consent we will proceed to ask a series of short questions relating to the use of public transport. The answers shall be noted through text on our cell phones.

These are typical question examples we would ask in order to gain insight into the general movement patterns of commuters and the general demographics. Some questions will have a series of options to select from and others will be specific to the individual. The participants may be asked to draw their daily commute and other movements on a map. Data may also be collected in the form of an online survey. This list of questions serves as a guide the interview and will depend on how much time the interviewee has available:

Demographics

1. What is your:
    a. Gender? Female/Male/Other
    b. Age?
    c. Nationality?
    d. Race? Black/White/Coloured/Indian/Asian/Other
    e. Profession/occupation?
2. Do you have any dependents?
3. Do you have any impairments? (if applicable)
4. Do you have difficulties due to impairments? (if applicable)

Patterns of movement

5. What suburb do you live in?
6. Have you experienced any difficulties with using public transport?
7. What do you enjoy about using public transport?
8. To where and from where are you travelling?
9. What is the purpose and frequency of the journey?
10. Which mode of transport do you frequently use?
11. Is this form of transport easily accessible?
12. How long have you been commuting?
13. What other options of travelling are available? (public and private)
14. Why do you choose to use this/these modes of transport?
15. What is your daily estimated transport budget?
16. What do you do when you can't access this mode of transport?
17. What is the duration of your commute?
18. How far do you walk/ cycle (other) along your journey? (0-2km, 2-5km, 5-10km.)

Emergent Economy

19. How long have you been operating here?
20. When do you start and how long do you operate for?
21. What did you do before operating here?
22. Where do you source your products?

Appendix 23: An example of the blank questionnaire for the informal vendors.

Exclusion, emergence & mobility: A critical socio-spatial assessment of inequality within Hatfield revealing the potential for stations as socio-economic integration hubs.

Informed consent form

Informed Consent Form

(Form for research participant's permission)

(Must be signed by each research participant, and must be kept on record by the researcher)

Preface:
As a group we will be conducting semi structured interviews for data collection for the research topic of Urban Infrastructure & Inequality under the supervision of Paul Devenish.
All researchers are students from the Department of Architecture at the University of Pretoria:

Christopher Thompson, 0780103887, u18080295@tuks.co.za

Tayla Summerton, 0736694853, u16027338@tuks.co.za

Taryn Glazebrook, 0826004697, u18130934@tuks.co.za

Thabiso Maja, 0812460101, u17160155@tuks.co.za

1. Project information

1.1 **Title of research project:**

Urban Infrastructure and Inequality

1.2 **Researcher details:**

All researchers are students from the Department of Architecture at the University of Pretoria:

Christopher Thompson, 0780103887, u18080295@tuks.co.za

Tayla Summerton, 0736694853, u16027338@tuks.co.za

Taryn Glazebrook, 0826004697, u18130934@tuks.co.za

Thabiso Maja, 0812460101, u17160155@tuks.co.za

1.3 Research study description.

(i) The project and project objectives

This project aims to understand issues of urban inequality and use of urban spaces adjoining public transport nodes in Hatfield, Tshwane. The exploration of patterns of use of urban infrastructure is aimed at developing new insights and approaches to reduce urban inequalities.

OBJECTIVES

In the context of the public transport infrastructure of Hatfield, Tshwane the project objectives are:

- to understand patterns of use of public transport infrastructure
- to identify issues of inequality
- to identify emergent patterns of use to reframe our understanding

(ii) What will required of participants

The process will undergo a semi-structured interview process where participants will be questioned voluntarily on matters regarding public transportation, movement patterns, activities, accessibility, and associated dynamics. The participants may be asked to draw their daily commute and other movements on a map. Data may also be collected in the form of an online survey

- A short list of question topics will be asked about their commute
  - To where, and from where, they are traveling
  - Frequency of journey

- Alternative ways of traveling
- The safety of transport infrastructure
- Informal networks around formal infrastructures
- Any other issues encountered along the route

- Participants must be over the age of eighteen (18) to participate in this interview.

(iii) The risks to participants

None of the identities and names of the participants will be revealed. Photos may be taken of the surroundings, any persons captured in the photograph will be concealed. No videos or voice recordings will be taken. However, demographic information may be asked such as age, gender, nationality, ethnicity and profession.

- Participants may be required to disclose locational information pertaining to their daily movements and use of public transport. All answers to questions are voluntarily disclosed, however the data gathered will be further analyzed and published as per the University of Pretoria's guidelines.
- This interview will approximately take twenty minutes to complete.
- All data will be collected using Epicollect (a cell-phone application).

2. Informed consent

2.1 I, _____ (Participant Name) hereby voluntarily grant my permission for participation in the project as explained to me by

Christopher Thompson, Tayla Summerton, Taryn Glazebrook, OR Thabiso Maja under the supervision of Paul Devenish.

Master's research group at the Department of Architecture, University of Pretoria (Module DIT 801).

2.2 The nature, objective, possible safety and health implications have been explained to me and I understand them.

2.3 I understand my right to choose whether to participate in the project and that the information furnished will be handled confidentially. I am aware that the results of the investigation may be used for the purposes of publication.

2.4 Upon signature of this form, the participant will be provided with a copy.

Signed: _____ Date: _____

Witness: _____ Date: _____

Researcher: _____ Date: _____

Appendix 24: A blank example of the informed consent form interviewees were requested to fill out prior to the interview.