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# **Retrofitting Accessibility in a Rapidly Expanding City**

The Case of Bus Rapid Transit and Transit-  
Oriented Development in Dar es Salaam

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# ABSTRACT

Urbanisation is a global trend, but in recent decades it has been occurring at particularly high rates in the Global South. Cities in Sub-Saharan Africa are facing a number of challenges as their populations grow, and among these, urban accessibility stands out as one of the most difficult to contend with. Meeting this challenge will require new solutions, and recently *Bus Rapid Transit* (BRT) and *Transit-Oriented Development* (TOD) have emerged as two potentially revolutionary innovations, especially when combined. In 2016, Dar es Salaam launched a BRT system, and in 2017 it introduced a TOD strategy in order to combat the city's urban accessibility crisis. This study investigates the urban form at and around BRT stations in order to characterise BRT-TOD in the city and extract lessons for future implementations of BRT-TOD in Dar es Salaam and beyond. The investigation was carried out within the framework of urban morphology. It was found that at locations in the city centre, BRT has generally been able to integrate seamlessly into the built environment and achieve many of the core principles of TOD. In the rest of the city, however, BRT acts simply as a form of transit, with stations generally removed from the urban fabric and the local place. Some general issues are the large building setback, the number of informal vendors, private transport operators, exclusive new developments, lack of public spaces, the low quality of the pedestrian environment and the reinforcement of unsustainable forms of urban sprawl. This study aims to contribute to a growing discussion of sustainable urban accessibility solutions in the rapidly expanding cities of the Global South.

# SAMMANFATTNING

Urbanisering är en global trend, men under de senaste decennierna har den pågått i särskilt hög takt i den globala södern. Städer i Afrika söder om Sahara står inför ett antal utmaningar i takt med att deras befolkning växer, och bland dessa särskiljer sig rörlighet och tillgänglighet som några av de svåraste att ta itu med. Att möta dessa utmaningar kommer att kräva nya lösningar, och nyligen har Bus Rapid Transit (BRT) och Transit-Oriented Development (TOD) framstått som två potentiellt revolutionerande innovationer. 2016 lanserade Dar es Salaam ett BRT-system, och 2017 infördes en TOD-strategi för att bekämpa den urbana tillgänglighetskrisen. Denna studie undersöker stadsutformningen vid och runt BRT-stationer för att karakterisera BRT-TOD i staden och hitta lärdomar för framtida implementeringar av BRT-TOD i Dar es Salaam och liknande städer. Undersökningen genomfördes inom det teoretiska ramverket stadsmorfologi. Det konstaterades att BRT på platser i stadskärnan generellt har kunnat integreras sömlöst i den byggda miljön och uppnå många av TOD:s kärnprinciper. I resten av staden fungerar BRT emellertid endast som ett transportmedel, med stationer som inte integreras med den urbana strukturen och den lokala platsen. Några allmänna observationer är det stora utrymmet som lämnas mellan vägen och angränsande byggnader, antalet informella säljare, privata transportmedel, exklusiva nya bostadsprojekt, brist på allmänna utrymmen, den låga kvaliteten på fotgängarmiljön och den potentiella förstärkningen av ohållbara former av urban spridning. Studien syftar till att bidra till en växande diskussion om hållbara lösningar för tillgänglighet i de snabbt växande städerna i den globala södern.

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# NOTES ON FIGURES

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The International Relations Office at KTH the Royal Institute of Technology, Stockholm, Sweden, administers the MFS Program within engineering and applied natural sciences.

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# TABLE OF CONTENTS

1. INTRODUCTION	1
2. LITERATURE REVIEW	3
2.1. ACCESSIBILITY	3
2.2. BUS RAPID TRANSIT (BRT)	4
2.3. TRANSIT-ORIENTED DEVELOPMENT (TOD)	6
2.4. BRT-TOD	7
2.5. RESEARCH QUESTIONS	8
3. THEORETICAL FRAMEWORK	9
4. METHODOLOGY	12
4.1. DATA COLLECTION	12
4.1.1. DESK-BASED STUDY	13
4.1.2. INTERVIEWS	13
4.1.3. OBSERVATIONS	13
4.2. DATA ANALYSIS	13
4.2.1. ABSTRACTION	14
4.2.2. TYPOLOGISATION	14
4.3. ETHICAL CONSIDERATIONS	15
5. CASE: DAR ES SALAAM	16
5.1. HISTORY	16
5.2. GEOGRAPHY	16
5.3. TRANSPORT SYSTEM	16
5.4. DAR RAPID TRANSIT (DART)	17
6. RESULTS	20
6.1. NEIGHBOURHOOD TYPES	20
Type 1: Business District	21
Type 2: Institutional	23
Type 3: Industrial	24
Type 4: Public Housing	25
Type 5: Formal High-Density Residential	26
Type 6: Informal High-Density Residential	28
Type 7: Formal Low-Density Residential	29
Type 8: Informal Low-Density Residential	30
6.2. REGIONAL DEVELOPMENT	31
Zone A	32
Zone B	33
Zone C	33

Zone D	34
Zone E	34
6.3. STATION TYPES	35
Type S1	36
Type S2	38
Type S3	40
Type S4	42
Type S5	44
Type S6	47
Type S7	49
Type S8	51
Type T1	52
Type T2	54
6.4. SUMMARY OF RESULTS	56
7. DISCUSSION	59
7.1. MAIN THEMES IN RESULTS	59
Neighbourhood Types	59
Building Setback	59
Barrier & Bridging Effects	60
Informal Vending	61
Public Spaces	61
Exclusive New Developments	62
Physical Limitations of BRT Improvements	62
Monocentricity	63
Incorporation of Other Modes	63
7.2. LIMITATIONS OF STUDY	64
8. CONCLUSION	65
9. REFERENCES	66

# 1. INTRODUCTION

In recent decades, unprecedented population growth has been witnessed in the world's urban areas, initially in the cities of the Global North, and shifting more recently to the rapidly emerging cities of the Global South. Urbanisation in the developing world, which was at a mere 18% in 1950, leaped to 40% in 2000, and is expected to extend beyond 50% in 2020 (United Nations, 2012). It is estimated that cities in developing countries will account for 95% of the urban population growth between the years 2000 and 2050, moving from 2.0 billion to 5.5 billion residents in this period (Suzuki, Cervero & Iuchi, 2013:3). Between 1995 and 2015, the African continent experienced an annual urban growth rate of 3.44% - the highest in the world, and almost 11 times greater than the equivalent growth rate in Europe (United Nations, 2016). By 2050, it is predicted that 62% of Africa's population will be urban (Loewenson, and Masotya, 2010). This rapid urban population growth has been brought on by several driving forces, including economic, demographic and political factors (Farrell, 2018). The effects on cities are tangible, with local authorities often finding themselves unable to provide for their expanding populations.

Among the vital services that city authorities struggle to provide, urban mobility stands out as one of the most urgent. Cities are not only growing in population, but they are also growing outwards. This means that there are ever larger numbers of people, needing to travel ever larger distances, on already constrained infrastructure. The result is an array of challenges, such as pollution, long travel times, inability to pay, decreased access to opportunities, spatial inequalities, traffic incidents and unattractive pedestrian environments, among others. Transportation poses a particularly potent challenge, because, unlike other urban issues, it is generally exacerbated by rising incomes. This is because residents with higher incomes are able to purchase private automobiles, thereby increasing the number of vehicles on the roads and perpetuating unsustainable forms of urban sprawl (Suzuki, Cervero & Iuchi, 2013). Despite these negative effects - many of which have already been witnessed in the cities of the Global North as a result of decades of auto-mobility culture - cities continue to focus heavily on new road infrastructure (Graham, 2018). If action is taken to shift course, some of the unsustainable urban forms which have been ingrained in the cities of the Global North may still be avoided, saving decades of corrective action. This will require new and innovative solutions.

It is clear that there are no ready-made solutions in the Global North that can simply be adopted by the cities of the Global South. This is both because no city has yet found a sustainable solution to urban mobility, and because any solution would be so context-specific that it would likely not be readily transferable to cities in the Global South. Farrell (2018) argues that the overt focus in academia on the Global North's urban issues has produced a significant knowledge gap, and he dismisses claims such as that of the World Bank (2009:49) that 'today's developing countries are sailing in waters charted by developed nations, which experienced a similar rush to towns and cities'. Lupala (2002) further emphasises the uniqueness of the conditions under which urban growth is occurring in many cities, especially in Sub-Saharan Africa, describing it as 'the uncontrolled expansion of cities with limited economic or productive bases' (Lupala, 2002:29). This urban growth, and the capacity of authorities to respond, must be understood against the historical, political, cultural and economic contexts of these cities. This includes centuries of colonisation, the fight for decolonisation and the Global North's erosion of public institutions through the structural adjustment programmes of the 1980s (see, for example, Kaseke (1998)). In light of these unique challenges, the cities of the Global South will need to continue to pioneer new urban mobility solutions.

In this search for solutions, Bus Rapid Transit (BRT) has emerged as a new mode of potentially sustainable mobility in many contexts where traditional modes have not been suitable. BRT has a range of unique benefits, and is viewed by many as particularly suitable for the rapidly expanding cities of the Global South. However, BRT is only part of the

solution, and cannot single-handedly reverse the unsustainable patterns of urban growth that have been witnessed since the dawn of auto-mobility culture. Transit-Oriented Development (TOD) is another concept that aims to increase accessibility to the city by concentrating populations, workplaces and services near transit stations, while simultaneously improving the quality of the urban environment around these stations. The concepts of BRT and TOD can be combined to take a more comprehensive approach to the challenge of urban accessibility. However, BRT-TOD is a contested concept, and there is no *one-size-fits-all* solution. The only way forward is for cities to experiment, and to learn from their own experiences and the experiences of other cities in similar situations. One challenge is that there are still relatively few examples of BRT-TOD to explore in the Sub-Saharan African context. Dar es Salaam recently emerged as one of the first cases, providing an interesting subject of study.

By exploring a case of BRT-TOD in its real-life context, this study aims to contribute to the discussion on, and development of, new urban accessibility solutions, especially in the rapidly expanding cities of the Global South. The study focuses on accessibility in the urban form of the areas around the BRT stations, which is a central tenet of TOD where there is much space for further research, especially in African cities. As the BRT serves existing neighbourhoods, none of these were planned explicitly with TOD principles in mind, although this has later become a stated goal of the city authorities. Because cities are constantly evolving, it is interesting to review the existing urban form from a TOD perspective, regardless of the planners' intentions. The purpose of the study is to contribute with empirical data, to test new methods of exploring urban form, and to spark debate about solutions to the urban accessibility crisis crippling many of the world's rapidly expanding cities. The findings are largely context-specific, and it is hoped that they can inform planners, designers and decision-makers during future expansions of Dar es Salaam's BRT system. It is also hoped that some of the lessons from Dar es Salaam can be applied in other cities around the world facing similar challenges.

The report consists of eight chapters. This introductory chapter has described the context of the study, and introduced the aim and purpose of the investigation. The Literature Review defines the key concepts relevant to the study, and summarises the existing research. The Theoretical Framework is introduced in Chapter 3, and this is followed by the Methodology chapter, describing the methods used for data collection and analysis. The object of the case study - Dar es Salaam's BRT system – is briefly introduced in Chapter 5. The results of the study are then presented in Chapter 6, which is divided into three sections reflecting the different levels of analysis: *Neighbourhood Types*, *Regional Development* and *Station Types*, before concluding with a summary of the results. The results are discussed in Chapter 7, before the report is concluded in Chapter 8.



# 2. LITERATURE REVIEW

This chapter introduces the key concepts relevant for this study, and reviews the existing research on these concepts in order to provide context for the present investigation. The concept of *accessibility* is first introduced as a suitable aim for transportation and land-use planning interventions. *Bus Rapid Transit* and *Transit-Oriented Development* are introduced individually, before the combination of the two concepts is presented as a more comprehensive solution to the issue of urban accessibility. The chapter ends with a presentation of the research questions, which are informed by the contents of the earlier sections.

## 2.1. ACCESSIBILITY

The concept of accessibility has gained significant attention as an alternative to the strong focus on mobility that has come to dominate spatial planning over the past century, but it remains an often '*misunderstood, poorly defined and poorly measured construct*' (Geurs & van Wee, 2004:127). In order to understand accessibility, we must first understand how we arrived at what Adams (2000) describes as a state of 'hypermobility'. The invention and mass production of the automobile resulted in a '*system of automobility*' (Urry, 2004), where the vital functions in an individual's daily life, such as home, work, shops and social interactions, could be physically separated and dispersed over 'time-space'. This model operated under the assumption that residents could move freely between the different areas, using fast, point-to-point transport provided by the automobile. This '*transport bias*' has appeared alongside a fragmentation of spatial planning practice, where land-use and transportation planning are often performed without sufficient coordination (UN Habitat, 2013). The planning of cities around automobiles has resulted in fragmented urban forms that are dependent on high levels of mobility, with an array of environmental, social and economic consequences.

The vast majority of trips in cities are made for a purpose (to access destinations, activities, services and goods) other than to simply be on the move (UN Habitat, 2013). The goal of accessibility, then, is to allow individuals to achieve these purposes, regardless of the means. Haugen (2012) highlights '*accessibility-by-proximity*' and '*accessibility-by-mobility*' as the two principal ways in which geographical accessibility can be achieved. The former involves land-use interventions to ensure that all necessary functions are available close to each other, whereas the latter involves transportation interventions to ensure that individuals can access all necessary functions in different places. During the age of the automobile, accessibility-by-proximity has largely been neglected in favour of accessibility-by-mobility (ibid). Geurs & van Wee (2004) identify four components of accessibility: the land-use, transportation, temporal and individual components. The land-use and transportation components coincide with the two principal approaches identified by Haugen (2012), and are of particular interest for this study. New technologies add an additional dimension to the concept of accessibility by allowing operations outside of traditional time-space constraints, but these aspects are not considered in the present study. Accessibility, in this study, is presented as an optimal combination of proximity and mobility that allows individuals to fulfil their needs and desires.

Accessibility is difficult to operationalise and measure, resulting in a large variety of indicators being used to describe it. Geurs & van Wee (2004) separate these into four categories: infrastructure-based, location-based, person-based and utility-based measures. Similarly, Neutens, et al. (2008) claim that accessibility can be considered from two principal perspectives: the location and the person, coinciding with the second and third types of measures highlighted by Geurs & van Wee (2004). By considering accessibility from the individual's perspective, factors such as income, age, gender and able-bodied status become important (Farrington & Farrington, 2005). This also means that an individual's access is largely impacted by how they perceive the environment they are operating in, including paths and barriers (Lynch,

1960). In this way, accessibility can be considered a social construct rather than simply a measure of travel times and physical barriers (Haugen, 2012). While the accessibility of automobiles can be included in the equation, the present study considers accessibility on a city-wide scale, where the mass adoption of automobility is not an option. Accessibility for non-drivers is therefore considered to be the main goal.

As the present study focuses on urban form, no attempt is made to evaluate the quality of the BRT system in terms of speed, ridership numbers or on-time performance. Rather, the BRT system is viewed as a purely mobility intervention that addresses the 'mobility' aspect of accessibility. The study instead focuses on the 'land-use' or 'proximity' aspect, specifically at BRT stations. This consists of physical access to the station, which is treated as granting de-facto access to all other stations in the network, which then includes access to the opportunities in the station areas, such as housing, work, shops, recreation, etc. In this way, accessibility is viewed at a very local rather than regional scale (under the assumption that the BRT provides access at the regional level - this could be the subject of a future study), and from the individual's perspective, with an emphasis on the pedestrian experience.

Walking is the most basic form of mobility, and is a part of almost every trip. Whether one is accessing an opportunity in the same area as one resides, or using public transit to travel further, there is most likely some walking involved. For the pedestrian, accessibility and mobility are almost synonymous, and pedestrians need to be able to make efficient, uninterrupted and non-circuitous trips (Montgomery & Roberts, 2008). There is often an accessibility conflict between pedestrians and other modes; in an analysis of shared streets, Tyler (2017) finds that pedestrian accessibility was reduced because of a perceived lack of safety due to the presence of large numbers of automobiles attempting to move through the area at speed. This becomes relevant for BRT, due to the at-grade operation of buses, which inevitably requires some interaction between pedestrians and vehicles or the circuitous rerouting of pedestrians.

Jacobs' (1961) seminal work on walkability and street life can also be viewed through the lens of accessibility. She highlights the importance of short and permeable blocks for allowing pedestrians to navigate the built environment. She also identifies street-level activities as important features both for providing perceived safety and other services, such as shopping, social interaction, etc. In this way, she draws concrete links between urban form and accessibility. Gehl (2010) builds on this work by exploring how the shape of the built environment influences how people can and will move through it. He provides guidelines for designing lively, safe, sustainable and healthy cities. While this may not have been either of their aims, the two authors' arguments about public space can be viewed from an accessibility perspective; there needs to be a reason for people to go to a place (the place is lively and attractive), and the number of barriers (both perceptual and physical) needs to be reduced.

The contested nature of the concept of accessibility means that it can be interpreted in different ways, allowing a flexible approach that is suitable for a case study. Accessibility in the present study will focus on pedestrians and urban form, including perceptual and physical connections, barrier, paths and edges. The next two sections examine, in more detail, how accessibility is operationalised in two separate but complementary ways.

## 2.2. BUS RAPID TRANSIT (BRT)

In 1974, the relatively anonymous Brazilian city of Curitiba kicked off a transport revolution when it inaugurated the world's first Bus Rapid Transit (BRT) system. This was a transportation innovation where buses were utilised to achieve many of the advantages of rail-based systems. Although many of the features were not new, this was the first time they had been combined in this way and under the brand of 'BRT' (Lindau, Hidalgo & Facchini, 2010). The concept garnered worldwide attention after its introduction and significant advancement in the Colombian city of Bogotá in the year 2000. It has since been widely acknowledged as a cost-effective mode for achieving high capacity, speed and service-quality

in public transportation (Institute for Transportation and Development Policy [ITDP], 2017a). Unique features of BRT systems include 'segregated bus lanes that are typically median aligned, off-board fare collection, level boarding, bus priority at intersections, and other quality-of-service elements (examples include information technology and effective branding)' (ibid). In Haugen's (2012) model, BRT contributes to providing *accessibility-by-mobility*.

Many of these features are adapted from rail-based rapid transit systems, and in terms of the user experience, BRT and rail are not significantly different. Ben-Akiva & Morikawa (2002) conclude that users care more about service characteristics than the mode that they are using, in their comparison of light rail and bus. In BRT systems, passengers generally enter an elevated platform using their ticket, from which they board the bus directly at all doors and without coming into contact with the driver. Buses can run at high frequencies, and achieve short hold times at the platform since ticket purchase and validation has already been completed prior to boarding. Buses generally travel in dedicated lanes, physically separated from other traffic in a similar way to a train line or underground metro. Alongside these similarities, there are also some major differences between the two systems, especially from the construction and operation perspectives.

Many cities in the Global South have been unable to justify the massive financial investments required to introduce traditional public transportation systems such as railway or metro. Construction of such systems is complex, labour-intensive and requires detailed planning with cooperation from various actors. BRT systems have the advantage of being able to be planned and constructed with a significantly smaller investment of capital and time than traditional metro and railway systems. By making use of mainly existing infrastructure, the disruption to the city and environment is also minimised during construction. Using existing roadways also has the added benefit that residents are likely to be familiar with the routes, and have probably already structured their daily lives around these corridors. (ITDP, 2017a).

Another common challenge with railway and metro systems is their lack of flexibility. They require a predictable and stable level of demand in order to be viable, and routes cannot easily be varied or extended. In a BRT system, the number of vehicles and frequencies can easily be increased or decreased depending on the actual demand. New routes and stations can be constructed without massive interventions. This means that BRT is well suited to growing cities, such as many of those in the Global South, where future demand and geographical changes cannot easily be predicted. The flexibility of BRT has allowed it to be adopted in larger cities such as Mexico City, Brisbane and Istanbul, as well as smaller cities such as Nantes and Strasbourg. (ibid)

BRT has also come to have significant symbolic value as an innovation that is often considered to have emerged from the Global South. It is often viewed as a leading example of 'South-South cooperation' - a model of policy teaching where ideas are shared between developing countries on a level playing field (Wood, 2015). BRT is widely considered to be a more realistic and suitable solution for cities in the Global South, due to the plethora of prominent examples of cities with similar contexts having successfully implemented their own systems. BRT advocates claim that there are currently BRT systems in 170 cities worldwide, with the majority in Latin America and Asia (BRTDATA.ORG, 2019). Individuals such as Enrique Peñalosa (two-time mayor of Bogotá) have advocated heavily for BRT, and there is a clear pattern of city authorities visiting Bogotá for study visits before deciding to implement the innovation (Montero, 2017).

Characterising the diffusion of BRT as a purely South-South initiative is, however, misleading. Rizzo (2017) identifies a group of organisations which he describes as the 'BRT Evangelical Society', including the World Bank, Volvo, the World Resources Institute, the Goldman Sachs Urban Investment Group and the ITDP. This group is most often present whenever a new BRT system is under consideration, providing support and funding. He finds these actors to be involved in the spreading of a neoliberal model of public transit provision, through his extensive case study of the new BRT system in Dar es Salaam. Montero (2017) describes the process of BRT policy diffusion as neither solely 'South-

South' or imposed from above, but rather something that occurs at the nexus of the two. The organisations in the Global North often impose 'soft power' by funding study tours for local decision-makers, thereby retaining the 'South-South' image which is often viewed favourably by populations in these countries (Montero, 2017). While BRT is not a silver bullet, and must be viewed critically in light of the policy implications it entails, it does have the potential to bring various benefits in terms of accessibility, especially when combined with Transit-Oriented Development.

## 2.3. TRANSIT-ORIENTED DEVELOPMENT (TOD)

While the rapid spread of BRT stoked optimism about the transformative power of urban mobility, there has also emerged a general consensus among urban thinkers that improved mobility alone cannot solve the problems faced by cities as they continue to grow outwards. The way that cities are built – the urban form – has an enormous impact on how people use the transport system, just as the design of the transport system affects how the city grows and the form it takes. This interrelationship justifies a greater focus on urban form in the study of urban mobility. Suzuki, Cervero & Iuchi (2013) caution against a singular focus on mobility in planning, and instead advocate for an integrated approach to land-use and transportation planning. In general terms, this means creating a mutually reinforcing relationship between the urban form and transit, where high-quality transit serves high-density areas – areas which, in turn, ensure high levels of ridership for the transit system. In addition to high-density development and high-frequency transit, there are a number of additional factors which are necessary for this integration to succeed. These factors are often integrated into the urban ideal of 'Transit-Oriented Development' (TOD). The goals of TOD can be summarised as trying to improve access to the transit network and also give people a reason to go to a place. While it has a heavy focus on place-making (i.e: 'accessibility by proximity'), it also encourages movement (i.e: 'accessibility-by-mobility').

First introduced by Calthorpe in the late 1980s (Carlton, 2009), the idea of TOD is contested, and several different characterisations have emerged. The term is interchangeably used to describe specific urban development projects in proximity to transit stations, and an ideal form of urban development on the city-scale that incorporates a number of different characteristics. ITDP, as a major advocate of BRT and TOD, has attempted to standardise the concept of TOD to allow it to be implemented in more cities around the world. In their TOD Standard (ITDP, 2017b), they assert that a high-quality TOD must incorporate eight key features, which they refer to simply as: 'walk', 'cycle', 'connect', 'transit', 'mix', 'densify', 'compact' and 'shift'. *Walk* and *cycle* imply that the area must be easily accessible for these two sustainable modes, enabling first and last mile transportation to and from the transit terminal, and allowing residents to thrive without a private vehicle. *Connect* means ensuring that the paths available to sustainable modes (pedestrians and cyclists) are more direct than those available to automobiles. *Transit* means ensuring that the development is within walking distance of a transit station. *Mix* refers to combining different land-uses in the same neighbourhood, in order to reduce the lengths of trips and ensure that neighbourhoods have activity throughout the day. *Densify* refers to increasing residential and non-residential densities, ensuring that the synergies of urban life are realised. While these ideals are almost universally accepted, their manifestations in urban planning and design remain contested, rendering BRT-TOD an interesting topic of continued study.

UN Habitat (2013), among others, bemoans the lack of integration of spatial planning and transportation planning. TOD is located at the nexus of these two practices, and is therefore only possible to implement through a cooperation between several different actors. However, even with cooperation of different actors, it can be difficult to encourage or force developers to implement TOD principles. Talen (2013) explains that current urban planning codes are generally based on zoning, which defines functions and leads to fragmented space. She makes a case for '*Form-Based Codes*' (FBCs), which instead dictate urban form and allow a variety of functions. Codes can be applied to building setbacks, active frontages, size and shape of blocks, etc. A transition to FBCs can be a big step for many cities to take, but Talen (2013) argues that it could be a vital step in creating more dense and sustainable cities.

While Cervero, Guerra & Al (2017) highlight the ineffectiveness of many planning authorities in the Global South in incorporating the different areas of planning, they remain hopeful: *'given that most future urban population growth over the next two decades will be in developing countries, the opportunities for successfully linking urban development and public transport in the Global South are unprecedented'* (Cervero, Guerra & Al, 2017:141). Suzuki, Cervero & Iuchi (2013) also seem to imply that a general change is taking place among planners in these cities. BRT projects are no longer being viewed as simply technical solutions to the issues of mobility and pollution, but are rather being used as parts of wider city redevelopment projects that include a variety of physical, social and economic interventions. Municipalities have been able to harness BRT projects to reinforce economic development with a mix of commercial and residential uses, especially in segregated and underdeveloped neighbourhoods. BRT has become the backbone of many TOD projects, by reducing travel times to services and ensuring that these are easily accessible to all, especially those without a private vehicle. Bringing public transit to new areas of a city incentivises new economic and social interactions that may result in significant improvements in quality of life and reductions in spatial inequalities (Rodríguez & Vergel, 2013). The term 'TOD' is used in this report to describe both the **immediate area around a transit station** and the **model of ideal urban development** described in this chapter.

## 2.4. BRT-TOD

By fusing the 'accessibility-by-mobility' and 'accessibility-by-proximity' components, the combination of BRT-TOD has the potential to act as a more comprehensive solution for accessibility than either BRT or TOD alone. In fact, Cervero & Dai (2014) argue that TOD is a necessity for successful BRT, and lament what they describe as the neglect of the 'city-shaping' potential of BRT in many cities who view it as simply a mobility solution.

Previous studies have explored a variety of aspects of BRT-TOD and its accessibility effects. Nelson, et al. (2013) found that BRT station catchment areas in Eugene (Oregon, USA) attracted more workplaces than the rest of the city. Studies in Seoul (Cervero and Kang, 2011), Sydney (Mulley, 2013) and Boston (Perk, et al., 2013), among others, demonstrate increases in property values in BRT station catchment areas. Interestingly, a similar study by Rodríguez and Targa (2004) in Bogotá revealed that, while proximity to BRT stations resulted in increased rental asking prices, outside the station areas the opposite was true - rental asking prices increased with the distance away from the BRT corridor. This, however, likely reflects the negative effects of being located adjacent to any busy traffic corridor, with or without BRT. Residential densities in Bogotá were also found to have increased more in station areas than in other areas of the city (Bocarejo, Portillo & Pérez, 2012). In terms of social impacts, Brown (2016) finds evidence of gentrification in BRT-adjacent areas in Los Angeles, and highlights the need for policies to counteract this effect. Researchers such as Judy (2007) (in a study of North America and Australia), and Suzuki, Cervero & Iuchi (2013) (more generally) describe the institutional challenges of achieving BRT-TOD due to the separation of land-use and transportation planning in many cities.

There are also a number of investigations exploring the effects form in BRT station-adjacent built environments. Chatman's (2013) study in New Jersey finds that the surrounding urban form has a larger effect on ridership than the mode of transit on offer (in a comparison between BRT and light rail). Jiang, Zegras & Mehndiratta (2012) prove that station and corridor design, as well as density, are important factors affecting the distance that potential users will walk to access the BRT system in Jinan, China. Estupiñán and Rodríguez (2008), similarly, find that BRT boardings in Bogotá are positively impacted by specific urban design interventions favouring walking and cycling over car use. Zegras, et al. (2016) highlight the inherent difficulties of BRT's at-grade operation, with accessibility impacts along the entire length of the system rather than only at stations, which they claim require particularly thought-out design interventions to reduce barrier effects. Cervero (2013) further highlights the inherent difficulties of integrating BRT

stations located in the medians of active roadways with the surrounding built environment. The examples of Bogotá's lengthy and circuitous aerial walkways and Ahmedabad's poor surface-level crossings are invoked to lament the lack of attention paid to the pedestrian experience in many BRT systems.

In summary, previous studies about BRT-TOD have highlighted a number of benefits and challenges. Proximity to a BRT station appears to be broadly valued by both residents and businesses, and evidence suggests that the accessibility improvements offered by transit are considered more important than the particular mode of transit. Density and design are important factors in the planning of BRT-TODs, and pedestrian accessibility is more important than private vehicle accessibility in influencing the number of people who choose to ride the BRT. The challenges of BRT-TOD are mainly related to the at-grade operation of buses, with residents indicating an aversion to heavily-trafficked corridors (with the exception of station areas). At stations, there is a trade-off between pedestrian accessibility and smooth vehicle movements; at some stations, vehicle movements are prioritised by shifting pedestrians onto aerial walkways, while at others, vehicles must give way to pedestrians crossing to and from the station.

The present study takes into consideration some of the aspects covered by Jiang, Zegras & Mehndiratta (2012) and Estupiñán & Rodríguez (2008) in their studies of Jinan and Bogotá, respectively. Jiang, Zegras & Mehndiratta (2012) create typologies of BRT corridors based on the roadway design, street patterns and activities on the street. Estupiñán & Rodríguez (2008) survey the areas within a 250m radius of BRT stations in Bogotá, looking at both social and physical features. Among the physical features surveyed, building setbacks, widths of sidewalks, dominant land uses and obstructions served as precedents for the present study. Whereas the authors in both studies go on to quantitatively relate the identified features and typologies to BRT ridership numbers, the present study performs a strictly visual and qualitative analysis, and does not attempt to establish causality between urban form and ridership numbers at stations. In addition to investigating a case that is relatively understudied, the present study explores new visual and descriptive methods for understanding BRT-TOD.

## 2.5. RESEARCH QUESTIONS

Based on the existing research and the definitions covered in this chapter, the present study sets out to answer the following two research questions:

1. How have BRT, and BRT stations in particular, been retrofitted into the existing built environment in Dar es Salaam? How do these infrastructures interact with the surrounding urban form (TOD)?
2. How does the existing form of BRT-TOD in Dar es Salaam affect accessibility on the local (station-area) scale? What form do paths and barriers take? How do users access the opportunities available in the station areas?

# 3. THEORETICAL FRAMEWORK

This investigation is anchored in the field of *urban morphology*, which can be described as the ‘*study of human settlements, their structure and the process of their formation and transformation*’ (Kropf, 2018). Urban morphology is an interdisciplinary field, and therefore combines perspectives from a variety of other disciplines, including architecture, geography, history and planning (Moudon, 1997). Historically, urban morphology emerged in two distinct schools: the Conzenian (British) school and the Muratorian (Italian) school. While the Conzenian school focused on understanding the city ‘from above’, the Muratorian school explored the city more from the street level, or ‘from within’ (Stojanovski & Axelsson, 2018). Both of these perspectives are vital to the study of urban form, and in later years much effort has been invested into integrating and reconciling the two approaches. Kropf (2018) identifies four contemporary approaches to the study of urban morphology: ‘typo-morphological’, ‘configurational’, ‘historico-geographical’ and ‘spatial analytical’. The present study uses elements from all of these different approaches.

Urban form only has meaning insofar as it is interpreted by its users. Kropf (2018) highlights the tendency of users of urban space to resort to normative judgments, and claims that it is the ultimate calling of urban morphologists to slow down this normative impulse. In order to do this, he proposes three sets of tools, of which two are relevant for the present study: 1. analysis, comparison, synthesis, and 2. description, evaluation, design. The present study applies these two sets of tools, but leaves the final step (design) to those more qualified. Kropf (2018) also identifies three interrelated aspects of urban morphology: the natural environment, human use, and the built form. Lynch (1960) elaborates on the importance of the user and their interaction with the built form, theorising the city as a collection of *spaces and flows*. Since BRT-TOD deals with the urban form and its relation to transportation systems, urban morphology is an ideal theoretical lens through which to view and analyse it.

In order to analyse the built environment, it must be divided into its basic elements, which then combine to create patterns (Kropf, 2018). Urban form can be broken down into three fundamental elements: buildings, plots and streets (Moudon, 1997; Kropf, 2018). While these elements are easily identified by those analysing the city, they are not necessarily the elements that are identified by the users on the streets. Lynch takes a more perceptual approach by identifying five urban elements that humans use to understand and navigate the city: paths, nodes, districts, edges and landmarks. Paths and edges are linear elements, with paths being those that users can move along, while edges are those that users are unlikely, or unable, to cross. Nodes and landmarks are points, with nodes being the points at which different paths cross, and landmarks being visual markers that can be used to position the user within the urban space. Districts have two-dimensional extent, and users can feel when they move from one district to another. Stojanovski (2015) adapts these elements to describe the interrelationships between public transport infrastructures and their surroundings. This is done by expanding the concept of the ‘*district*’ to include ‘*desirability cores*’ as a new element, and by dividing the ‘*edges*’ element into three types of barrier - ‘*impermeable*’, ‘*permeable*’ and ‘*no barrier*’ – to better describe their effect on users. Elements from both the objective and perceptual approaches can be used in combination to explore BRT-TOD.

Since large numbers of individual elements combine to form expansive patterns, it is also vital to consider the scale at which the city is being viewed. Moudon explains that the urban form can be ‘understood at different levels of resolution. Four scales are commonly recognised, corresponding to the building/lot, the street/block, the city, and the

region' (Moudon, 1997:7). It is vital to consider the city at all of these scales, from the facades within viewing distance of the station exit, to the entire built-up area of a city. All of these scales affect accessibility in the city – the design of the station area can affect whether a user considers the possibility of using public transit, and the street pattern of a neighbourhood can affect whether a pedestrian chooses to walk or take a taxi. In addition, it is also vital to consider the interaction between the different scales; Lynch highlights that a given object can take on different roles depending on the scale at which the object is being viewed. For example, a district at the city scale may become a node at the regional scale. Scale is one of the main aspects to consider when analysing the urban form of a city.

In addition to scale, the perspective from which the city is being viewed must also be considered. The two basic perspectives – from *within* and *above* – have already been identified. While Lynch's elements are identified from the 'street view' (view from within the city), he advocates for these elements later being plotted on maps (view from above) to gain a holistic understanding of the city. However, there is more complexity here as well; the user's perspective must also take account of the user's individual characteristics, and an individual object can take on several different meanings depending on the user that is viewing it. For example, a motorway is a path for a driver, but can be a major edge/barrier for a pedestrian. An organic street pattern can feel like home for a local resident, but can be confusing for a first-time visitor. This is an idea that Lynch highlights when advocating for the more in-depth consideration of the city's 'moving elements' – the users. He posits that every individual is both an observer and an element in the city, and that their activities are just as important to consider in the analysis of the city as the stationary elements which are traditionally considered (Lynch, 1960). The users' perception of the city can therefore not be separated from the physical form.

Stojanovski's (2015) desirability cores are an articulation of this concept specifically adapted to public transportation. Desirability cores are the areas exposed to large flows of pedestrians emerging from transit stations, and which therefore make attractive places for commercial purposes. They are a product of both the static and dynamic features of the city – while they are basically defined by the line of sight from the station exit, they can be extended by movements of people, as pedestrians are likely to continue subconsciously with crowds of people moving in the same direction. They can therefore, to some degree, be influenced by designers and architects, but they are also subject to dynamic forces. In cities with large informal economies, this concept becomes especially interesting, as informal operators (such as vendors, transport providers) are extremely dynamic and can relocate on a day-to-day basis to take advantage of pedestrian flows. It is therefore important to consider users of the city as both observers and shapers of the urban environment.

Urban morphology's ultimate goal is to understand which urban forms work. With attractiveness being a subjective concept, it is important to be able to deconstruct the urban form and identify which elements and combinations of elements result in attractive spaces, and which ones do not. The previously described elements are useful in this deconstruction, but the next step is putting the elements back together, and this requires the identification of different types. This is a practice which stretches as far back as the fourth century BC, when Aristotle suggested that the physical world could be divided and categorised. More recently, researchers such as Rådberg & Friberg (1996) and Stojanovski & Kottenhoff (2013), among others, have used typologies to analyse urban form and identify ideal patterns. Stojanovski (2019) demonstrates that typologies can be defined by pattern-matching and abstraction. This can be done by selecting representative prototypes, but can also be aided by following the historical emergence of different patterns. Abstractions and typologies are tools that can be used to make sense of the complexities of urban form.

Since urban morphology involves understanding the emergence and continuous evolution of cities, it is also important to have a basic understanding of theories on why and how cities come to exist and grow. This is the main focus of the historico-geographical approach to urban morphology (Kropf, 2018). One of the earliest theorisations on the form of



cities is Burgess' (1925) idea of concentric zones, with five identified land uses radiating from the city centre in concentric circles. Hoyt (1939) modified this model, proposing instead that areas with coherent land uses could radiate from the urban core in the form of sectors. Hoyt's model is more applicable to cities that developed during the railway era, before automobiles became common, and unlike the Burgess model, it allows for projections outwards as cities continue to expand. Whitehand (1967) builds on these theories, proposing that the expansion of a city reflects economic cycles. The focus is on the *fringe belts* which develop during periods of economic stagnation at the edge of a built-up area, and which contain land-uses such as playing fields, community buildings, cemeteries, allotment gardens and some types of industry. When economic growth picks up, these areas generally survive as a belt separating older and newer development (Whitehand, 1967). These three theories provide a useful frame of reference for understanding the historical development of Dar es Salaam's urban form, and will be referred to in Chapter 5.

Kropf (2018) introduces a number of methods that can be applied in the study of urban morphology. He recommends the combination of desktop analysis and field surveys as two complementary methods for data collection. The methods used in the present study are covered in more detail in Chapter 4. In summary, urban morphology is a broad and multi-disciplinary field that is informed by various other academic disciplines, making it an ideal lens through which to explore BRT-TOD. Urban morphology allows the deconstruction of urban form into its basic elements, as well as the identification of typologies from which useful information can be extracted. This can be done both through pattern matching and abstraction, as well as the study of historical developments.

# 4. METHODOLOGY

A *case study* was selected as the most suitable methodological approach for the current investigation, as it fulfils a number of key criteria established by research methodologists and practitioners. Firstly, the idea of retrofitting cities for accessibility is deeply context-specific, and is inseparable from the social, historical, geographical and political contexts in which the phenomenon occurs. This is a typical situation where Yin (2009) and Gillham (2000) advocate the use of a case study approach. Yin (2009) adds that the case study methodology is particularly suitable for investigations aiming to answer ‘*how?*’ or ‘*why?*’ questions, as well as in situations where the researcher has little control over events - two conditions which hold true for the current investigation. Case studies enable the examination of complex phenomena, by allowing the researcher to remain reflexive and by focusing on understanding underlying processes (Gillham, 2000). Echoing this sentiment, Stake (1995) asserts that case studies should aim to uncover the complexity of a single case, rather than aiming to be generalisable to other cases, making them particularly suitable for specific phenomena. While critics take aim at the lack of generalisability of case study research, advocates of the method instead highlight the value of deep, context-specific knowledge, with Flyvbjerg (2006) claiming that social science is essentially a vast collection of knowledge about specific cases.

When considering the object of the case study, Stake (1995) advocates for the selection of unusual or ‘instrumental’ cases (referred to by Patton (2002) as ‘information-rich’ cases) rather than representative cases. In this investigation, Dar es Salaam was selected because of the existence of a high-profile BRT system, with this case being considered ‘instrumental’ rather than representative of rapidly expanding cities. Of the three case study approaches identified by Yin (2009), this study aimed to be *exploratory* and *descriptive*, rather than *explanatory*. With this in mind, theory was built inductively - a process described by Gillham (2000:7) as ‘*making sense of what you find after you’ve found it*’. The research was guided by a constructivist epistemological approach, acknowledging scientific knowledge as a social construct rather than something to ‘be discovered’ (Stake, 1995) and recognising the researcher’s role in the construction of this knowledge (Patton, 2002). The researcher is never a detached scientist, and it is vital to understand the researcher’s role in what they discover (Gillham, 2000). Nevertheless, research can be performed from either an ‘*emic*’ (insider) or ‘*etic*’ (outsider) perspective - both of which have come to be understood as valuable - ‘*the challenge is to combine participation and observation so as to become capable of understanding the setting as an insider while describing it to and for outsiders*’ (Patton, 2002:268). The present study was done from an etic perspective, and efforts were made to understand the context as an insider, while also making the researcher’s perspective clear in the presentation of the results.

## 4.1. DATA COLLECTION

There are a number of generally accepted methods of data collection that can be applied in case studies - Patton (2002) and Stake (1995) identify three, whereas Yin (2009) further deconstructs these to identify a total of six. Despite their differences, both methodologists agree that two or more methods should be used in a single study in order to achieve a sufficient level of accuracy. This can be described as triangulation of data sources, where the evidence converges in a triangular fashion towards a meaningful truth (Stake, 1995; Patton, 2002; Yin, 2011). In this investigation, the three most commonly recognised methods were used: desk-based study, interviews, and observations (there is some variation in the terms used by different authors to describe each method). The three methods were applied simultaneously during a nine-week study period in March-May 2019, on location in Dar es Salaam. While each method served a slightly different main purpose, data was regularly cross-checked between the sources. In a reflexive and

inductive fashion, data collection and analysis was iterative, with both processes proceeding simultaneously and informing each other.

### 4.1.1. DESK-BASED STUDY

The investigation began with the sourcing and collection of documents and other secondary sources of data, which is a vital first step in any case study (Gillham, 2000; Yin, 2009). Data sources included historical accounts of Dar es Salaam, newspaper articles about the city's BRT, planning documents for the BRT system and TOD strategy, maps, ridership data and satellite imagery. Some of this data was collected after interviews, and the data was analysed continuously to inform the observations and cross-check findings. In addition to this, the desk-based study was vital for providing the context for the investigation and in identifying neighbourhood types.

### 4.1.2. INTERVIEWS

Interviews were carried out with three key people and one organisation related to Dar es Salaam's urban planning in general, and the BRT system in particular. Two of the interviews took on a semi-structured form, using an interview guide to ensure that the relevant themes were explored and necessary data validation occurred. These interviews were recorded and later transcribed. The other two interviews were carried out in an informal conversational style, with only notes being taken. All interviews took place at the interviewees' places of work, in order to ensure that they were comfortable in the setting. Interviews were carried out according to the thorough framework established by Patton (2002). Data from interviews was useful in finding new themes to explore and validating observed phenomena.

Interview 1: Urban Planning Academic (unstructured)

Interview 2: Bus Operations (semi-structured)

Interview 3: Urban Planning Professional (semi-structured)

Interview 4: Traffic Safety Organisation (unstructured)

### 4.1.3. OBSERVATIONS

Observations provided the bulk of the data used in the final report. These were carried out on a near daily basis, along the entire length of the BRT system and in surrounding neighbourhoods within the study area. Data was recorded in the form of field notes and photographs. Patton (2002) and Yin (2011), in particular, highlight the importance of taking descriptive, thorough field notes, and provided a basic structure for these. Gillham (2000) also highlights the importance of transporting the reader to the case study setting, especially when physical artefacts are involved, arguing for the inclusion of photographs alongside descriptive texts in case study reports. In particular during the observations, recurring elements of the street space, such as commercial building frontages, residential facades, sidewalks, walls, greenery and undesignated open spaces were identified. The informal, and therefore less permanent, features of Dar es Salaam's streetscape, such as street vendors and private transport operators, were also recorded, due to their significant impact on the user's experience of the urban realm.

## 4.2. DATA ANALYSIS

With the investigation's focus on form, methods of analysis were mostly visual and spatial. Taking an exploratory approach, it became clear early on that the study area was extremely heterogeneous in form, function and street-level activities. This made categorical aggregation necessary - a process which Stake (1995) describes as the '*aggregation*

of instances until something can be said about them as a class'. In order to do this, the defining features of each category, or typology, had to be identified. Abstraction was used here to separate the important information from the large amount of primary data that had been collected. Once the study area had been divided into manageable groups, each group was described using the data collected.

## 4.2.1. ABSTRACTION

Abstractions were necessary to isolate relevant information from the large amount of data contained in the visual primary sources (photographs and maps). Three formats of abstraction were used. Firstly, simple maps containing the outlines of buildings and streets (sourced from OpenStreetMap contributors 2018) allowed the identification of development patterns in terms of block sizes and shapes, building density, street widths, etc. Secondly, cross-sections of the streetscape were used to illustrate the view from within the city – a format which provided useful information on the relationship between vertical and horizontal features and the user experience. The third format involved the superposition of observed urban elements onto close-up satellite images of station areas, allowing for an analysis of how station areas may be understood by their users at the street level. These abstractions were used, together with the photographs and field notes, as inputs for the creation of typologies.

## 4.2.2. TYPOLOGISATION

Once the data had been collected and abstracted, it was used to typologize the neighbourhoods and station areas. This was done through pattern-matching (a process introduced briefly by Yin, 2009). Physical similarity to a prototype was primarily used, with consideration also taken of the social constructs which were manifested in the urban designs. These are two methods which are used and described by Stojanovski (2019) in the identification of Swedish neighbourhood types. In the identification of typologies, the field notes and photographs were used alongside the spatial abstractions to validate and add an extra level of detail to the typologies. The urban form was analysed at three levels suitable for the study area, based on a combination of Moudon's four scales and Lynch's elements. The first level is the city/regional scale, taking into account the entirety of the BRT system and the surrounding urban form within a 1000 m radius. The second level is the neighbourhood level, which is based on areas of recognisably cohesive urban form, roughly corresponding to Lynch's concept of *districts*. The third level is the BRT-TOD level, which incorporates the immediate vicinity of the BRT stations, combining Moudon's scales of the plot/street/block, and Stojanovski's *desirability cores*, which are specifically relevant for station areas. Typologies were identified at each scale, with the entirety of the study area being divided into categories based on these typologies.

Once the typologies had been identified, they were described using representative exemplars in the form of abstractions, photographs and summarised field notes. In most cases, photographs were selected to be representative, but in some cases they were selected to be 'information-rich', illustrating a specific phenomenon that was considered important. Field notes from observations in different areas of the relevant category were combined and summarised, with both recurring phenomena and interesting instances being highlighted. While the abstractions provide information solely about form, photographs and field notes provide data both about form and how the space is used.

## 4.3. ETHICAL CONSIDERATIONS

Researchers must ensure that their research does not negatively impact the communities they are studying. In this study, interviewees were completely anonymised to ensure that there were no repercussions from their involvement in the research. Observations were performed in an unobtrusive way, respecting residents' dignity and privacy. This meant avoiding taking photographs where people could be identified, as well as avoiding photographing any private spaces or other situations where the act of photographing could be considered offensive.

# 5. CASE: DAR ES SALAAM

Dar es Salaam serves as the object of the current case study, with a specific focus on accessibility in the city. This chapter briefly introduces the city and its history, before focusing on its geography and transport system. The new DART BRT system is introduced thoroughly at the end of the chapter as the focal point of the case study.

## 5.1. HISTORY

Dar es Salaam is Tanzania's largest city, located on the east coast of the country's mainland portion on the Indian Ocean. The city was founded by the Sultan of Zanzibar in 1866, near the site of a small fishing and agricultural village named Mzizima (Brennan & Burton, 2007). The city's rise to prominence began in 1887, when the German East Africa Company established a trading station there, later turning the city into the administrative and commercial centre of Germany's East Africa colony. This included the construction of infrastructure such as a railway terminus and port. The colony was ceded to Britain during World War I, and Dar es Salaam became a centre of anti-colonial resistance as its population grew rapidly after World War II. The city was named the capital of the independent Tanganyika in 1961, and retained this status when the newly independent nation merged with Zanzibar in 1964 to form the United Republic of Tanzania. While the status of official capital has now shifted to Dodoma – a city closer to the country's geographical centre - Dar es Salaam remains the country's most important commercial, transportation, administrative and population centre. (Moshi, Msuya & Todd, 2018)

## 5.2. GEOGRAPHY

The city has grown outwards along five main arteries extending from the colonial core, resulting in a mono-centric urban form (Moshi, Msuya & Todd, 2018). The population has grown exponentially, from an estimated 20,000 residents in 1900 (Lupala, 2002) to the 4,364,541 residents recorded in the 2012 census (Broadway Malyan, 2017). Informal ethnic segregation, which began under the German occupation, was formalised during the British occupation in the form of building ordinances. While not claiming an explicit ethnic basis, this resulted in different areas of the city being designated for 'European', 'African' and 'Asian' settlement (Brennan & Burton, 2007). While ethnic segregation is no longer enforced by the authorities, the structures of spatial inequality persist; high-income residents reside in previously 'European' areas, while low-income earners mostly occupy the areas previously designated for 'Africans'. Formal measures to combat these inequalities are few, and urban planning measures are generally lacking (Moshi, Msuya & Todd, 2018). The city's last master plan is from 1979, and while a new master plan is being prepared, a completion date is yet to be set. The city is formally divided into 5 administrative districts, consisting of a total of 90 wards (Broadway Malyan, 2017). An estimated 80% of existing buildings in the city are informal (O'Loghlen, 2015).

## 5.3. TRANSPORT SYSTEM

Much like the majority of the city's economy, transportation has long been provided by informal operators. After independence, attempts were made to provide official public transport service. However, these were unsuccessful, due in large part to the structural adjustment programmes of the 1980s which aimed at reforming the economies of developing nations (Rizzo, 2017). As such, transport provision was gradually handed over to private operators, resulting

in a flourishing network of minibuses known colloquially as 'daladala'. A combination of government regulation and self-regulation has made these daladalas operate set routes with set prices, but with no set schedules. Daladalas generally operate between a number of terminals spread out across the city, where several routes converge. These terminals have varying levels of formality, ranging from those located in open parks, to those with platforms and shelters. In 2014, there were an estimated 6,000 daladalas in operation in Dar es Salaam (ibid). The relatively comprehensive daladala network is complemented by individual transportation options, consisting of motorbikes ('pikipiki'), three-wheeled auto-rickshaws ('bajaji') and taxis. Some taxis and bajajis operate shared services from major transport hubs. Many residents are captive users of the daladala network, with its affordable and regulated prices. A *Dar es Salaam Transportation Master Plan* was completed in 2019 by the Japan International Cooperation Agency (Interview 3).

## 5.4. DAR RAPID TRANSIT (DART)

In 2002, the World Bank loaned the Tanzanian government US \$150 million toward the construction of a BRT system, which was later formally launched as *Dar es Salaam Rapid Transit* (DART). The idea of launching BRT in Dar es Salaam was first introduced by ITDP, a suggestion which was later followed by a study visit by Tanzanian decision-makers to Bogotá. Due to a variety of setbacks, including lobbying from daladala drivers' associations and disagreements between key government actors, the project was delayed by a number of years, and the first phase of the system was officially launched in 2016. While the World Bank insisted on an international bidding process for the operation, where preference would be given to companies with previous experience, an interim operation contract was granted to the Tanzanian company Usafiri Rapid Transit (UDA-RT) in 2015. While originally slated to be the first operational BRT in Africa, several cities in South Africa did launch BRT-like systems before Dar es Salaam. Rizzo's (2017) case study of the planning and decision-making process preceding the launch of DART phase 1 provides an interesting account of the power relations and political ideologies underpinning BRT implementations. (Rizzo, 2017)

The project is planned to eventually comprise 7 stages, with 137 km of exclusive lanes, 18 terminals and 228 stations (Broadway Malyan, 2017). At the time of the observations, only the first phase was in operation, with 27 stations and 5 terminals along a trunk line with two branches (see Figure 5). In the early days of operation, only smart cards were used, meaning that the operator was able to collect data on ridership. The data only shows boardings at each station at different times throughout the day, with no information about where passengers disembark. Ridership numbers for a typical weekday are also displayed in Figure 5. The entirety of phase 1 runs on segregated bus lanes, as illustrated in Figure 1. The buses are high-capacity, articulated buses, as shown in Figure 2. BRT stations are located in the median of roads, with elevated, enclosed platforms as illustrated in Figures 3 and 4. Dar es Salaam was awarded the ITDP's Sustainable Transport Award in 2018 (ITDP, 2019) for its DART system, making it a much-discussed example and an interesting case with potentially significant implications for other cities hoping to follow in its footsteps.

However, as discussed in the literature review, public transportation in itself is not a comprehensive solution for urban accessibility. In 2017, the *Prime Minister's Office – Regional Administration and Local Government* (PO-RALG) commissioned a project for the development of a Corridor Development Strategy (CDS) as part of their *Dar es Salaam Metropolitan Development Project* (DMDP). Once again funded mostly by the World Bank, the work was carried out primarily by international consultants, led by London-based Broadway Malyan. The need for a CDS was advocated by the World Bank after the implementation of the DART phase 1. Prior to this, the BRT system was viewed by planners as solely a mobility intervention, and there were no plans for the station areas or the development of new centres. The project aimed to create a strategy for implementation of BRT-TOD in the city, and to inform work on the new master plan. The main TOD principle under consideration are the strategic densification of BRT station areas and the increase of property values, with property owners considered as the main stakeholders. Planners in Dar es Salaam are

particularly concerned about urban sprawl, as well as the incohesive, non-strategically located high-rise developments emerging across the city. They hope that the CDS can address these concerns under a unified, strategic vision for future development. (Interview 3)

The CDS generally avoids prescribing measures on urban form and station design, and this is a significant knowledge gap which the current study aims to contribute to filling. With Dar es Salaam's population expected to continue its rapid growth, the city is on track to attain megacity status (over 10 million residents) by 2030 (Moshi, Msuya & Todd, 2018), meaning that the search for sustainable accessibility solutions is more vital than ever.



**Figure 1: A DART bus traveling on a segregated bus lane.**



**Figure 2: The inside of a high-quality, high-capacity DART bus.**



**Figure 3: A DART bus docked at a BRT station in the road median.**



**Figure 4: Inside of a DART bus station, with elevated platform and almost full enclosure.**



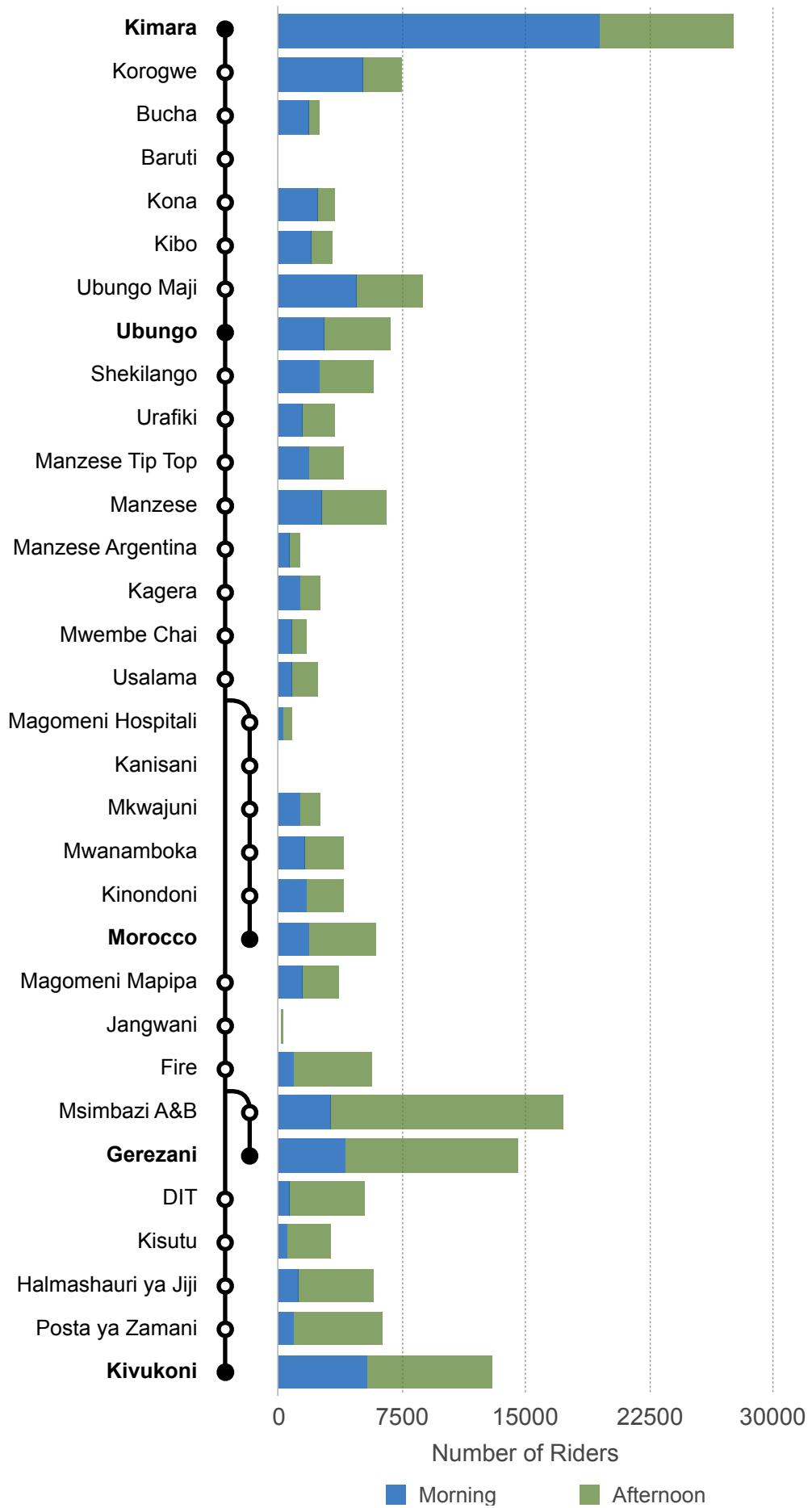


Figure 5: A schematic illustration of the DART phase 1 BRT system, showing the trunk line and two branches. Terminals are indicated in bold. Number of boarding passengers in the morning and afternoon are displayed, providing an insight into the general flow of passengers along the line.

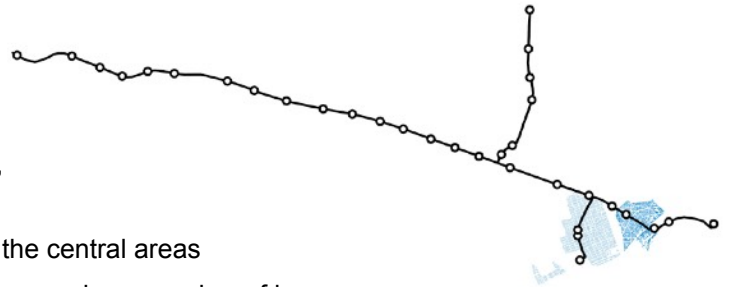
# 6. RESULTS

The results are organised into three sections, representing the different scales of the analysis. Chapter 6.1. is an inventory of the study area, identifying neighbourhood types and separating the entirety of the study area into these types. Chapter 6.2. zooms out to the regional scale, identifying how these neighbourhood types combine to form different regions within the study area (which acts as a cross-section of the city's outwards expansion). Chapter 6.3. finally zooms back in to the station scale, taking a closer look at the types of stations that exist and the urban form at and in the immediate vicinity of these stations.

## 6.1. NEIGHBOURHOOD TYPES

Based on the morphological methodologies described in earlier chapters, the urban fabric in the entirety of the study area was divided into neighbourhood types. This chapter introduces these neighbourhood types, including both their urban form and their functions, without consideration of the BRT infrastructure. Descriptions of the neighbourhoods are made from the 'above' and 'within' perspectives, based on a combination of spatial data and observations. As with any exercise in classification, the neighbourhood types are inevitably approximations, with some generalisations and trade-offs being made in order to confine area to a single category. There are variations within each neighbourhood type (more in some types than in others), and boundaries between different neighbourhood types are often not clearly defined. Some neighbourhood types are defined by the uniformity of their urban form, whereas others are defined majorly by their function, displaying more variation in form. The neighbourhood types have vastly different physical footprints within the study area, and most occur more than once. In total, eight neighbourhood types were identified. Two of these also had notable variations that allowed a further division into subtypes.

# Type 1: Business District



Neighbourhood Type 1 is home to a diverse mix of functions, including offices, retail space, restaurants, hotels, residential units, parking structures and public parks. This neighbourhood type is formally planned, and occurs only in the central areas of the city. Most buildings are medium- or high-rise, but there are also a number of low-rise structures dispersed between these. Ground floors of buildings are, in general, commercially active and are used for a variety of functions, including retail space and food service. Buildings generally extend to the edge of the plot, with little, if any, setback from the street. Pedestrian paths are often grade-separated and incorporated into the building facade, shaded by building overhangs or awnings (see Figure 6). A very small number of plots have perimeter walls or fences that reduce visual permeability and street activity. Apart from a few major thoroughfares, streets are generally narrow and have a sense of enclosure due to the tall buildings on both sides.

While active street frontages contribute to a lively pedestrian environment, there are also a number of vernacular uses that affect street life. Informal vendors occupy some sidewalks and open spaces, generally clustering around public transport stations and along major thoroughfares. Private transport providers (taxis, bajajis and motorcycles) also cluster at street intersections and in proximity to public transport stations. The area is interspersed with public parks, which are used as spaces for socialising and resting. Considerable space is also dedicated to private vehicle parking; many of the city's higher-income car owners work in these areas but live elsewhere, leading to a high concentration of parked vehicles during business hours. While there are a number of parking garages and parking lots on private land, parked vehicles are also prevalent on street edges, sidewalks and in undesignated open spaces.

These parked vehicles often act as barriers for pedestrians moving through the city (as illustrated in Figure 8). Neighbourhood Type 1 can be further divided into two subtypes that occur in distinct areas of the city, with variations in street patterns and vernacular activities setting them apart.



**Figure 6: Sidewalks in Neighbourhood Type 1 are generally of a high quality, often embedded into the building frontage and shaded by an overhang. Most building frontages are commercially active.**



**Figure 7: Informal vendors have a significant presence in some areas of Neighbourhood Type 1.**



**Figure 8: Tall buildings and narrow streets give Neighbourhood Type 1 a sense of enclosure. Parked vehicles sometimes inhibit pedestrian movements.**

## Type 1a: Irregular Street Pattern

Neighbourhood Subtype 1a lacks a cohesive street pattern, with buildings organised into a combination of triangular, trapezoidal and rectangular blocks (see Figure 9). The blocks have relatively short edges but are mostly impermeable, with no laneways for pedestrians. Despite this, the urban realm is relatively conducive to navigation by pedestrians, due to its recognisable landmarks such as tall buildings, unique street corners, parks, religious sites, etc. Informal vendors located along sidewalks generally contribute to activating the streetscape, but they can also act as barriers for pedestrians trying to pass by, especially during peak hours when there are large pedestrian flows. The number of informal vendors is significantly less than in Subtype 1b.



**Figure 9: Irregular street pattern of Neighbourhood Type 1a.**

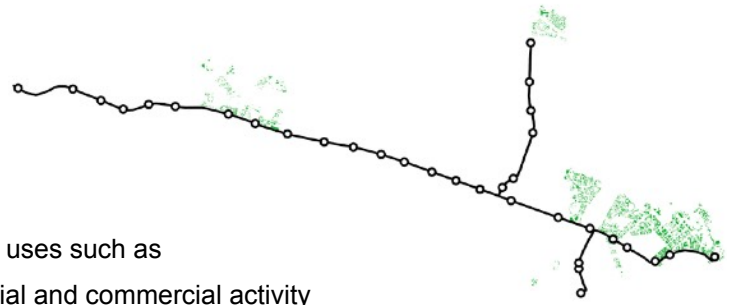
## Type 1b: Regular Street Pattern

Buildings and streets in Neighbourhood Subtype 1b are organised into a strict grid pattern (see Figure 10). Blocks generally have short edges, increasing permeability and easing navigation through the neighbourhood. In addition to its rectangular blocks, it is also the high level of informal commercial activity that sets this subtype apart. Many streets are home to sprawling informal markets, in addition to the existence of large designated marketplaces. To a greater degree than in other neighbourhood types, these vernacular uses impede pedestrian flows. The sheer volume of informal vendors occupying sidewalks, in many places, forces pedestrians onto the street surface designated for vehicle movements (see Figure 7). Some areas of subtype 1b have less informal vending, and here the street space is instead used for private vehicle parking, which also acts as a barrier for pedestrian movements.



**Figure 10: Regular street pattern of Neighbourhood Type 1b.**

## Type 2: Institutional



Neighbourhood Type 2 is predominantly home to institutions such as government departments, foreign embassies, aid organisations, NGOs, education providers, religious sites and hospitals, as well as more land-intensive uses such as golf courses and sports fields. There is also limited residential and commercial activity dispersed across these areas. As such, this neighbourhood type is defined mostly by its social function, rather than its cohesive urban form. In fact, the urban form is extremely varied, with buildings of irregular heights and styles, ranging from low-rise colonial houses to brutalist office blocks to modern high-rise structures. The most unifying characteristic of the urban form in this neighbourhood type is its diversity, making it a collective category for areas that do not fit into other categories but perform the functions previously described. There are, however, some common features that characterise this neighbourhood type.

A significant number of plots have perimeter walls or fences, reducing visual permeability and street-level commercial activity. The rights-of-way are generally wide, with large setbacks of buildings and barriers from the street edge. This allows for pedestrian movements, informal vending and vehicle parking along the edges of the streets. The neighbourhoods have a significant amount of greenery, located along the streets (see Figure 13), on private property and landscaped into public parks. Building density is relatively low, with many buildings only occupying a fraction of the plot. In some areas, streets are organised into a grid pattern (as in Figure 11) or a 'loops and lollipops' pattern, while in other areas this neighbourhood type completely lacks a street pattern. Neighbourhood Type 2 occurs in two distinct areas of the city, which can be considered fringe belts, as many of these institutional functions are those that are typically constructed in fringe belts (see Whitehand, 1967).

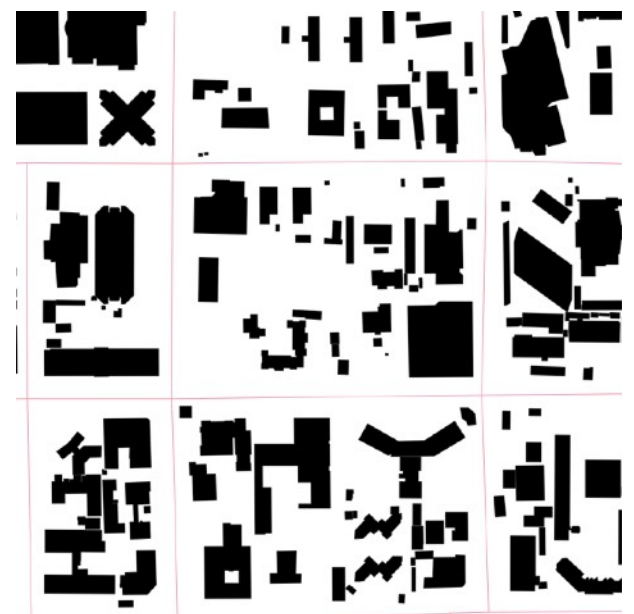


Figure 11: A section of Neighbourhood Type 2 that is organised into a regular street pattern. Note the low building coverage on each block.



Figure 12: Typical buildings in Neighbourhood Type 2.



Figure 13: Typical street in Neighbourhood Type 2, with street edges used for walking and parking.

## Type 3: Industrial

Neighbourhood Type 3 is dominated by industry, and is thus defined mostly by its function. This function does, however, also manifest itself in unique built environments. Most industrial complexes are large and cover an area that would normally consist of several blocks (see Figure 14), making these neighbourhoods generally impermeable for pedestrians, beyond the main thoroughfares. The plots are mostly surrounded by walls or fences, minimising activity on the streets. The physical form and the functions of these areas mean that there are very small pedestrian flows, beyond a small number of employees walking to their places of work. There are generally no sidewalks, and streets are often unsealed, meaning that pedestrians must share a low-quality street surface with vehicles. There are a few informal vendors and private transportation providers, but apart from these, there is almost no activity on the streets. Neighbourhood Type 3 has very few characteristics of urban space, but due to the development pattern of Dar es Salaam, has a significant footprint in what are now relatively central areas of the city. Similar to Neighbourhood Type 2, this type occurs in the two areas in Zones A and D which can be considered fringe belts.

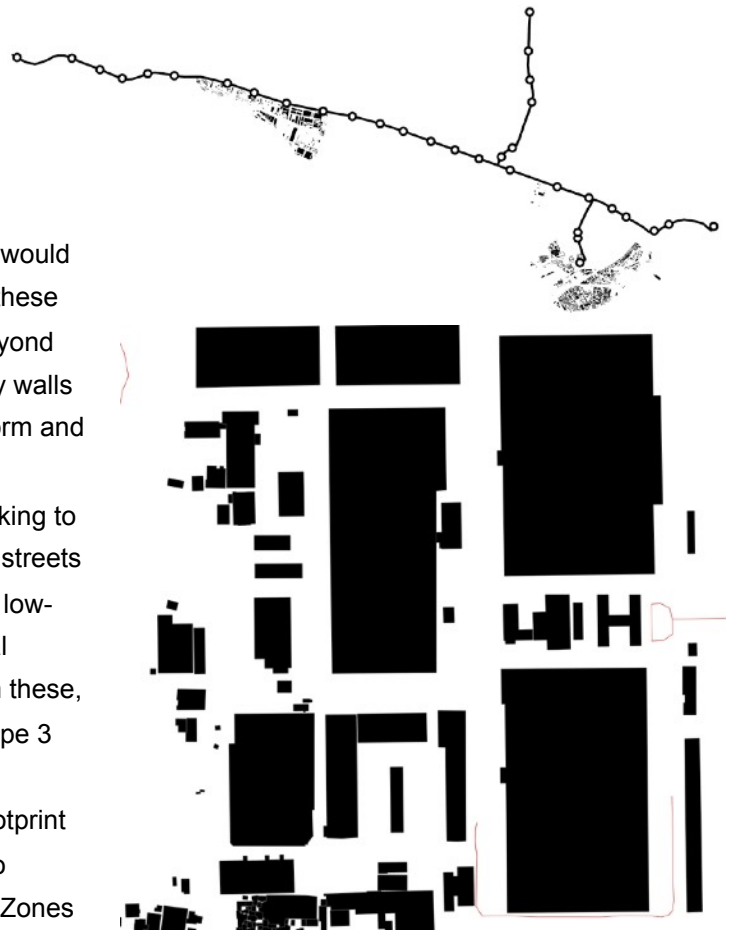


Figure 14: Neighbourhood Type 3 consists of large buildings on large plots.

# Type 4: Public Housing

Neighbourhood Type 4 is exclusively residential, consisting of government-supported affordable housing projects. While this neighbourhood type is based on a social ideal, it manifests itself in a relatively consistent physical form. These areas consist of low- and medium-rise homes (generally 2-4 storeys), with some degree of separation of private and public space, often in the form of a wall or fence around individual buildings or entire complexes (see Figure 16 and Figure 17). The buildings are organised into varying constellations (see Figure 15 for an example). This neighbourhood type is unique in that it is the only type of 'comprehensive' development within the study area, where a number of buildings and plots are built in a cohesive design. The separation of private and public space, as well as the inactive ground floors, means that there is very little formal or informal commercial activity within these areas. This neighbourhood type has an extremely small physical footprint within the study area, occurring in two small patches in proximity to the identified fringe belts.

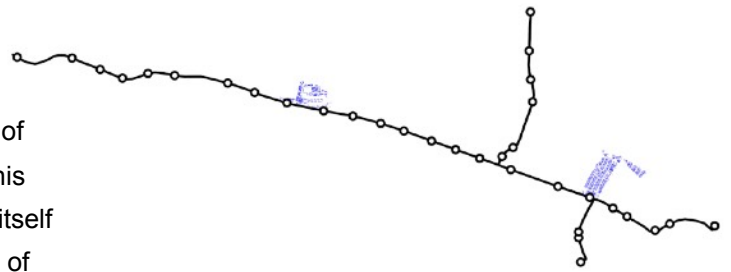


Figure 15: Neighbourhood Type 4 consists of multi-family residences organised into patterns.



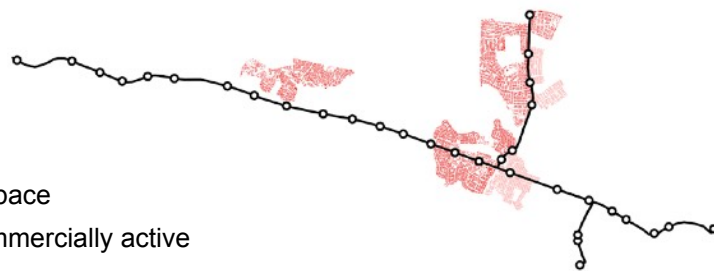
Figure 16: Neighbourhood Type 4 with walls around individual buildings.



Figure 17: Neighbourhood Type 4 with fence around entire complex

# Type 5: Formal High-Density Residential

Neighbourhood Type 5 is predominantly residential, dominated by single-family homes. In the vicinity of major thoroughfares, however, street frontages are almost exclusively commercial – often connected to a residential space in the same building or on the same plot. Beyond these commercially active blocks, there is a mixture of homes with open facades (see Figure 24) and homes surrounded by walls or fences. Buildings are overwhelmingly low-rise (generally single-storey), but a scattering of medium- and high-rise structures are emerging across the landscape. Newer developments are often surrounded by perimeter walls or fences, and include private parking lots (see Figure 21).



Traffic volumes are generally low on local streets, meaning that pedestrians have minimal issues sharing the street with cars (see Figure 18). Many streets are unsealed, and there are very few vehicles parked on the streets. Informal vendors and individual transport providers concentrate themselves in the more commercially active areas close to major thoroughfares (see Figure 22), meaning that many streets are quite quiet. Neighbourhood Type 5 occurs in two subtypes, distinguished by their street patterns and street hierarchies. Both of these subtypes are concentrated in an area just beyond the city centre in Zone B, with a small section also present near the second fringe belt in Zone D.



Figure 18: Typical multimodal street in Neighbourhood Type 5, with open residential facades.

## Type 5a: Rectangular Street Pattern

Neighbourhood Subtype 5a is organised into a rectangular grid with relatively short blocks (see Figure 19). This permeable urban fabric is conducive to pedestrian movements, as it allows long-range viewing and provides several route options. Streets are generally wide and multimodal, with minimal vehicle traffic moving at low speeds. There is no clear street hierarchy, with all streets having a similar form and function. Major thoroughfares are located at the edges of these areas. This subtype occurs alongside subtype 5b, often without clear delineation between the two.



Figure 19: Rectangular Street Pattern of Neighbourhood Type 5a



## Type 5b: 'Loops & Lollipops' Street Pattern

Neighbourhood Subtype 5b is organised into various iterations of the 'loops and lollipops' street pattern, based on a more 'suburban' ideal (see Figure 20). This creates a hierarchy of streets with different volumes and speeds of traffic flow, where the trunk streets have clear separation of vehicles and pedestrians (see Figure 23) to allow for higher speeds, while the branch streets are multimodal. The limited connections between streets limit the potential route options. The curved nature of the streets also reduces the distance that pedestrians can see ahead, and therefore affects how they move and perceive their location within the city. The vernacular uses in these neighbourhoods take on a similar form to those in subtype 5a, with commercial frontages and informal activity concentrated along the major thoroughfares and at intersections.



Figure 20: 'Loops & Lollipops' Street Pattern of Neighbourhood Type 5b



Figure 21: Example of exclusive new development in Neighbourhood Type 5, with perimeter wall and private parking.



Figure 22: Informal vendors and individual transportation providers cluster at major street corners in Neighbourhood Type 5.



Figure 23: A larger thoroughfare in Neighbourhood Type 5b, with commercial activity on major street corners.



Figure 24: A typical residential facade in Neighbourhood Type 5.

# Type 6: Informal High-Density Residential

Neighbourhood Type 6 consists predominantly of informal single-family residences, but it is also home to large volumes of commercial activity. Buildings are predominantly low-rise (generally single-storey) (see Figure 27), with a scattering of medium-rise structures emerging across the landscape. The building and population densities are high, with almost all open space being occupied. Streets take on an organic form, with curved shapes and no discernible pattern (see Figure 25). A street hierarchy exists, with trunk routes having large flows of vehicles and pedestrians, while the branches are relatively quiet and mostly unpaved. Most streets lack physical separation between modes, and many are lined with drainage canals, posing safety risks to pedestrians. Some areas also have significant movements of heavy vehicles, further endangering pedestrians. Blocks are irregularly shaped and often quite large, with many interior buildings only accessible by unpaved footpaths. This lack of permeability, combined with the lack of a street pattern and recognisable landmarks, makes the area difficult to navigate on foot. Due to their informal nature, most buildings in these neighbourhoods lack access to services such as water, sewerage, drainage, electricity and solid waste collection.

Neighbourhood Type 6 is home to significant levels of informal vending. As in Neighbourhood Type 5, these activities are concentrated along major thoroughfares, often at the edge of the large blocks, with residential spaces behind. There are some dedicated marketplaces, but much of the informal vending takes place on sidewalks (see Figure 26). While this contributes to creating an active public realm, it can also impede pedestrian movements, often forcing pedestrians into busy vehicle lanes. Neighbourhood Type 6 occupies a large swathe of land across the middle of the study area, but is also present in other areas, often filling the gaps between formally planned neighbourhoods.



Figure 25: Organic Street Pattern of Neighbourhood Type 6



Figure 26: Informal vending in Neighbourhood Type 6



Figure 27: High density housing in Neighbourhood Type 6

# Type 7: Formal Low-Density Residential

Neighbourhood Type 7 is predominantly detached, single-family residential, with a scattering of other functions such as restaurants and offices. Most structures are low-rise, with extremely few medium-rise structures. Almost all plots are surrounded by

perimeter walls or fences (see Figure 28), often with security guards stationed at the entrances. This creates a clear demarcation between public and private space, and explicitly discourages pedestrians from using the street for anything other than passing through. These neighbourhoods are home to affluent residents who almost exclusively travel by private vehicle. The majority of people working at the businesses and residences are, however, captive pedestrians and transit users, meaning that there are pedestrian movements even in these neighbourhoods. Streets are generally wide, but of a low quality, unpaved and lacking separation between modes. The streets are organised into irregular blocks (see Figure 29) suitable for private vehicle movements. The limited pedestrian flows and lack of sidewalks and other public spaces mean that there is also very limited informal vending activity. This type of development is dominant in the higher-income residential areas of the city, and has a very limited physical footprint within the study area.

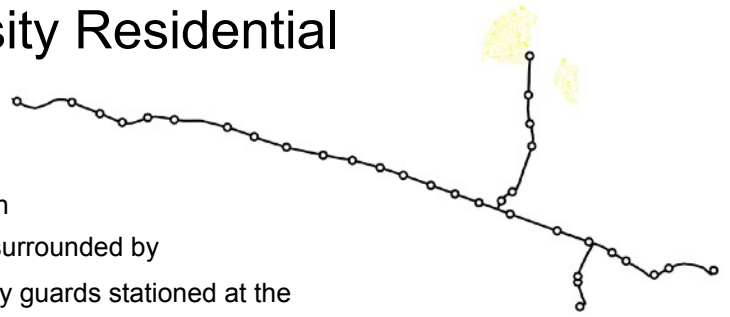


Figure 28: Most plots in Neighbourhood Type 7 are surrounded by perimeter walls.



Figure 29: Neighbourhood Type 7 is characterised by its low building density.

## Type 8: Informal Low-Density Residential

Neighbourhood Type 8 consists of low-density, detached single-family residences (see Figure 30), with an extremely limited presence of commercial activity.

Buildings are almost exclusively low-rise (single- or double-storey). Some homes have perimeter walls or fences, while others are built

on open plots. Many buildings remain under construction for long periods of time, with

work being done gradually as finances allow for it. There is no discernible pattern of streets or blocks

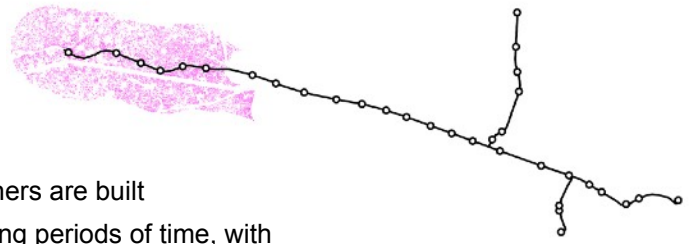
(see Figure 31), with these emerging organically and without planning. Many buildings are only accessible by way of informal unpaved paths, which appear to have emerged to connect each new building to the nearest street. This means

that while pedestrians do not have to contend with many vehicles, distances can be large and the path surface can

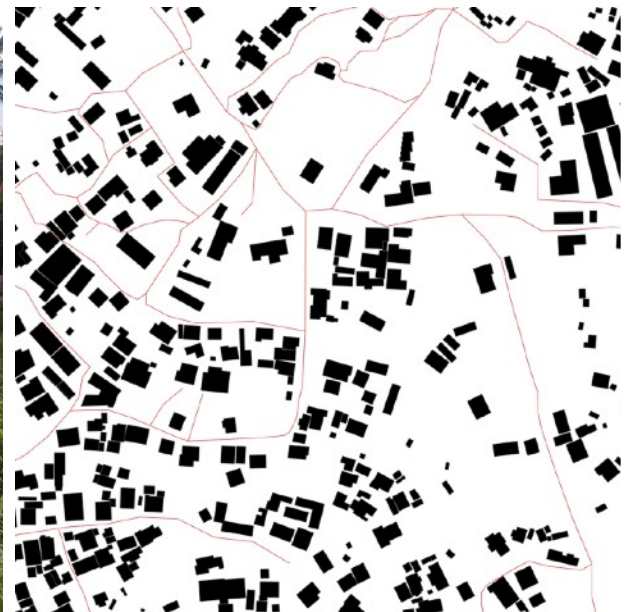
pose some risks, especially in adverse weather. Informal and formal commercial activity is generally clustered along major thoroughfares and specifically around transit stops. The informal nature of these areas means that there is only

limited infrastructure provision. With few urban features, these neighbourhoods are better described as suburban or

peri-urban. They solely occupy the outskirts of the city, at the western edge of the study area.



**Figure 30: Neighbourhood Type 8 has an extremely low building density.**



**Figure 31: Neighbourhood Type 8 has an organic street pattern.**

# 6.2. REGIONAL DEVELOPMENT

This chapter presents the study area as a whole, drawing links between the existing urban form and the city's historical development. The study area is defined as the area falling within a 1000 metre radius of the phase 1 BRT line, as this is generally accepted as the outer limit of what can be considered 'transit-oriented' and therefore relevant for a review of TOD. Because the BRT line traverses Dar es Salaam from the centre to the periphery, the study area represents a cross-section of the city along one of its major arteries. The identification of development zones is based on the neighbourhood types identified in Chapter 6.1. and the theories of urban morphology presented in Chapter 3. Based on this framework, the study area can be divided into five morphological zones, reflecting the city's outwards expansion. Some zones are relatively homogeneous, consisting of only a single neighbourhood type, while other zones contain several different types of urban form. The division of these zones is illustrated in Figure 32. Each zone is then introduced individually - including its historical development, its role in the city as a whole, as well as its internal composition.

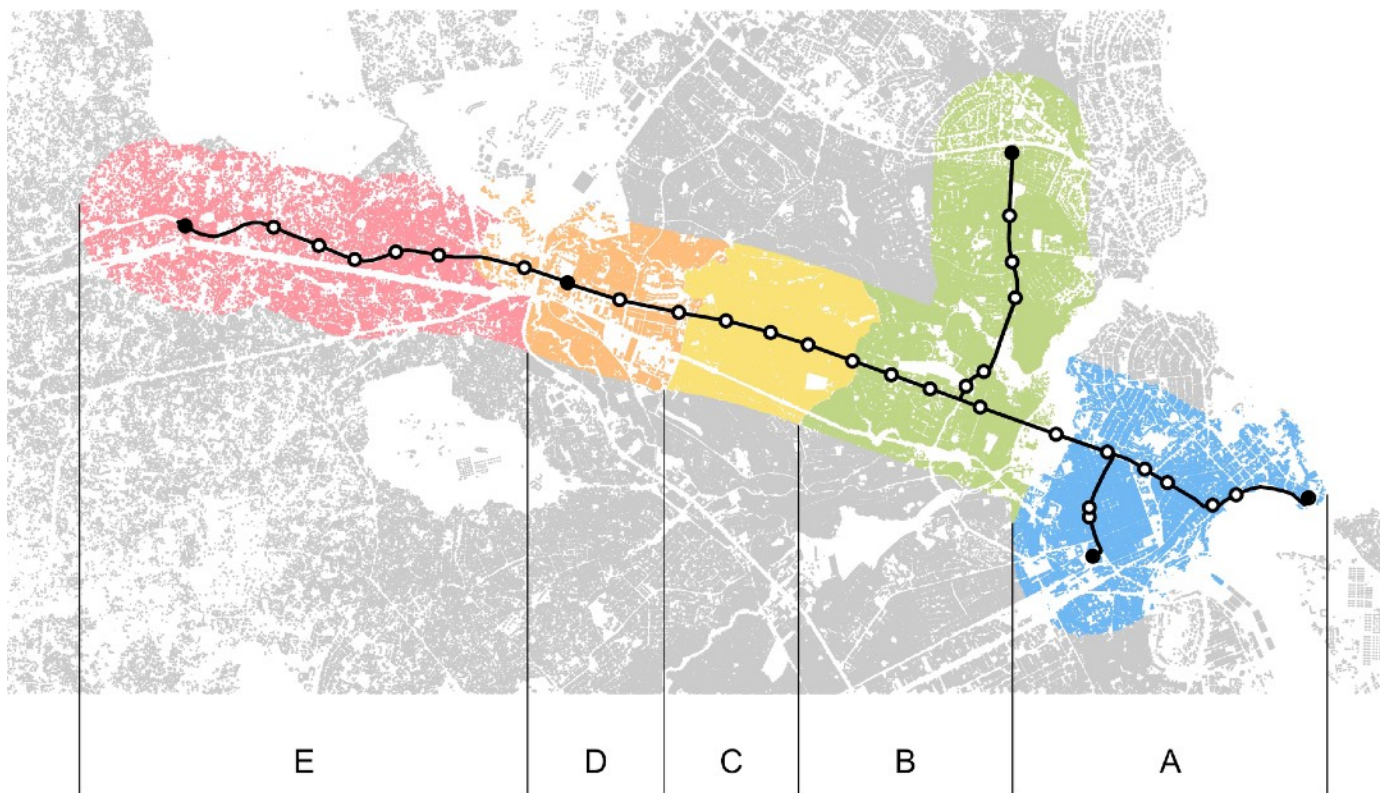


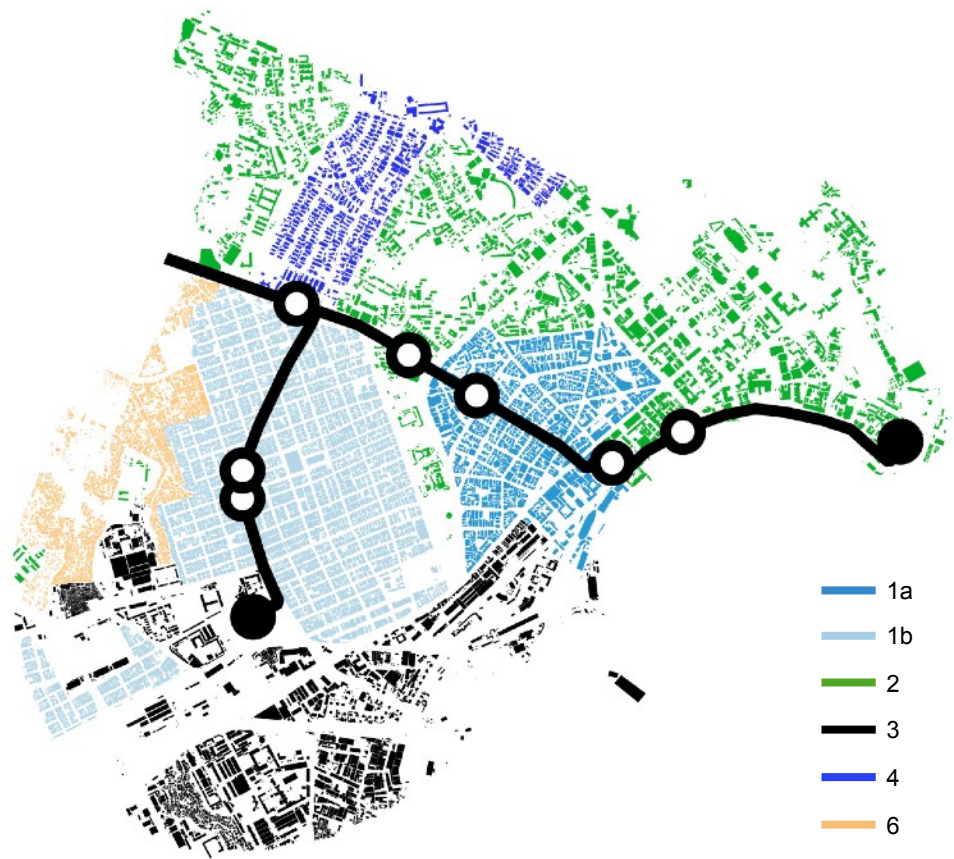
Figure 32: Division of the study area into five morphological zones, with BRT route and stations shown in black.

# Zone A

Zone A comprises the city centre, which was established near the site of the earlier fishing and agricultural village, and later became the focal point of the German and British occupations. The area is centred around Kisutu Ward, on the waterfront, which today comprises the central business district belonging to Neighbourhood Type 1a. This is surrounded by an area that takes the form of a first fringe belt, currently containing hospitals, universities, parks, a golf course and other land-intensive functions such as embassies and government offices. The majority of these activities take place in Kivukoni Ward, but the area also includes Upanga Ward, which was originally designated as a housing area for Asian residents, but which is now home to a blend of institutions and residences. The Mnazi Mmoja park, which extends southwards between Kisutu and Gerezani Wards also forms part of this belt, and the park was intentionally planned by the colonial occupiers as a buffer zone between the different ethnically segregated zones of the city (Brennan & Burton, 2007). This contiguous belt, where the built environment takes on a variety of different forms, is categorised as Neighbourhood Type 2 based on its social function rather than a cohesive physical pattern.

From the centre, the city extends westwards, being constrained by the harbour and the Indian Ocean in the east. Beyond the initial fringe belt, a second business district exists in the Kariakoo and Gerezani Wards. This area is categorised as Neighbourhood Type 1b; the form is similar to the central business district, but has a number of key differences. This area was originally designated as housing for African residents in the ethnically segregated colonial city, but has more recently also become home to many Indian businesses and residents (Smiley, 2009). There is a small section of public housing embedded into the outer edge of the institutional fringe belt, which is categorised as Neighbourhood Type 4. An industrial sector extends in a

south-westerly direction from the city centre along the colonial-era railway, appearing to conform to Hoyt's (1939) model of pre-automobile urban development by taking the form of a sector rather than a concentric circle. On the western edge of Kariakoo Ward, there is a small area of informal housing belonging to Neighbourhood Type 6. This fills the gap between the formal development of Neighbourhood Type 1b and the Msimbazi River floodplain, which marks the western boundary of Zone A. Six different neighbourhood types can therefore be discerned in Zone A. This zone acts as a net destination, with significantly higher numbers of boardings in the afternoons than the mornings. The geographical extent and internal composition of Zone A is illustrated in Figure 33.



**Figure 33: Composition of Zone A, showing different neighbourhood types, as well as BRT lines, stations and terminals.**

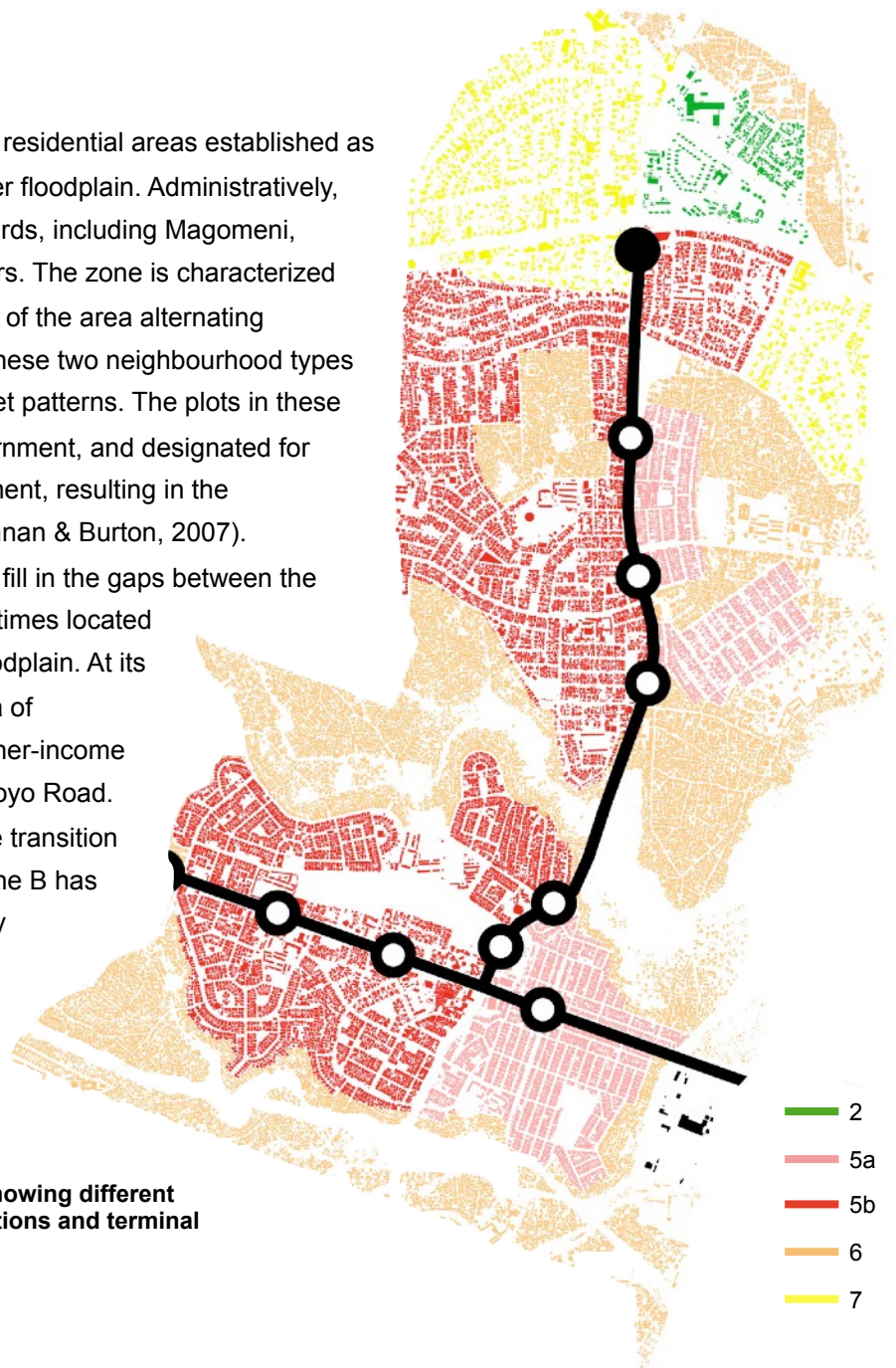
## Zone B

Zone B consists of the predominantly formal residential areas established as the city expanded beyond the Msimbazi River floodplain. Administratively, the area consists of a number of different wards, including Magomeni, Mwananyamala and Kinondoni, among others. The zone is characterized by its fragmented structure, with the majority of the area alternating between Neighbourhood Types 5a and 5b; these two neighbourhood types take on a similar form, but with different street patterns. The plots in these areas were established by the colonial government, and designated for wealthier African residents for 'self-development, resulting in the construction of mostly 'Swahili houses' (Brennan & Burton, 2007).

Neighbourhoods of Type 6 have emerged to fill in the gaps between the formally planned areas, and these are sometimes located precariously close to the Msimbazi River floodplain. At its northern end, the zone contains a small area of Neighbourhood Type 7, belonging to the higher-income beachside communities across from Bagamoyo Road.

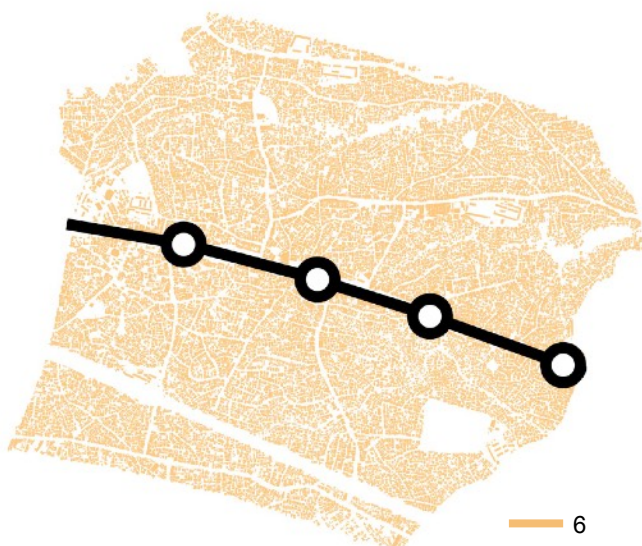
The western limit of Zone B is marked by the transition to a completely informal residential area. Zone B has relatively low ridership numbers, quite evenly spaced across the morning and afternoon. The geographical extent of Zone B and its internal composition is illustrated in Figure 34.

34.



**Figure 34: Composition of Zone B, showing different neighbourhood types, BRT lines, stations and terminal**

## Zone C

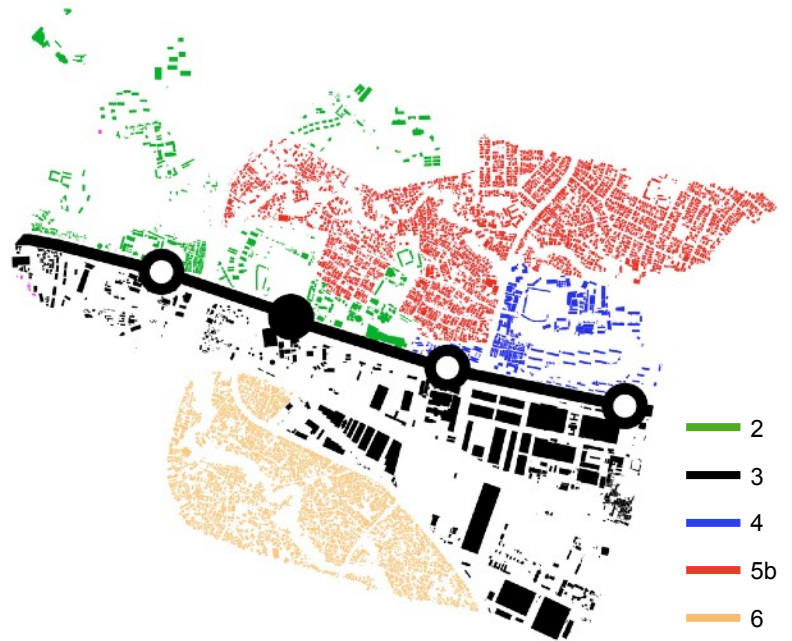


**Figure 35: Composition of Zone C, showing the single neighbourhood type, BRT line and stations.**

Zone C consists of informal housing, emerging at the edge of the formally planned city, predominantly in the Ndugumbi, Tandale, Manzese and Makurumla wards. These areas started off as peri-urban villages, but densification was spurred by the construction of Morogoro Road in the 1950s, and by the establishment of an industrial area at Ubungo to the west in 1968, providing a number of work opportunities (Brennan & Burton, 2007). The urban fabric in this zone is relatively uniform, belonging solely to Neighbourhood Type 6. The zone is constrained in the west by an area that takes the form of a second fringe belt. Zone C experiences relatively low ridership numbers, quite evenly dispersed across the morning and afternoon. The geographical extent of zone C is illustrated in Figure 35.

## Zone D

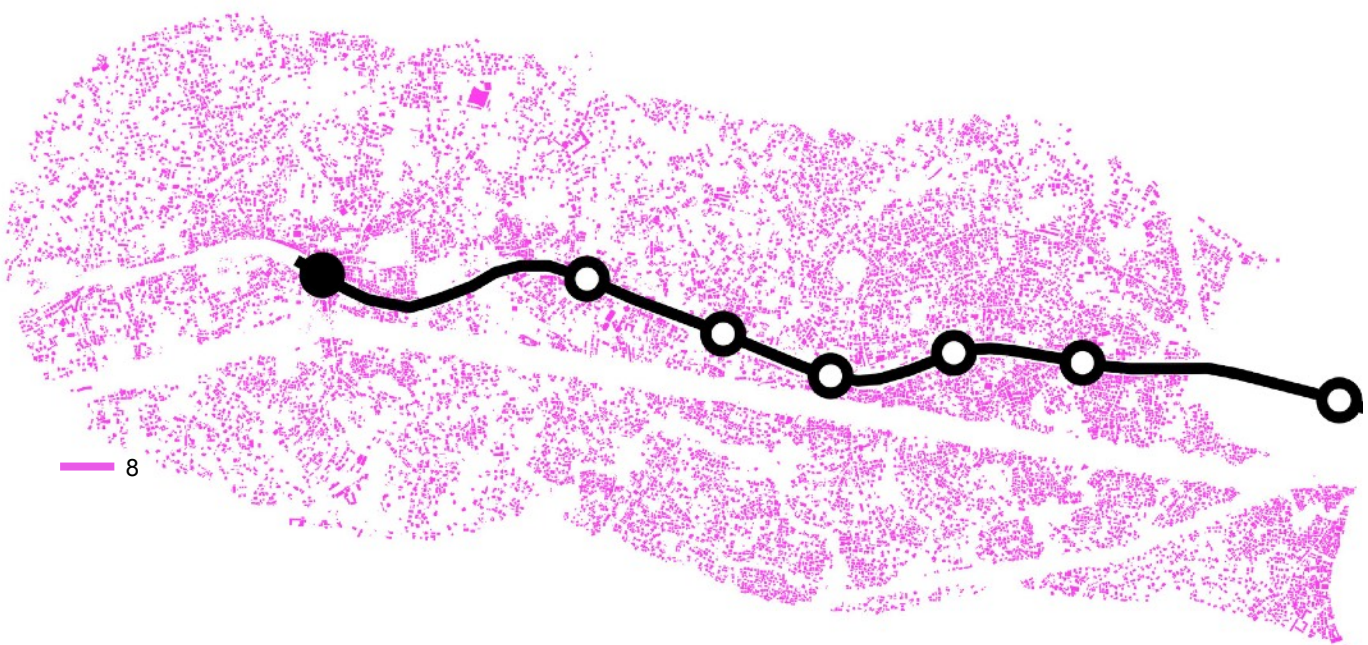
Zone D can be considered part of a fringe belt, constructed at the edge of the greatly expanded urban area. Most of the zone belongs to the Ubungo and Sinza wards. It consists of four neighbourhood types, divided into two sections by Morogoro Road. The first of these is an industrial area to the south, which is categorised as neighbourhood type 3. Beyond this, there is also an area of high-density informal residential, belonging to neighbourhood type 6. To the north of Morogoro Road, there is a section of public housing of type 4. The zone also contains the edges of the university area (Neighbourhood Type 2), which is located to the north and is also part of the fringe belt. Zone D has low numbers of boardings, both in the mornings and afternoons. The geographical extent of Zone D, along with its internal composition, is illustrated in Figure 36.



**Figure 36: Composition of Zone D, showing the different neighbourhood types, BRT line, stations and terminal.**

## Zone E

Zone E forms part of the suburban area which extends from the second fringe belt to the edge of the city's administrative boundary. The zone gradually reduces in density as the distance from the centre increases. It consists of mostly low-density informal residences, characterising neighbourhood type 8, which is also unique to this zone. While this zone is unplanned, it is generally home to higher-income residents than those residing in Zone C (Brennan & Burton, 2007). Zone E acts as a net origin, concentrated heavily at Kimara Terminal, with significantly more boardings in the mornings than in the afternoons. The geographical extent of Zone E is illustrated in Figure 37.



**Figure 37: Composition of Zone E, showing the different neighbourhood types, BRT line, stations and terminal.**



## 6.3. STATION TYPES

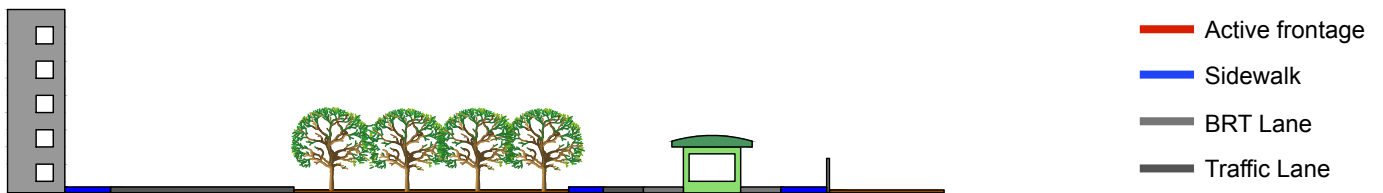
This chapter analyses the interface between the BRT infrastructure and the surrounding built environment. This is done by identifying a number of categories of TOD and dividing the stations and terminals into these categories. Categories of TOD are identified through a combination of characteristics, including the surrounding neighbourhood types, station designs and station functions. Representative exemplars and abstractions are then used to describe each category, from both the above and within perspectives. Unique and generalisable features of each TOD type are then summarised. Stations of each type are generally geographically clustered, and many of the TOD types coincide with the zones identified in Chapter 5. Terminals are treated separately, and are more spread out. In total, eight types of station (denoted with an 'S') and two types of terminal (denoted with a 'T') were identified.

# Type S1



Between *Kivukoni Terminal* and *Halmashauri ya Jiji Station*, the BRT line traces an arc along Dar es Salaam’s waterfront (see Figure 39). The two parallel BRT lanes are located adjacent to two mixed-traffic lanes, and each side of the road has a wide sidewalk (see Figure 38). Access to the waterfront is restricted by a boundary fence. On the other side, the adjacent urban fabric is of Neighbourhood Type 2. There is a generally large separation between the BRT and the urban fabric due to the low building density in this neighbourhood type and the width of the parallel road. There is little commercial activity on the ground floors along this stretch, due to the institutional nature of most activities (see Figure 41). The prevalence of private automobile transportation also reduces the amount of pedestrian traffic. The combination of the large physical separation, the lack of commercial activity and the reduced pedestrian traffic, mean that there is no strong desirability core. However, a few informal vendors positioned near the station exits and along the sidewalks do contribute to creating a weak desirability core around the single station located along this stretch.

BRT-TOD Type S1 is only represented at a single station, but it has the potential to serve as an interesting precedent for future station design due to its unique incorporation of public space. It is the only existing station in the city to incorporate such a space. The station stretches along one edge of a public park, separating the park from the waterfront. This park is used for resting and socialising, and the corners adjacent to the BRT station exits are also used for informal vending and the clustering of private transportation providers. The opposite side of the station also has the potential to become an attractive space, if the waterfront were to be opened up and fully utilised (see Figure 36). While passengers are required to cross traffic lanes, there is a clear visual link between the station and the adjacent public space (see Figure 40). Together, this BRT stretch and its stations are located in one of the city’s most attractive areas. While public spaces already exist around the station, these could potentially be expanded as part of a wider waterfront redevelopment project.



**Figure 38: Cross-section of S1. Note the wide right of way, the presence of a public park, and the lack of active frontages.**



**Figure 39: View of S1 along the roadway, showing the waterfront and the wide and inactive pedestrian sidewalk.**



**Figure 40: View of S1 from the adjacent park.**

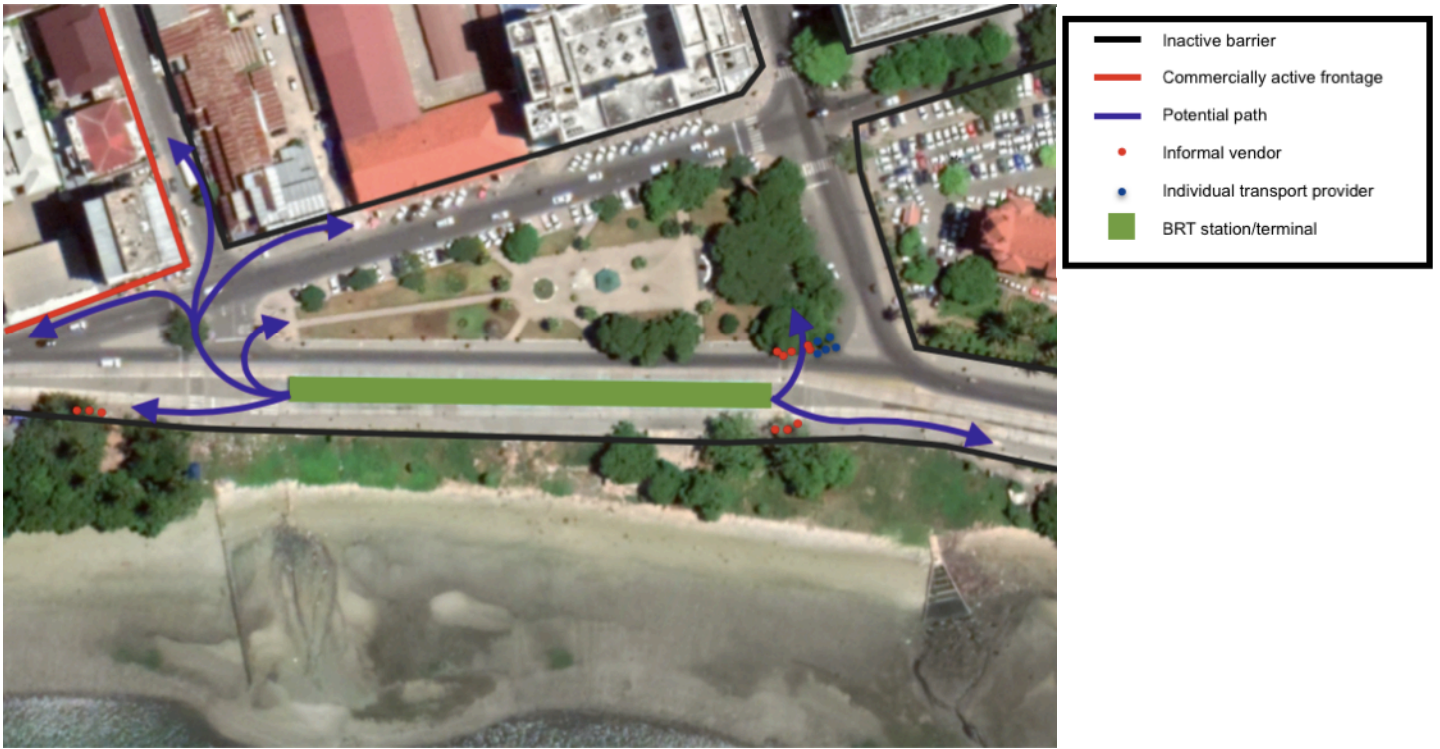


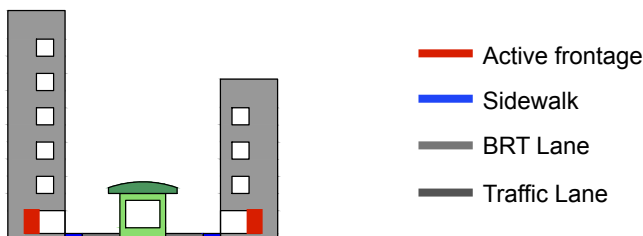
Figure 41: Close-up of station type S1. Note inactive frontages and few route options, as well as the few informal vendors and individual transport providers.

# Type S2



After tracing the waterfront, the BRT line makes a sharp S-turn to enter the central business district in Kisutu ward. The narrow right of way here necessitated the implementation of a BRT-exclusive stretch, which includes two stations: *Halmashauri ya Jiji* and *Kisutu*. Sidewalks are narrow and sometimes grade-separated or marked by bollards, but there is otherwise minimal separation between pedestrian paths and the BRT vehicles due to the lack of space. The BRT lanes are used by crossing pedestrians, cyclists and motorcyclists whenever buses are not approaching. This stretch is characterised by its sense of enclosure, with tall buildings occupying both sides of the narrow streets, as illustrated in Figure 42.

The surrounding urban form is dense, with both sides of the stretch belonging to Neighbourhood Type 1a. As with most buildings in this neighbourhood type, ground floors are almost 100% commercially active, forming a linear desirability core which also extends into perpendicular streets around the stations. Disembarking passengers are immediately greeted by commercial activities and active street corners. They have the option of continuing along the BRT stretch, or infiltrating the relatively permeable urban fabric at several points (see Figure 45). The generally large flows of disembarking passengers ensure that the desirability cores around stations extend into side streets, and also onto parallel streets a block or two back. There is a strong visual connection between the urban fabric and the BRT stations, due to their proximity and the active street frontages, as well as the absence of mixed traffic lanes separating the stations from the sidewalk (see Figure 43). The permeable street pattern also means that stations can be identified from a distance on perpendicular streets. Neighbourhood Type 1a intrinsically contains many of the characteristic features of TOD, and the introduction of BRT along this stretch appears relatively seamless. This stretch is a good example of BRT-TOD and how public transport infrastructure can be incorporated into even the densest urban cores.



**Figure 42: Cross-section of S2. Note the narrow right of way, tall buildings, narrow sidewalks and active frontages.**



**Figure 43: Narrow BRT lane and active commercial frontage at S2.**



**Figure 44: Bus traveling on BRT-exclusive lane near S2.**

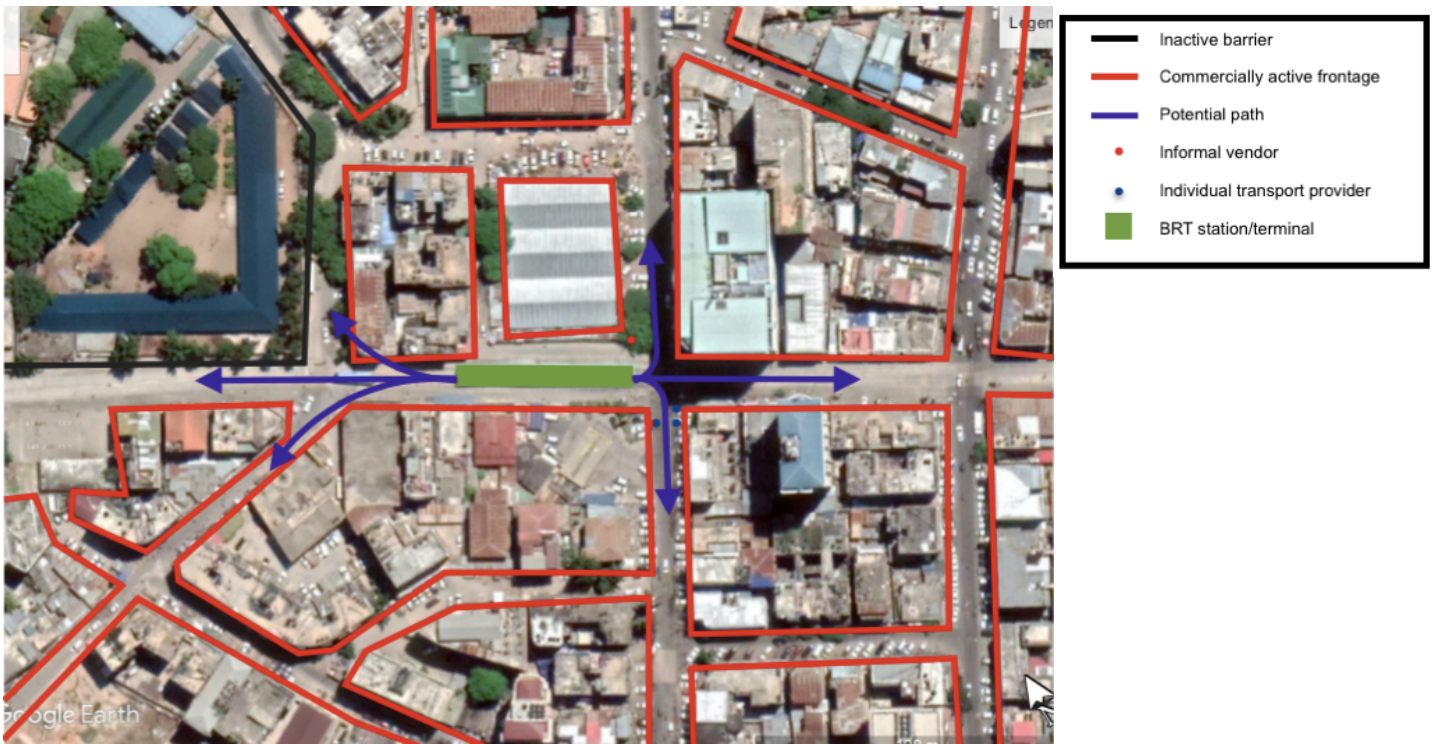


Figure 45: Close-up of station type S2. Note the overwhelmingly active building frontages and proximity of station to building frontages.

# Type S3



A second branch of the BRT line connects *Gerezani Terminal* to the trunk line near *Fire Station*, passing exclusively through Neighbourhood Type 1b and containing the *Msimbazi Station*. This category of BRT-TOD has a number of similarities to Type S2, although the BRT street is significantly wider (with the addition of two lanes of mixed traffic) and there are much higher levels of informal vending. As with Type S2, almost all building frontages are commercially active, even away from the major thoroughfares. In addition to this, many streets and sidewalks are occupied by informal vendors, often organised in double- or triple-file. This activity on the sidewalks sometimes forces pedestrians into the street and BRT lane, as illustrated in Figure 47. While the street is relatively wide along this stretch, the area maintains an enclosed 'urban' atmosphere, due to the heights of the surrounding buildings.

The activity on the sidewalks, and the large pedestrian flows, create an extended desirability core that extends along the entirety of the BRT stretch and onto parallel blocks (see Figure 49). While vehicle movements in the mixed traffic-lanes may constitute a barrier for pedestrians crossing to and from the BRT stations, the narrow nature of the streets and the dominance of pedestrians in the area mean that vehicles generally travel at lower speeds and are encouraged to give way to crossing pedestrians. The strict grid pattern of the streets in Neighbourhood Type 1b simplifies navigation to and from the stations and ensures that the stations are visible from a distance. In general, Station Type S3 is present in a neighbourhood type that has many characteristics of TOD, and therefore fits quite seamlessly into the built environment.

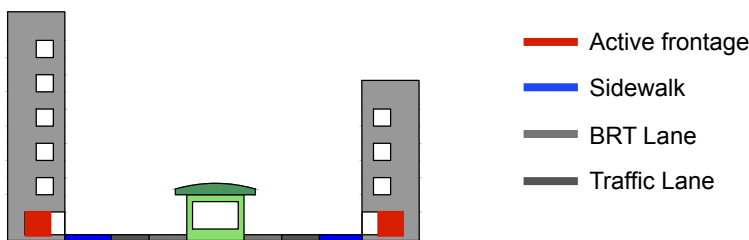


Figure 46: Cross-section of Station Type S3. Note the increased width of the right of way and sidewalks as compared to S2.



Figure 47: Pedestrians forced into vehicle lanes near station of Type S3.



Figure 48: Station of type S3 with surrounding buildings.

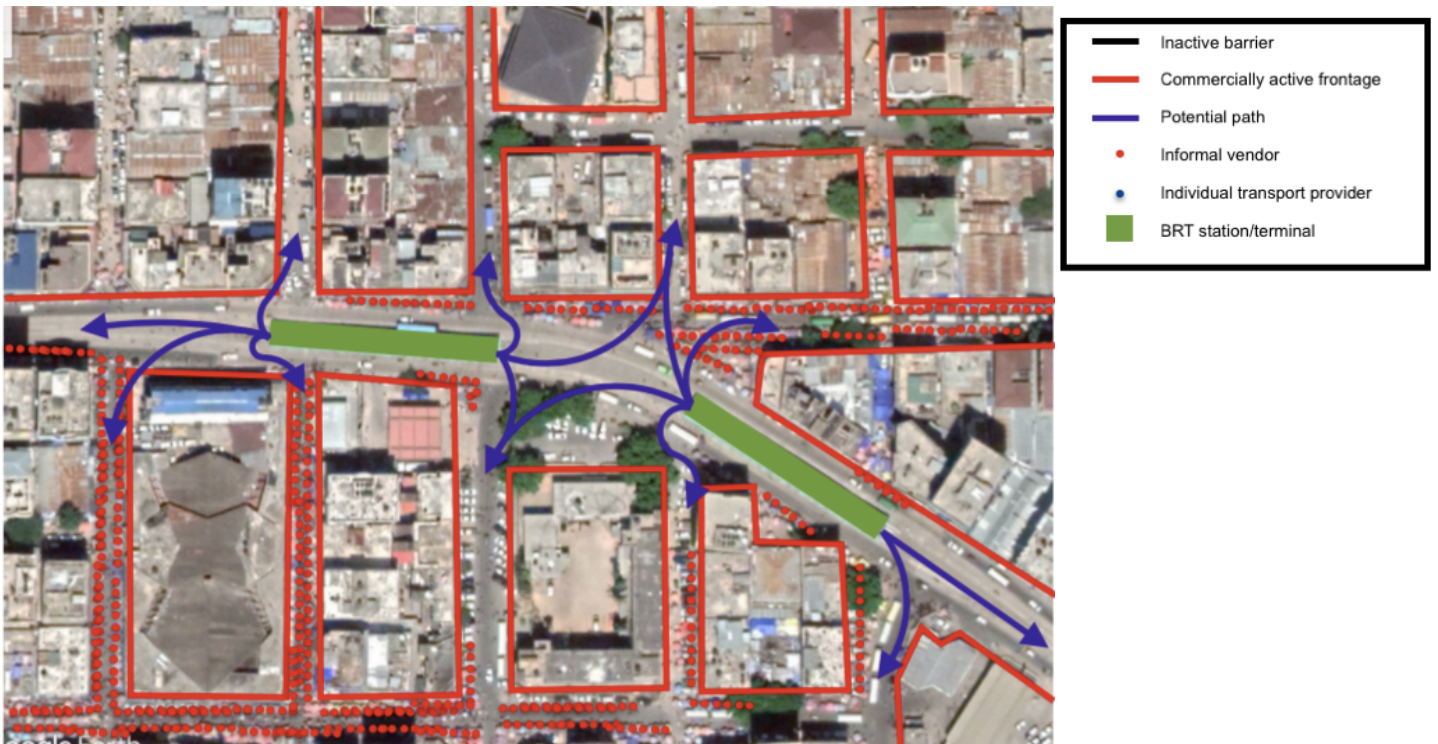


Figure 49: Close-up of station type S3. Note the large numbers of informal vendors and the permeable street pattern.

## Type S4



After emerging from the dense Kisutu ward, Morogoro Road - the right-of-way carrying the BRT trunk line - is joined by four lanes of mixed traffic, and therefore widens significantly. This width is maintained along the entire length of the trunk line to *Kimara Terminal*. Station Type S4 also has wide sidewalks, and in some places, a significant building setback - both contributing to a wide right of way. The stretch is bordered by neighbourhood types 1b, 2 and 4. Station Type S4 is characterised by its location between different neighbourhood types, passing between districts rather than through a homogeneous district, giving this station type a distinct character.

Due to its lack of surrounding urban fabric and its insignificant ridership numbers, Jangwani Station, located in the Msimbazi Rover floodplain, is not included in this analysis. The two other stations on this sub-stretch – *DIT Station* and *Fire Station* - have a number of generalisable features. Both require passengers to cross several lanes of traffic to reach the sidewalk, reducing the visual and physical connection between the stations and the surrounding urban fabric and also reducing the sense of enclosure (see Figure 50). The low height of buildings in relation to the street width (see Figure 52), with a few exceptions, further reduces this sense of connectedness and enclosure. Once passengers reach the sidewalk, there are no commercial activities or public spaces that create a sense of place, other than a small number of informal vendors (see Figure 53). Rather, the sidewalks simply become a space of flows of pedestrians continuing to their final destinations. Commercial activities are more commonplace on the side streets in the adjacent Neighbourhood Type 1b, but these are at the periphery of the view-shed for passengers exiting the BRT stations. Nonetheless, large flows of pedestrians in this direction do create an extended desirability core that goes some of the way in bridging the perceptual gap between the stations and the commercial activities.

This stretch is also home to two large shopping centres, which are designed at a non-human scale. With no adjacent public spaces to attract pedestrians from the sidewalk, the shopping centres instead provide large private parking lots for their patrons. In other places, the sidewalks are lined by long perimeter walls with few points of access to the activities beyond, such as at the Dar es Salaam Institute of Technology (DIT), the adjacent temple and the two secondary schools lining this sub-stretch. Such designs further reduce activity on the street. There is a small green space located along the sub-stretch, which was not publicly accessible at the time of observation. The sidewalks along this stretch are wide (generally 4 metres in width), cohesive and high-quality, appearing to be integral parts of the BRT project. This allows for large volumes of pedestrian flows, as well as some informal vending.

Overall, this stretch acts as a significant barrier in the urban fabric, and the BRT stations of type S4 are located on this barrier. This is due to the width of the street and the limited connection of the stations to the surrounding built environment. The existence of different neighbourhood types on each side of the stretch also contributes to a lack of cohesiveness and connectivity in the urban space across the BRT corridor. The absence of commercial activities and accessible public spaces within the view-sheds of the stations means that there is no sense of place, and that these areas are used solely as spaces of transit, rather than as destinations in themselves.





Figure 50: Wide roadway between S4 and the sidewalk. Note inactive frontages and informal vending.



Figure 51: Wide right of way at S4 with relatively low building heights.

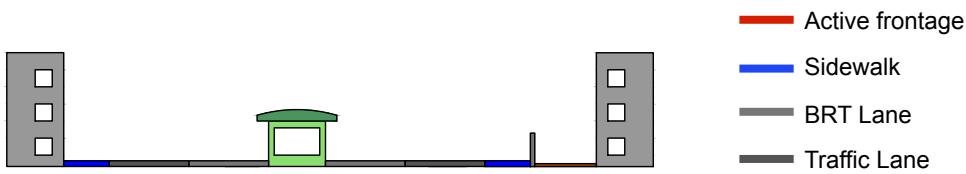


Figure 52: Cross-section of S4. Note the increased width of the right of way, inactive frontages, and lower building heights.



Figure 53: Close-up of station type S4. Note the generally inactive frontages facing the station.

## Type S5



Station Type S5 occurs in Zone B, which consists of a combination of neighbourhood types 5a, 5b, 6 and 7. Most stations interact only with types 5a and 5b, and despite some subtle variations, the stations are generally consistent and can be summarised as a single type. This station type occurs on both the trunk line and the Morocco branch. The right-of-way along this stretch is generally wide, and it varies significantly in width from a low of 41 metres to a high of 77 metres (see Figure 53). This is due to a combination of the width of the streets (with four lanes of mixed traffic along the whole stretch and four BRT lanes at stations), wide sidewalks, as well as the generally large setback of buildings from the street edge. This means that pedestrians must walk a significant distance between the urban fabric and the station, and that destinations may not be able to attract as much attention as they could have if they were closer. This disconnectedness is strengthened by the generally low height of surrounding buildings, which does not create the sense of enclosure that is characteristic of urban space (see Figure 54). The street setback is generally used for informal vending or the manoeuvring and parking of vehicles. For these reasons, the BRT stations can be perceived more as components of the road and the flow of people through the area, rather than as part of the local place.

Despite the relative lack of connection between BRT station entrances and the surrounding urban form, building frontages along the BRT line are, in general, commercially active. This commercial activity creates a linear desirability core with peaks around the stations, but also extending between stations. It is difficult to ascertain to what extent this desirability core is a result of the BRT, as it is likely that the majority of this commercial activity existed along Morogoro Road even before the introduction of the DART. Commercial activities generally continue one or two blocks back from the BRT stretches, extending the desirability core perpendicularly into the side streets.

Informal vendors may provide a more useful indication of the effects of the introduction of BRT, as they can dynamically relocate to take advantage of newly-created desirability cores. At stations of type S5 informal vendors generally occupy areas of the sidewalk or the undesignated street setback, clustering around BRT stations and daladala stops. Motorcycles and bajajis also cluster along the sidewalk near station exits in an attempt to attract potential customers. This means that passengers emerging from the BRT stations, after having crossed several lanes of traffic, are greeted by a number of activities on the sidewalk. Unlike in Zone A, there are no planned public spaces in the vicinity of the BRT stations on this stretch, meaning that there is limited non-commercial activity, such as idle sitting, playing or socialising. The open spaces created by building setbacks could, in certain places, be developed into parks or plazas in the vicinity of BRT stations, in order to strengthen the sense of place and reinforce the BRT system as an important feature of the local place.

The sidewalks along these stretches are wide and of a high quality, generally being sufficient to support the existing activities and pedestrian flows. Informal vendors and individual transportation providers do, however, sometimes impede the flow of pedestrians. While the high-quality pedestrian paths contribute to improving the conditions for first- and last-mile transportation by foot, the sidewalks constructed as part of the BRT project are limited to the BRT streets, and the quality of the pedestrian environment degrades rapidly once leaving these main paths. This could be an inhibiting factor for the large number of riders accessing destinations not located along the main stretch.

Figure 59 illustrates the layout of a representative station in relation to the surrounding urban fabric. One unique characteristic, especially of the grid-patterned areas (Neighbourhood Type 5a), is the high permeability of the urban fabric. Short blocks (with their shortest edges being parallel to the BRT street) mean that there are several points where pedestrians can infiltrate the urban fabric. These side streets are generally wide and multimodal, as illustrated in Figure 56. The grid pattern additionally eases navigation and makes BRT stations visible from a significant distance on many of

the perpendicular streets. The short blocks also increase the number of street corners, which generally become attractive commercial spaces due to their simultaneous exposure to several pedestrian flows. For those stations interfacing with Neighbourhood Type 5b, the urban fabric is less permeable and generally requires pedestrians to use sidewalks parallel to relatively busy feeder routes. There are several medium- and high-rise buildings under construction near S5 stations, where the proximity to transit provides good conditions for the implementation of TOD principles. There are, however, no unifying design guidelines or form-based codes for such developments, meaning that they remain incohesive, individual projects rather than integrated neighbourhood developments. Furthermore, many such buildings provide private parking, as well as perimeter walls or fences, which severely reduces their TOD-character.



**Figure 54: Cross-section of Station Type S5. Note the large building setback beyond the sidewalk.**



**Figure 55: Wide right of way at Station Type S5.**



**Figure 56: Permeable urban fabric adjacent to Station Type S5.**



Figure 57: Individual transport providers clustered near Station Type S5.



Figure 58: Active sidewalk and high-quality pedestrian crossing adjacent to Station Type S5.



Figure 59: Close-up of Station Type S5. Note the active frontages and extremely permeable urban fabric.

## Type S6

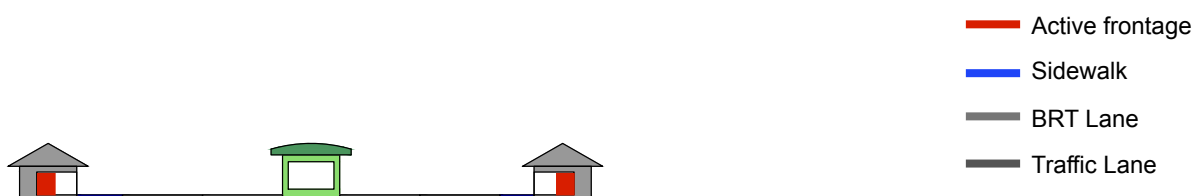


Station Type S6 occurs in Zone C, which consists solely of Neighbourhood Type 6. The right of way on this stretch is generally wider and more variable than on previous stretches, due to the large and uncoordinated setback of buildings from the street edge (see Figure 60). This is likely a result of the lack of formal planning in the area, with most buildings appearing to have emerged individually, without coordination. Many of the open spaces created by the setback of buildings from the street edge are used for parking, manoeuvring of vehicles, informal vending and other vernacular activities. The sidewalks in this section are of a similarly high-quality to those found in Zone B, but they are often also used by vehicles crossing between the road and the open street setback, reducing pedestrian safety and accessibility. As in Zone B, the quality of pedestrian infrastructure deteriorates rapidly when leaving the main BRT stretch (see Figure 62).

The wide right of way, combined with the low building heights characteristic of Neighbourhood Type 6, contribute to a lack of visual and physical connectivity between the BRT stations and the surrounding built environment (see Figure 61). While the urban form is consistent both along and across this zone, contributing to a sense of cohesiveness and place, the road and BRT infrastructure itself acts as a barrier in the urban fabric. While there are designated pedestrian crossings at each BRT station entrance, these are located at about 500 metre intervals, meaning that pedestrians often need to walk large distances in order to cross between two relatively proximate points. Crossing the road at undesignated crossings poses a significant risk to pedestrian safety, and the BRT therefore creates a significant physical and perceptual barrier in the urban space of Zone C.

Building frontages along the BRT line in this zone are mostly commercially active, and there is a large volume of informal vending and individual transport provision. Commercially active building frontages often take on a similar character to those located in Zone B, occupying the frontal section of a single-storey building, or occupying a separate building on a plot with residential buildings located directly behind. However, informal vending takes up significantly more space here than in Zone B. Because of this, sidewalks often become crowded, especially around stations, sometimes forcing pedestrians out into the busy street (see Figure 64).

While pedestrian movements along the BRT stretch are eased by the presence of wide and high-quality sidewalks, movements into and within the surrounding urban fabric are inhibited by poor pedestrian paths and a lack of planning. The organic street pattern of Neighbourhood Type 6 results in large blocks and only a few major thoroughfares that pedestrians can use to navigate to and from the BRT stations. The high building density and lack of planning also means that there is minimal public space (see Figure 65 for an illustration of a typical S6 station and its surrounds).



**Figure 60: Cross-section of S6. Note the low building heights. The width of the right of way varies significantly, and this figure illustrates a stretch with smaller building setbacks.**



Figure 61: Wide right of way in Zone C.



Figure 62: View of station of type S6 from side street.



Figure 63: Significant commercial activity near S6.



Figure 64: Informal vendors and individual transport providers near S6.



Figure 65: Close-up of station type S6. Note the active frontages, impermeable urban fabric and large number of informal vendors.

# Type S7



This station type occurs in Zone D, which contains a combination of neighbourhood types 3, 4, 5b and 6. The industrial side of the stretch has extremely limited public space and is generally impermeable for pedestrians, meaning that there are very few 'urban' characteristics. The industrial plots are generally surrounded by walls or fences, and have a large setback from the street edge. This means that there is very little connectivity between the BRT stations and the built environment. The street setback is used by a small number of informal vendors, but there is otherwise very little activity on this side. On the public housing and institutional side to the north, there is also often a large setback from the street edge (see Figure 68). Both neighbourhood types make significant uses of fences and walls to separate their functions from the public space, and there is minimal formal commercial activity outside the walls (see Figure 66). The spaces between the street and the barriers are home to a number of informal vendors (see Figure 67). Along most of the stretch, the numbers of pedestrians and informal vendors are not large enough to cause any conflicts over sidewalk space.

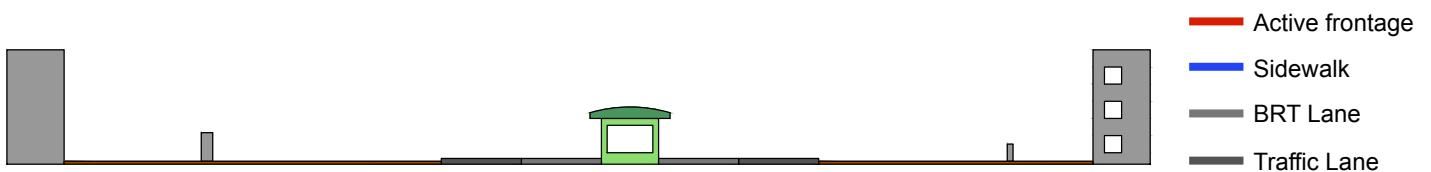


Figure 66: Cross-section of S7. Note the perimeter walls and wide right of way.

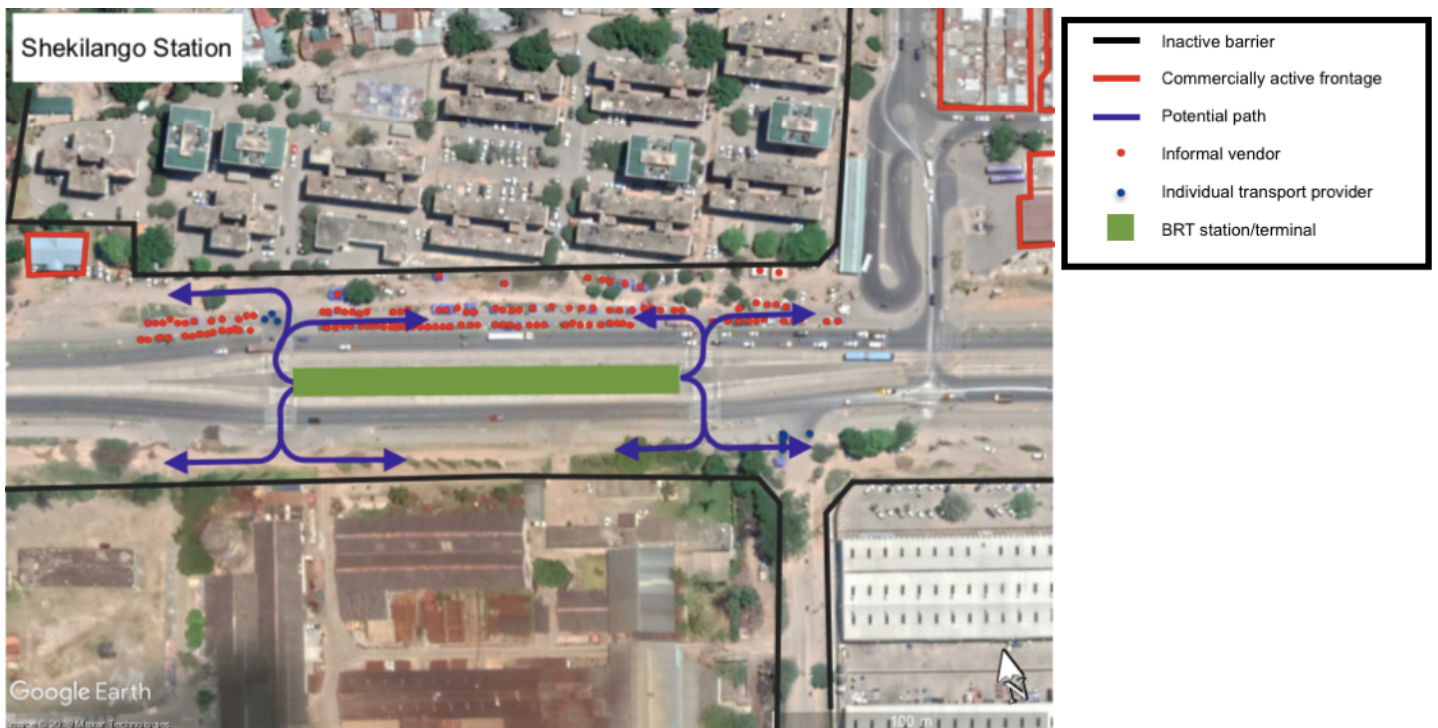


Figure 67: Cross-section of S7. Note the large blocks and impermeable urban fabric.



**Figure 68: Station of type S7, showing connection to Neighbourhood Type 4 in the background.**



**Figure 69: View from station of type S8. Note the low level of activity and low building density.**

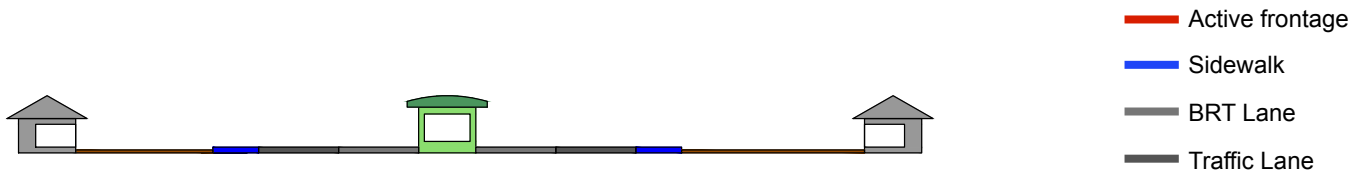


# Type S8



Station Type S8 describes the stations located in Zone E - the peripheral suburbs of the city. The general length of stations on this stretch is shorter than on the rest of the line, due to the smaller number of passengers and buses operating. The roadway has a similar design to that in types S5, S6 and S7, with four lanes of mixed traffic and two segregated BRT lanes. The setback of buildings from the street edge is irregular and generally large - more so than in type S6. Unlike on the other stretches, the low building density of Neighbourhood Type 8 means that sidewalks across from stations of type S8 are often not lined uninterruptedly by buildings. Rather, buildings are scattered, with large amounts of open space between them. As previously described, Neighbourhood Type 8 has very few urban features, resembling a suburban area verging on rural. Despite this low density and relatively low ridership numbers at stations of type S8, there is a small level of activity around stations, mostly created by informal vendors and individual transport providers.

Because of the low building density, many passengers for the BRT must walk long distances or transfer from other (mostly individual) modes. The extremely skewed ridership numbers make these stations currently feel like obstacles for buses ultimately trying to arrive at Kimara Terminal in order to pick up or drop off the majority of their passengers. However, since the city is expected to continue growing at a rapid pace, these areas will soon become ripe for development. Since there is not much urban fabric with which to integrate the stations, the first step as the city expands to the suburbs in Zone E must be to increase the density around stations. The lack of urban fabric may be beneficial, as it minimises the difficult task of retrofitting existing urban form.



**Figure 70: Cross-section of S8. Note the wide right of way and generally inactive building frontages.**

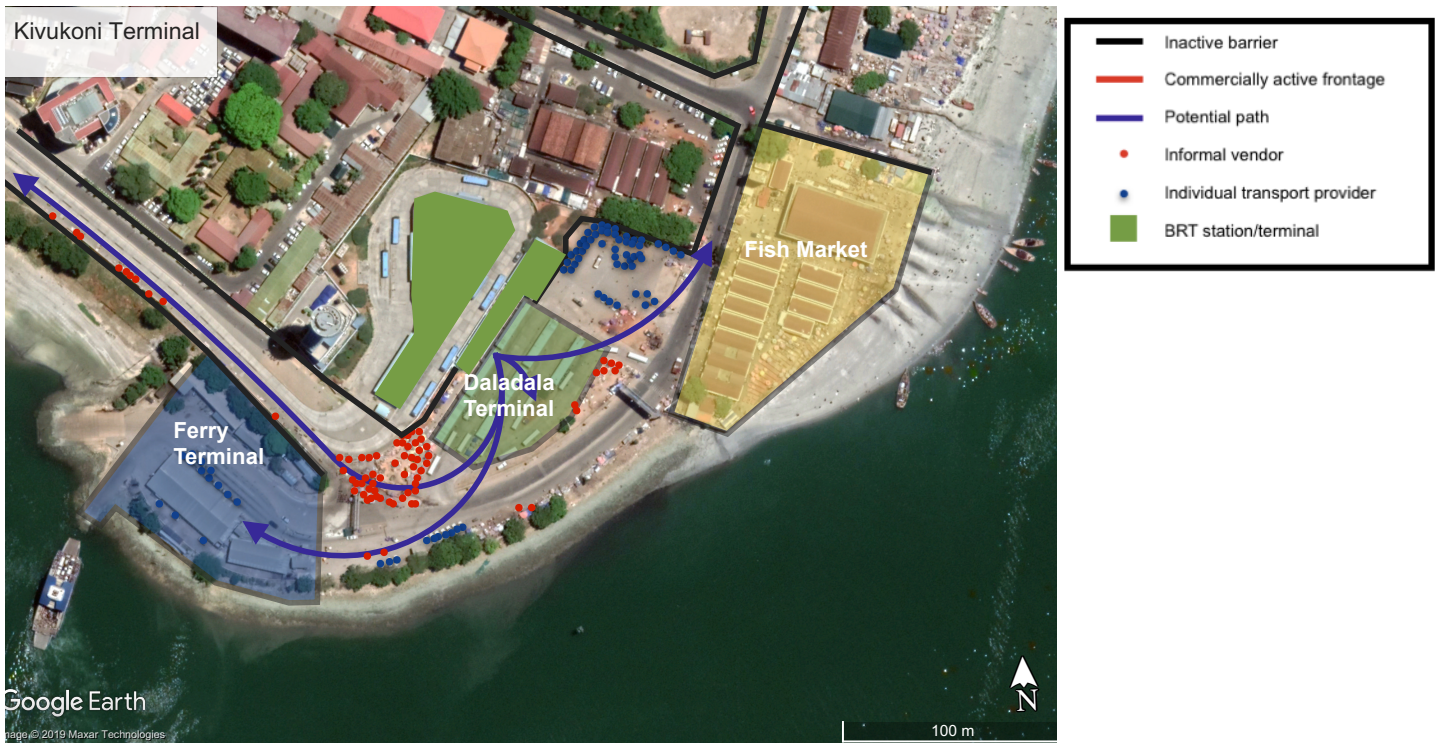
# Type T1

This first category of terminal describes the two terminals located in Zone A – *Kivukoni* and *Gerezani* – which act as net destinations in the BRT network. Large volumes of arrivals occur in the mornings, from the periphery of the city, and the same passengers depart again in the afternoons. These terminals have a large physical footprint and are separated from the surrounding urban fabric with large perimeter walls, that have only a single point for entry and exit. The large physical area allows for the parking and servicing of vehicles between trips. While both terminals are located adjacent to other transportation infrastructure, including daladala and ferry terminals, these are not well integrated, and transfers seem to be relatively uncommon. The terminals generate large volumes of pedestrian traffic, which then disperse into the surrounding built environment (see Figure 72). Sometimes the flows of pedestrians are so large that pedestrians are forced to share the street surface with cars.

While the perimeter walls of the terminals are inactive and lack formal commercial activity, informal vendors occupy these areas in large numbers (see Figure 71). The vendors seem to have established themselves along major paths that pedestrians take to and from the terminals. Individual transport providers also cluster in areas that are visible to emerging BRT riders. These activities contribute to activating the sidewalks, but they can also, at times, inhibit pedestrian movements. While the two terminals of type T1 are located in two different neighbourhood types (*Kivukoni* in Neighbourhood Type 2, and *Gerezani* in Neighbourhood Type 1b), they have a life of their own - mostly separated from the urban fabric - that makes them similar to each other. There is potential at both of these terminals to take further advantage of the flows of pedestrians to create attractive public or commercial spaces.



**Figure 71: Informal vending at the entrances to terminal type T1.**



**Figure 72: Close-up of terminal type T1. Note the large numbers of informal vendors and individual transport providers, as well as the impermeable urban fabric and limited number of paths for pedestrians.**

## Type T2



Terminal type T2 describes the terminals located outside of the city centre. Unlike terminals of type T1, which act as destinations in themselves, terminals of type T2 are overwhelmingly places of transit rather than places where people end their journeys. Their role is mostly to collect passengers from large catchment areas and funnel them onto the BRT. All terminals of type T2 are therefore integrated with other transport modes: at Morocco, this is in the form of a daladala terminal, at Ubungu in the form of an upcountry bus terminal, and at Kimara in the form of a daladala terminal and an official DART feeder service (see Figure 75). Each terminal also has significant numbers of individual transport providers, bringing passengers to and from the terminals. These providers, especially bajaji drivers, sometimes offer shared services to passengers travelling in a similar direction.

These terminals all straddle the roadway, requiring passengers to use an elevated walkway in order to access the platforms. The aerial walkway is reached by a ramp with a shallow incline, making it time- and energy-consuming for pedestrians to access the terminal (see Figure 73). While this design was clearly a balancing act between pedestrian accessibility and smooth vehicle movements, pedestrians appear to have been inconvenienced at the cost of vehicles using the mixed traffic lanes. This design also significantly separates the terminals from the surrounding urban form. Despite this, large numbers of informal vendors cluster around the ramp entrances, especially at Kimara Terminal (see Figure 74). This, combined with large flows of pedestrians, creates a lively pedestrian realm on the sidewalks on either side of the terminals. These areas could be described as desirability cores, extending linearly along the sidewalks parallel to the BRT lanes. The aerial walkways are not protected from the weather, and there has been no attempt to beautify them.



**Figure 73: Ramp leading to aerial walkway for access to terminal type T2**



**Figure 74: Significant informal vending near entrances to terminals of type T2.**



Figure 75: Integration of daladala terminal with terminal type T2.



Figure 76: Close-up of terminal type T2. Note the large number of informal vendors and individual transport operators.

# 6.4. SUMMARY OF RESULTS

In summary, the study area consists of a variety of zones, neighbourhood types, and types of TOD. Figure 77 summarises the eight neighbourhood types (including two types with subtypes), based on the main form of classification that was used. The first four types were defined by their different functions, which were sometimes manifested in either cohesive or incohesive forms. The last four categories have a similar, predominantly residential function, being defined by their varying densities and levels of formal planning.

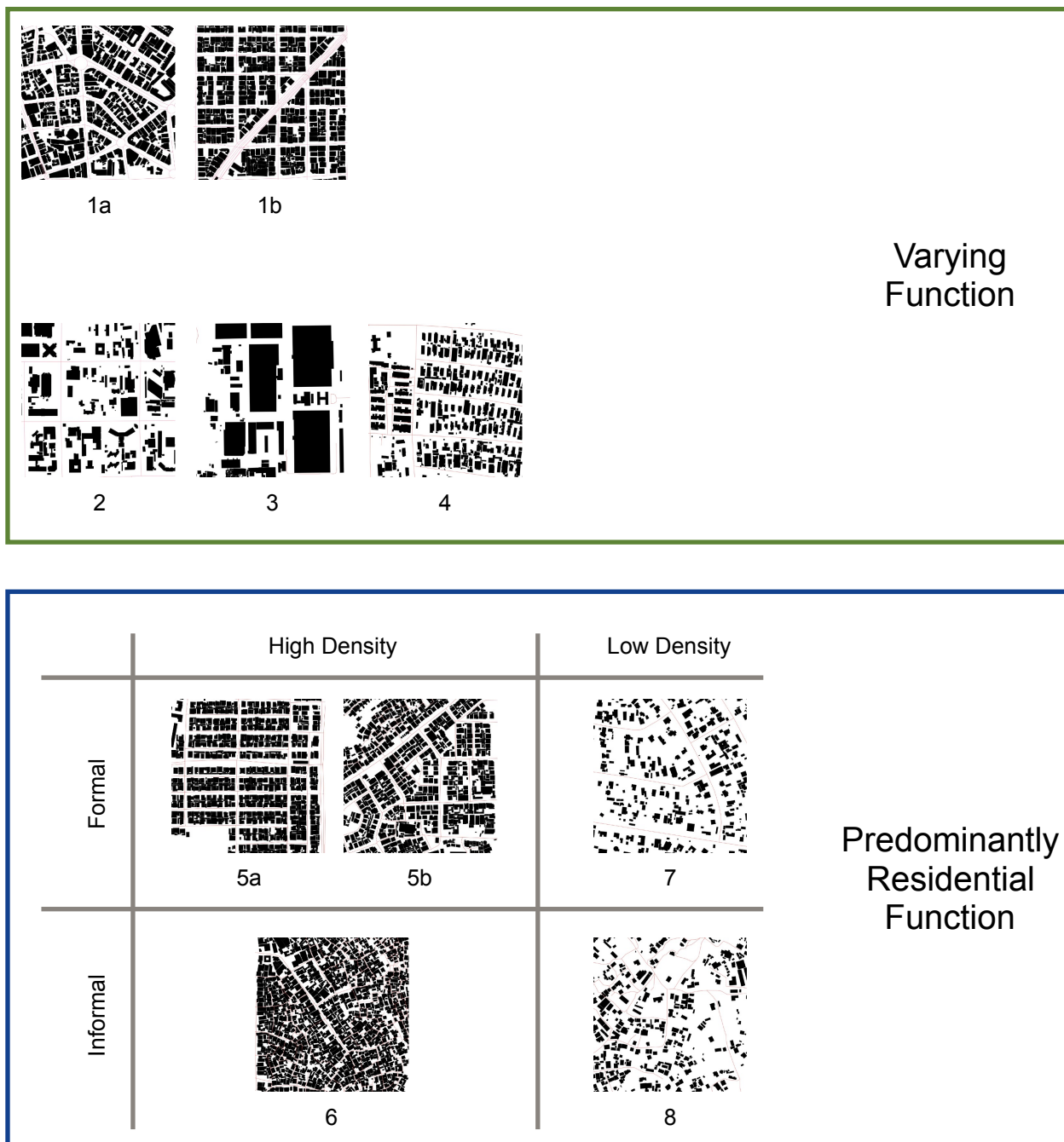
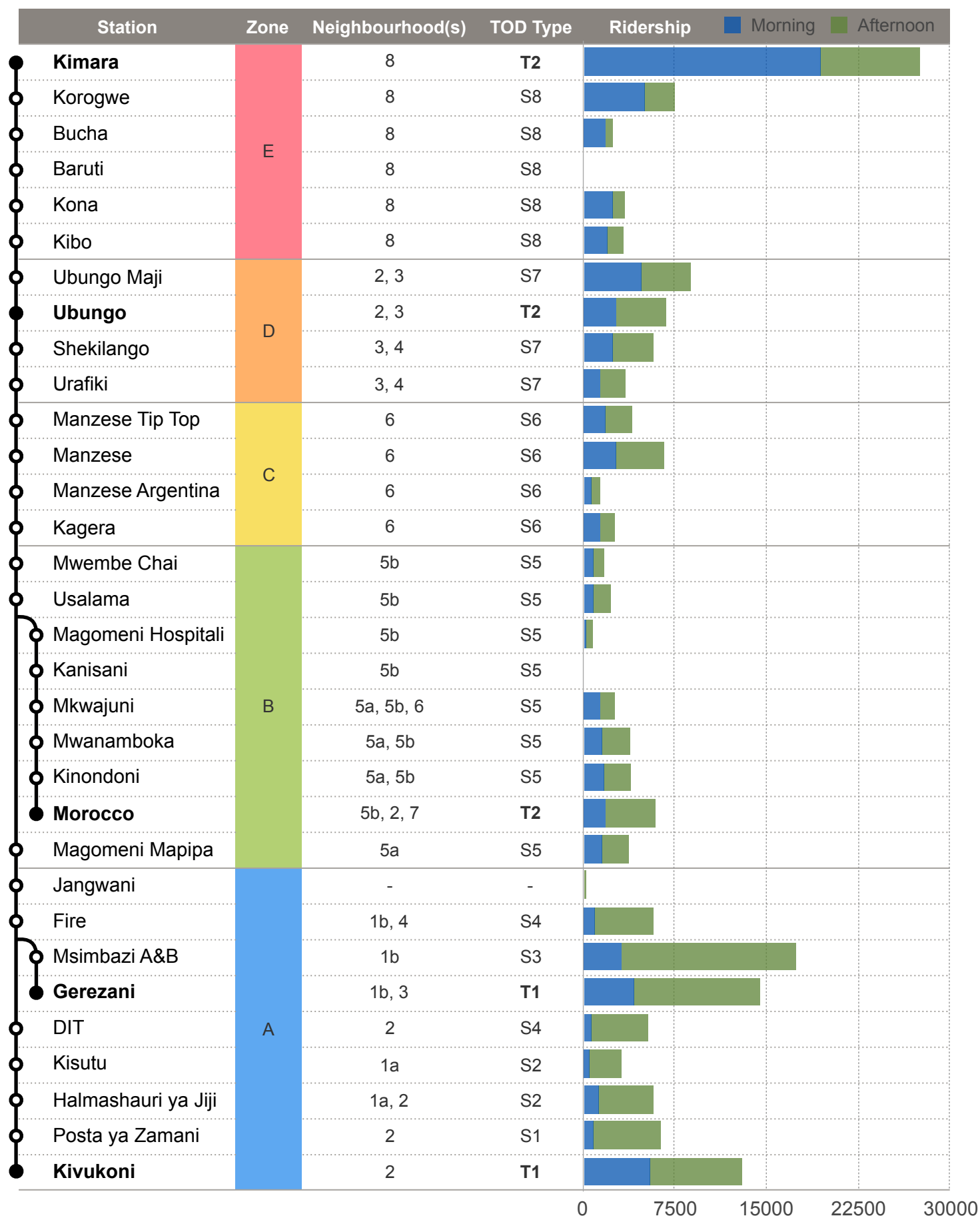


Figure 77: A summary of the identified neighbourhood types, describing how they were classified.

Table 1 summarises the regional development zones identified in Chapter 6.2., linking them to the station types they contain and the neighbourhood types which surround these stations. While ridership numbers are included, this is not an attempt to indicate causality.

**Table 1: A summary of zones, neighbourhood types, station types and ridership numbers within the study area.**



The cross sections of all station types are summarised in Figure 78, showing the variation in right of way and building heights from the city centre to the periphery. There is a clear trend of right-of-way increasing in width and building heights reducing with the distance from the centre.

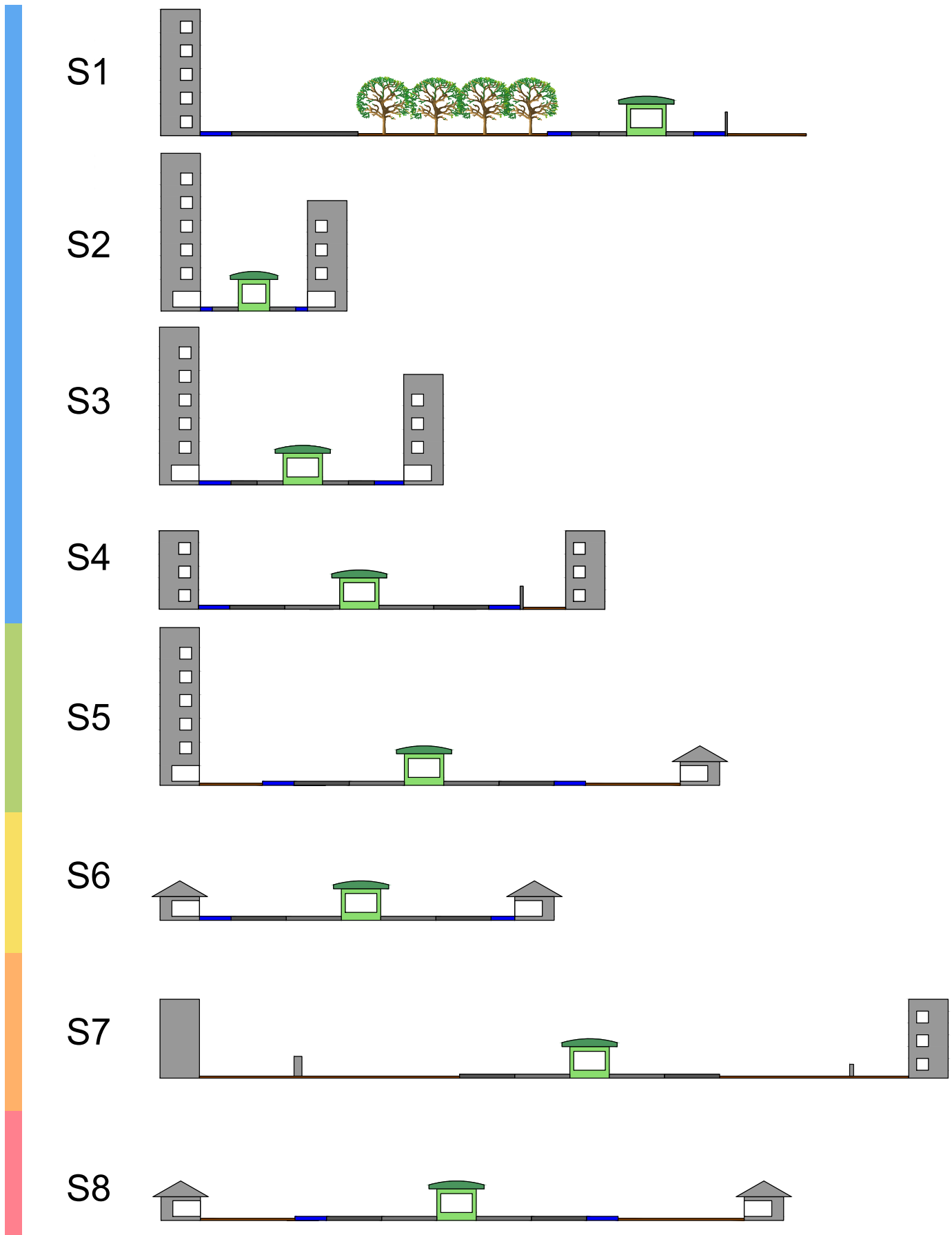


Figure 78: an illustration of how the station cross sections change along the BRT line.



# 7. DISCUSSION

This chapter discusses the results by identifying nine major themes in the findings, followed by a discussion of the accuracy of the results.

## 7.1. MAIN THEMES IN RESULTS

Nine main themes emerged when collating the results.

### Neighbourhood Types

The neighbourhood types surrounding a station have a significant impact on the design of the immediate station area and how accessible it is in terms of number of potential paths, activities at the street level, distances needing to be walked, etc. Neighbourhoods near the centre intrinsically incorporate many of the characteristic features of TOD, such as high densities, short blocks and walkable streets, whereas more peripheral neighbourhoods do not. It would be ideal if new centres could be developed around BRT stations along the whole network, based on the urban form existing in neighbourhood types 1a and 1b, which fulfil many of the requirements of TOD. While it is difficult to retrofit entire neighbourhoods, at least gradual changes will need to occur to existing neighbourhoods if the visions of Dar es Salaam's urban planners are to come to fruition. Luckily, there are a number of stations which exhibit a particularly strong TOD character already in existence in the city, which can be used as design precedents, although the process by which change can occur is less clear. Characteristics of the successful TOD neighbourhood types include grid-patterned streets, short and permeable blocks, medium-rise development, active frontages, public spaces and high-quality, cohesive pedestrian infrastructure.

### Building Setback

At a majority of BRT stations and terminals, buildings are set back significantly from the street and sidewalk edge, leaving large swathes of open, under-utilised land (see Figure 79). This reduces the proximity of BRT stations to the surrounding urban fabric, and makes the BRT a less obvious transportation option for pedestrians in adjacent areas, as well as reducing the liveliness and urban character of the space. In addition, it minimises the benefits that BRT can bring for local commercial activities, by weakening the desirability cores around the stations. This is because disembarking passengers are not as directly exposed to the distant shopfronts, and are therefore more likely to instead just continue along the sidewalk to their final destinations. There are several factors that could be contributing to the continued enforcement of this street setback.



**Figure 79: Building setback in Zone B used for parking.**

Firstly, the Tanzanian law of road reserves makes construction in the vicinity of any important roads treacherous. The law allows buildings within the reserve to be demolished, without compensation, if the road needs to be expanded or altered. This reserve can measure up to 121.5 m on each side of the road (Kamagi & Letea, 2017), therefore covering a

significant number of existing buildings. While this policy gives planners flexibility as the city expands its transport infrastructure, it creates an uncertain environment for developers and landowners, discouraging them from exploiting valuable land. These issues must be solved through long-term strategic planning, which can reduce the need for future alterations to the transport infrastructure. It is also vital that these plans and policies are communicated clearly to landowners and developers, giving them confidence to fully utilise valuable land in the vicinity of BRT stations.

A second reason for this setback may be concerns about health issues related to noise and air pollution being emitted from the vehicles on the road. This is an issue that all cities grapple with, and several solutions have been found. Areas in proximity to major thoroughfares could be zoned exclusively for functions such as retail, office space, public parks or plazas, thereby reducing residents' exposure to these risks. These are decisions that must also be made as part of a wider strategic plan for the city.

Thirdly, most wealthy residents have private vehicles, and they are also the customers that are likely to spend the most money in the shops. In order to attract these customers, shops need to provide parking space. The street setback is also often used as an informal side street, allowing vehicles to travel from one of the relatively few exits off the main roads to their final destinations. This negatively affects the public realm, taking away space from pedestrians and imposing additional barriers to their movement. Imposing stricter limits on private vehicles, such as physical boundaries and fines for misuse, may help to alleviate this. The public image of the BRT must also be lifted, encouraging higher-income residents to use it as a better alternative than the private vehicle.

In summary, the large setback of buildings from the street edge creates a number of challenges, detracting from the quality of pedestrian spaces around BRT stations. These spaces are vital to consider as part of a wider city redevelopment plan, especially when moving from a vehicle-centred transportation system to a human-centred one. These spaces also present an opportunity, as they are currently underdeveloped and a number of interventions could be made without majorly affecting the existing urban fabric. One does not need to look far for precedents on how this could be achieved. As Figure 75 illustrates, the width of the right-of-way generally increases with the distance from the centre. BRT has been implemented on narrow rights-of-way, such as those in TOD types S2 and S3. These roadway designs, especially the BRT-exclusive right-of-way through the central business district, could serve as useful precedents for other neighbourhoods and other cities struggling to make space for BRT in dense urban cores. While these TOD types have one less lane of mixed traffic to contend with, there are several aspects that are transferable. Examples from other cities also indicate that it is possible to build right up to the edge of sidewalks on mixed traffic and BRT streets, even on major thoroughfares.

## Barrier & Bridging Effects

While the BRT has so far only been introduced along well-established major thoroughfares, it uses different routes than the daladalas, and it would be interesting to see how this has affected residents' perceptions of the city. The major roads which the BRT line traverses, especially Morogoro Road and Kawawa Road (trunk line and Morocco Branch, respectively), were already significant paths and edges in the urban fabric before the introduction of BRT, depending on if one was traveling along or across them. The introduction of BRT has significantly altered the form and conditions under which pedestrians can cross or traverse these paths and edges. With the widening of the roads, as well as the BRT buses being larger and traveling faster than the majority of other traffic, pedestrians have further to cross and a higher risk in the case of a collision. However, with reasonably well-respected pedestrian crossings at each station (approximately 500m intervals), the system attempts to funnel pedestrians into these for a safe crossing. For pedestrians moving along the BRT line, the introduction of cohesive, high-quality pedestrian sidewalks has significantly altered walking conditions, likely resulting in a more accessible walking experience. Overall, it is unclear what

accessibility effects the BRT infrastructure has had on residents' perceptions of the city, but it is likely to have had some sort of effect, and this would be an interesting topic of future study.

No good accessibility solution has yet been found for BRT stations located in the medians of busy thoroughfares. Level crossings can feel unsafe for pedestrians, and they inhibit the movements of BRT vehicles and other traffic. Raised crossings require physical exertion, and are time-consuming for pedestrians, thereby prioritising the smooth flow of vehicles over pedestrian comfort. The latter model exists in Dar es Salaam only at terminals of type T2, where ridership is highest. While there is no win-win solution, there are a number of different ways to improve access to stations and terminals. Some cities have incorporated elevated crossings into adjacent buildings, allowing pedestrians to use internal elevators and escalators to reach the crossing, and benefitting the businesses in these buildings by creating a flow of potential customers. In other places, elevated crossings have been designed as attractive public spaces, with greenery and seating. As Dar es Salaam densifies and BRT ridership increases, conflicts between vehicles and pedestrians at level crossings may become more common. This may require a rethink of how these stations are accessed, and how they are incorporated into the surrounding urban fabric.

## Informal Vending

Informal vendors have a significant presence along the BRT line, especially in Zones A and C. Informal vendors benefit from the flows of pedestrians around BRT stations. The informal vendors reciprocate by providing products and services to BRT riders, increasing street-level activity for pedestrians and therefore improving the passenger experience. In this way, there is potential for significant synergies between the two. In many places, however, space is limited, causing pedestrians and informal vendors to compete for this space. This can be harmful for both parties. The significant number of informal vendors in Dar es Salaam is a symptom of the economic situation, and is not something that can be addressed solely through spatial interventions.

However, such interventions can also play their part. Like in many rapidly expanding cities, past and current policies in Dar es Salaam have generally aimed at eliminating informal vendors. This ignores their vital roles in the city's economy, and planners may have more success if they instead try to cooperate with these vendors. Some cities have been able to assign space for informal vending, and have supported the vendors with seating areas or more permanent stalls. This can contribute to activating the urban realm, while allowing pedestrians to move more freely along allocated sidewalks. The power of informal vendors to activate urban space could be harnessed when rethinking the uses of street setbacks. In summary, informal vending is a way of life for many of Dar es Salaam's residents, and in order to ensure that vendors maintain a mutually beneficial relationship with BRT-TOD, they should be included as key stakeholders in the planning of stations and station areas.

## Public Spaces

Outside of the city centre, Dar es Salaam generally lacks public parks or plazas, probably due to a lack of formal planning. Planned public spaces are an important tool for creating a sense of place. They are also vital for ensuring that members of different social classes come into contact with each other, and ensuring that lower-income residents have spaces where they can be without having to spend money. In many cities, TOD has been implemented by locating public spaces directly adjacent to transit stations. One design challenge for combining BRT stations with public spaces is the large physical and perceptual separation between median BRT stations and the surrounding urban form. However, design precedents exist, both in Dar es Salaam (see TOD Type S1) and in other cities, for how this gap can be bridged. The important thing is that planners begin to prioritise public spaces, especially outside of the city centre. Planning these spaces in conjunction with BRT-TOD can create positive synergies for both projects.

# Exclusive New Developments

Several new medium- and high-rise housing developments are emerging in the study area, and along other routes slated for future BRT implementation. This means that there is a significant opportunity to reap the potential benefits of the synergies between BRT and TOD as the city densifies. However, many of these developments are designed to be private and car-centric, with high perimeter walls, inactive ground floors, security guards and individual parking spaces – features that are likely desired by the future residents, often belonging to higher-income groups. The projects are also often individual - designed to stand out from, rather than blend in with, the neighbourhoods they are located in. Additionally, there is a risk of gentrification if the new developments raise property prices and force lower-income long-term residents out of these neighbourhoods. While these developments contribute to the much-needed densification of the city, they also risk perpetuating unsustainable urban forms and mobility patterns. In order to combat this profit-driven approach to urban development, more interventions are needed from urban planners.

Firstly, policies that encourage more sustainable forms of densification should be enforced. This could include direct government involvement in social housing programs, such as those already existing in zones A and D, or the encouragement of housing cooperatives and land-pooling to allow individual land-owners to more fully utilise their land by building upwards. Form-Based Codes could also be useful to ensure that developers adhere to TOD principles, and to ensure a cohesive urban environment rather than a patchwork of incohesive, individual projects. Cohesive neighbourhood-scale developments must also include interventions in the existing public spaces between private properties, such as streets and sidewalks, as well as the creation of quality public spaces. In many places in Dar es Salaam, there is a stark contrast between the quality of public space and private space. In order to achieve TOD, planners must ensure that public spaces are not neglected. This can be done either by developing public spaces with public funds or, since such funds are scarce, by requiring private developers to improve the areas surrounding their properties as part of their building rights.

# Physical Limitations of BRT Improvements

The BRT project included a complete makeover of the existing roads, including sidewalks, crossings, bollards and traffic signals. A common observation in zones B, C, D and E was the stark contrast between the pedestrian infrastructure on the BRT roads and that in adjacent areas. Sidewalks along to the BRT lines are generally cohesive and high-quality, with bollards and marked pedestrian crossings. Beyond these, however, sidewalks are often missing or unmaintained (see Figure 80). In order to achieve complete TOD, a wide perspective needs to be taken and the entire trip needs to be considered, including the ‘first and last mile’. This is not something that was included in the DART project, and is also an aspect that has a limited presence in the CDS project (confirmed in interview 3 and through document review). While many riders do not have other options than walking for the ‘first and last mile’, their transit experience could be significantly improved if the pedestrian experience was consistent along the entire path. As the areas surrounding the BRT lines grow and develop, efforts should be made to ensure a cohesive pedestrian space.



**Figure 80: Low quality pedestrian environment directly adjacent to BRT line in Zone C.**

# Monocentricity

As previously described, Dar es Salaam is a monocentric city, with large commuter flows during the morning and afternoon peak hours. While one goal of the BRT system and the Corridor Development Strategy was to distribute functions to create a more polycentric city, it does not appear that much progress is being made. The ridership data suggests that the BRT phase 1 is being used to transport large volumes of passengers from a sprawling catchment area in the urban periphery into the centre in the mornings, and back out again in the afternoons. This is also evidenced in the design of peripheral terminals (TOD type T2), which mainly act as transfer points to and from the BRT system. The system thereby reinforces existing commuting patterns, and may even enable longer commutes due to time savings along the main corridors. This means that people could potentially move even further out of the city.

TOD requires tackling the accessibility issue at both the local and regional scale, and in the case of DART, the goal has been to continue enabling the existing long-distance flows at the regional scale, rather than reducing these flows (as covered in interview 3 and in review of the CDS documentation). This fits Cervero & Dai's (2014) assertion that cities often neglect the 'city-shaping' potential of BRT. This is a danger when transportation planning is carried out separately from land-use planning; the transport network largely reinforces existing unsustainable growth patterns. In order to reverse this trend, local planners must introduce policies to concentrate growth and introduce quality place-making in proximity to existing and planned stations, rather than encouraging the continued horizontal expansion of the city.

## Incorporation of Other Modes

With the BRT system currently having limited coverage, a large proportion of Dar es Salaam's residents and visitors still rely on other modes of transport to move around the city. However, as the BRT network expands, decisions will need to be made about whether to incorporate or eliminate informal transport providers, such as daladalas, bajajis and motorcycles. As described in Chapter 4, conflicts have already taken place between daladala operators and DART during the planning of the BRT system. While there are a number of relevant economic, environmental and safety issues pertaining to the operations of informal modes, it must be remembered that they also provide a vital service for the city. While this study focuses on urban form, it is important also to briefly consider the other complex and interrelated factors which impact ridership decisions, and which may contribute to the low ridership numbers at most stations in zones B, C and D.

Firstly, the BRT currently has limited coverage compared to the daladalas, which wind their way through side streets and bring passengers to a variety of destinations. The fact that daladalas remain more convenient for a large proportion of the population is, of course, related both to the fact that the BRT network is incomplete, and to the lack of strategic focusing of densities along the BRT corridor. A second potential factor is the BRT fare, which is higher than the typical daladala fare. With the zones B, C and D being home to mainly low-income earners, many are likely to value the monetary savings of riding the daladala higher than the time savings of riding the BRT. The lack of integrated ticketing also means that combining two modes can be unattainably expensive. Thirdly, the extreme crowding on many BRT buses by the time they reach stations in zones B, C and D, mean that passengers often have to wait for several buses to pass before there is one that they can board. These network planning and operational challenges must be tackled simultaneously with the implementation of TOD.

The question then remains about whether to incorporate the existing informal modes into the wider public transportation network, or whether to completely replace these modes with formal BRT service. Some scholars, such as Cervero (2017), argue that informal modes can be a suitable complement to formal public transit in certain cases. However, the incorporation of other modes would also require a rethinking of station and station-area design to ensure safe and

efficient transfers. Current stations are not set up for large numbers of transfers, with the exception of TOD Type T2, where attempts have been made to incorporate daladala terminals. In order to incorporate the full range of transport options, stations would need to provide space for daladalas, bajajis, motorcycles, and potentially even taxis (most of which currently operate from the sidewalk adjacent to stations). This begs the question of whether it wouldn't be better to use this space to densify and provide more residences and opportunities within walking distance of the stations, rather than focusing on residents living further away.

## 7.2. LIMITATIONS OF STUDY

Despite efforts to accurately collect and interpret the data, there are several limitations in this study which must be considered when making use of the results. Firstly, a larger number of interviews could have been used in order to gain a broader set of data and to be able to triangulate more data from other data sources. Due to time constraints, the number of interviews was limited to four. There were also some challenges in gaining access to population data, especially for informal settlements, where only estimations by Broadway Malyan could be found. Planning documents were not always publicly available, which limited the understanding of the planning process in the city. Finally, with Dar es Salaam undergoing a continued transformation, including significant construction of new buildings and infrastructure, the results may quickly become outdated. This is especially relevant in Zone D, where construction work was underway along most of the BRT corridor during the period of observation. The results should therefore be considered as representative of a snapshot in time.

# 8. CONCLUSION

In conclusion, many cities around the world are facing an accessibility crisis due to rapidly expanding populations and physical footprints. Dar es Salaam is one of these cities, and has recently implemented a BRT system and a TOD strategy to deal with these challenges. The BRT-TOD combination is hailed by many as a potentially comprehensive approach to accessibility, but there are a number of challenges of integrating the infrastructure into the existing urban fabric in a way that achieves both the goals of efficient mobility and attractive spaces. This study has investigated the accessibility effects of BRT-TOD in Dar es Salaam as a case study from an urban morphological perspective, using visual and spatial methods, as well as abstractions and typologies. The research questions are related to how BRT-TOD has been designed into the existing urban fabric, as well as how this has affected accessibility. The results are largely descriptive, presenting classifications of neighbourhood types, regions and station areas, before evaluating these against the backdrop of accessibility. A number of key themes emerged relating to how the urban form affects accessibility at the station area and regional scale, with some categories of station area being considered more accessible than others. While this project has taken a first step in understanding BRT-TOD in Dar es Salaam, there is much work left to be done.

A survey of BRT users could be performed, using mental mapping to attempt to understand how the users perceive their daily mobility patterns and the urban environment in which they operate. This could be helpful in identifying ways to improve the user experience from origin to destination, which ultimately affects whether they use the BRT or not. Environmental psychologists could perform 'go-along' interviews to gain a deeper understanding of the users' interaction with the built environment around stations. Geographic information systems and statistical measures of monocentricity could be used to ascertain whether the BRT system is strengthening or challenging existing patterns of monocentric growth. Design research could also be performed to explore ways of incorporating public spaces into station design or ways of improving access to the stations from the surrounding urban fabric. Environmental scientists may be able to explore the effects of the BRT on emissions and energy consumption. While studies of space and the perception of space are important, it is also vital to examine the processes by which space is produced. This could involve diving deeper into planning documents or interviewing more urban planners than in the present study, to try to understand how public spaces, residences and commercial spaces are produced in Dar es Salaam, and how these processes could be adjusted to encourage more sustainable urban development. Economists may also be able to look into the dynamics of land ownership, land pooling and housing cooperatives, to try to understand how sustainable urban developments that serve the needs of residents might be financed.

With BRT being considered by more and more cities as their populations grow, it is vital to understand the relationship between BRT and TOD in a variety of contexts. If there were to be one central finding of this study, it would be that BRT was never going to be able to solve Dar es Salaam's accessibility challenges in the current context of unplanned urban growth. Rather, BRT must be viewed as one component of an integrated land-use and transportation plan that delivers accessibility through both mobility and proximity.

# 9. REFERENCES

- Adams, J. (2000). *The Social Implications of Hypermobility – Speculations About the Social Consequences of the OECD Scenarios for Environmentally Sustainable Transport and Business-As-Usual Trend Projections in OECD*. Project on Environmentally Sustainable Transport (EST): The Economic and Social Implications of Sustainable Transportation. Proceedings from the Ottawa Workshop. Organization for Economic Co-operation and Development (OECD), Paris.
- Ben-Akiva, M. & Morikawa, T. (2002). *Comparing Ridership Attraction of Rail and Bus*. Transport Policy. Volume 9(2). Pp. 107-116.
- Bocarejo, J.P., Portilla, I. & Pérez, M.A. (2012). *Impact of Transmilenio on Density, Land Use, and Land Value in Bogotá*. Research in Transportation Economics. Volume 40(1). Pp. 78–86.
- Brennan, J.R. & Burton, A. (2007). *The Emerging Metropolis: A history of Dar es Salaam, circa 1862-2000*. in Brennan, J.R. (ed.), Burton, A. (ed.) & Lawi, Y. (ed.) (2007). *Dar es Salaam: Histories from an Emerging African Metropolis*. Mkuki Na Nyota Publishers, Dar es Salaam. Pp. 13-76.
- BRTDATA.ORG. (2019). *Global BRT Data*. [Online] Accessed 2019-09-18.
- Brown, A. (2016). *Rubber Tires for Residents: Bus Rapid Transit and Changing Neighbourhoods in Los Angeles, California*. Transportation Research Record: Journal of the Transportation Research Board. No. 2539. Pp. 1–10.
- Broadway Malyan. (2017). *Dar es Salaam Metropolitan Development Project – Corridor Development Strategy*. Final Consultancy Report. Broadway Malyan, London.
- Burgess, E.W. (1925). *The Growth of the City: An Introduction to a Research Project*. in Marzluff, J.M. (ed.), Shulenberger, A. (ed.), Endlicher, W. (ed.), Alberti, M. (ed.), Bradley, G. (ed.), Ryan, C. (ed.), Simon, U. (ed.), ZumBrunnen, C. (ed.). (2008). *Urban Ecology: An International Perspective on the Interaction Between Humans and Nature*. Springer, New York.
- Carlton, I. (2009). *Histories of Transit-Oriented Development: Perspectives on the Development of the TOD Concept*. Working Paper 2009-02. Institute of Urban and Regional Development, University of California, Berkeley.
- Cervero, R. (2013). *Transport Infrastructure and the Environment: Sustainable Mobility and Urbanism*. Working Paper 2013-03. Institute of Urban and Regional Development, University of California, Berkeley.
- Cervero, R. (2017). *Mobility Niches: Jitneys to Robo-Taxis*. Journey of the American Planning Association. Volume 83(4). Pp. 404-412.
- Cervero, R. & Dai, D. (2014). *BRT TOD: Leveraging Transit Oriented Development with Bus Rapid Transit Investments*. Transport Policy. Volume 36. Pp.127-138.



- Cervero, R., Guerra, E. & Al, S. (2017). *Beyond Mobility: Planning Cities for People and Places*. Island Press, Washington DC.
- Cervero, R. & Kang, C.D. (2011). *Bus Rapid Transit Impacts on Land Uses and Land Values in Seoul, Korea*. *Transport Policy*. Volume 18(1). Pp. 102-116.
- Chatman, D. (2013). *Does TOD Need the T? On the Importance of Factors Other Than Rail Access*. *Journal of the American Planning Association*. Volume 79(1). Pp. 17-31.
- Estupiñán, N. and Rodríguez, D.A. (2008). *The Relationship Between Urban Form and Station Boardings for Bogotá's BRT*. *Transportation Research Part A: Policy and Practice*. Volume 42(2). Pp. 296–306.
- Farrell, K. (2018). *Rapid Urbanization: An Inquiry into the Nature and Causes of the Urban Transition in Developing Countries*. Doctoral Thesis. KTH Royal Institute of Technology, Stockholm.
- Farrington, J. & Farrington, C. (2005). *Rural Accessibility, Social Inclusion and Social Justice: Towards Conceptualisation*. *Journal of Transport Geography*. Volume 13(1). Pp. 1–12.
- Gehl, J. (2010). *Cities for People*. Island Press, Washington DC.
- Geurs, K.T. & van Wee, B. (2004). *Accessibility Evaluation of Land-Use and Transport Strategies: Review and Research Directions*. *Journal of Transport Geography*. Volume 12. Pp. 127-140.
- Gillham, B. (2000). *Case Study Research Methods*. Real World Research Series. Continuum Books, London.
- Graham, S. (2018). *Elite Avenues*. *City*. Volume 22(4). Pp. 527-550.
- Haugen, K. (2012). *The Accessibility Paradox: Everyday Geographies of Proximity, Distance and Mobility*. Doctoral Thesis at Umeå University, Department of Geography and Economic History.
- Hoyt, H. (1939). *The Structure and Growth of Residential Neighborhoods in American Cities*. review by Green, H.W. (1941) *American Sociological Review*. Volume 6(3). Pp. 445-446.
- Institute for Transportation and Development Policy. (2017a). *BRT Guide*. [Online]. Available at: <<https://brtguide.itdp.org/branch/master/guide/pdf/the-brt-planning-guide.pdf>> [accessed 2019-06-10]
- Institute for Transportation and Development Policy. (2017b). *TOD Standard*. (3rd edition). Institute for Transportation and Development Policy, New York.
- Institute for Transportation and Development Policy. (2019). *Sustainable Transport Award*. [Online]. Available at: <<https://staward.org>> [accessed 2019-07-03]
- Jacobs, J. (1961). *The Death and Life of Great American Cities*. Random House, New York.
- Jiang, Y., Zegras, P.C. & Mehndiratta, S. (2012). *Walk the Line: Station Context, Corridor Type and Bus Rapid Transit Walk Access in Jinan, China*. *Journal of Transport Geography*. Volume 20. Pp. 1-14.

- Kamagi, D. & Letea, H. (2017). *JPM: Demolish Tanesco Office*. Article in The Citizen Newspaper 2017-11-16.
- Kaseke, E. (1998). *Structural Adjustment Programmes and the Problem of Urban Poverty: an African Perspective*. International Social Work. Volume 41. Pp. 311-320.
- Kropf, K. (2018). *The Handbook of Urban Morphology*. John Wiley & Sons, New Jersey.
- Lindau, L.A., Hidalgo, D. & Facchini, D. (2010). *Bus Rapid Transit in Curitiba, Brazil: A Look at the Outcome After 35 Years of Bus-Oriented Development*. Transportation Research Record. Volume 2193. Pp. 17-27.
- Loewenson, R. & Masoty, M. (2010). *What Does the Literature Tell Us? Responding to inequalities in urban areas in east and southern Africa*. in Moshi, I., Msuya, I.R. & Todd, G. (2018). *Tanzania: National Urban Policies and City Profiles for Dar es Salaam and Ifakara*. Research Report, Ifakara Health Institute, Tanzania.
- Lupala, J.M. (2002). *Urban Types in Rapidly Urbanising Cities: Analysis of Formal and Informal Settlements in Dar es Salaam, Tanzania*. Doctoral Thesis. KTH Royal Institute of Technology, Stockholm.
- Lynch, K. (1960). *The Image of the City*. MIT Press. Cambridge, Massachusetts.
- Montero, S. (2017). *Study Tours and Inter-City Policy Learning: Mobilizing Bogotá's Transportation Policies in Guadalajara*. Environment and Planning A. Volume 49(2). Pp. 332–350.
- Montgomery, B. & Roberts, P. (2008). *Walk Urban: Demand, Constraints and Measurement of the Urban Pedestrian Environment*. Transport Papers TP-18. The World Bank Group, Washington DC.
- Moshi, I., Msuya, I.R. & Todd, G. (2018). *Tanzania: National Urban Policies and City Profiles for Dar es Salaam and Ifakara*. Research Report, Ifakara Health Institute, Tanzania.
- Moudon, A.V. (1997). *Urban morphology as an emerging interdisciplinary field*. Urban Morphology. Volume 1. Pp. 3-10.
- Mulley, C. (2013). *Accessibility and Residential Land Value Uplift: Identifying Spatial Variations in the Accessibility Impacts of a Bus Transitway*. Urban Studies. Volume 51(8). Pp. 1707-1724.
- Nelson, A.C., Appleyard, B., Kannan, S., Ewing, R., Miller, M. and Eskic, D. (2013). *Bus Rapid Transit and Economic Development: Case Study of the Eugene-Springfield BRT System*. Journal of Public Transportation. Volume 16(3). Pp. 41–56.
- Neutens, T., Schwanen, T., Witlox, F. & De Maeyer, P. (2008). *My Space or Your Space? Towards a Measure of Joint Accessibility*. Computers, Environment and Urban Systems. Volume 32(5). Pp. 331–342.
- O'Loghlen, A. (2015). *The Nexus of Displacement and Urbanisation: Assessing the Asset Vulnerability and Livelihood Strategies of Urban Refugees in Dar es Salaam, Tanzania*. Working Paper C-40113-TZA-1. International Growth Centre, London.

- Patton, M.Q. (2002). *Qualitative Research & Evaluation Methods*. (3rd Edition). Sage Publications, Thousand Oaks, California.
- Perk, V., Bovino, S., Catalá, M., Reader, S. and Ulloa, S. (2013). *Silver Line Bus Rapid Transit in Boston, Massachusetts: Impacts on Sale Prices of Condominiums Along Washington Street*. Transportation Research Record: Journal of the Transportation Research Record. No. 2350. Pp. 72–79.
- Rizzo, M. (2017). *Taken For A Ride: Grounding Neoliberalism, Precarious Labour, and Public Transport in an African Metropolis*. Oxford University Press.
- Rodríguez, D.A. & Vergel, E. (2013). *Bus Rapid Transit and Urban Development in Latin America*. Lincoln Institute of Land Policy. [Online] Available at: <<https://www.lincolninst.edu/publications/articles/bus-rapid-transit-urban-development-latin-america>> [accessed 2019-06-10]
- Rodríguez, D.A. and Targa, F. (2004). *Value of Accessibility to Bogotá's Bus Rapid Transit System*. Transport Reviews. Volume 24(5). Pp. 587–610.
- Rådberg, J. & Friberg, A. (1996). *Svenska stadstyper: historik, exempel, klassificering*. Research Report. KTH Royal Institute of Technology, Stockholm.
- Smiley, S.L. (2009). *The City of Three Colors: Segregation in Colonial Dar es Salaam, 1891-1961*. Historical Geography. Volume 37. Pp. 178-196.
- Stake, R.E. (1995). *The Art of Case Study Research*. Sage Publications, Thousand Oaks, California.
- Stojanovski, T. (2015). *The Morphological Effect of Public Transportation Systems on Cities: Urban Analysis of Transit-Oriented Development (TOD) in Swedish Cities*. Proceedings of ISUF 2015 XXII International Conference: City as Organism.
- Stojanovski, T. (2019). *Urban Form and Mobility Analysis and Information to Catalyse Sustainable Development*. Doctoral Thesis. KTH Royal Institute of Technology, Stockholm.
- Stojanovski, T. & Kottenhoff, K. (2013). *Bus Rapid Transit (BRT) och Transit-Oriented Development (TOD): Stadsutveckling för effektiv kollektivtrafik*. Research Report. KTH Royal Institute of Technology, Stockholm.
- Stojanovski, T. & Axelsson, Ö. (2018). *Typo-morphology and environmental perception of urban space*. Proceedings of ISUF 2018 XXV International Conference: Urban Form and Social Context: from Traditions to Newest Demands.
- Suzuki, H., Cervero, R. & Iuchi, K. (2013). *Transforming Cities with Transit: Transit and Land Use Integration for Sustainable Urban Development*. World Bank, Washington DC.
- Talen, E. (2013). *Zoning For and Against Sprawl: The Case for Form-Based Codes*. Journal of Urban Design. Volume 18(2). Pp. 175-200.
- Tyler, N. (2017). *Safety Accessibility and Sustainability: The Importance of Micro-Scale Outcomes to an Equitable Design of Transport Systems*. IATSS Research. Volume 41. Pp. 57-65.

- United Nations. (2012). *World Urbanisation Prospects: The 2011 Revision*. United Nations Department of Economic and Social Affairs - Population Division.
- United Nations. (2016). *World Cities Report 2016 - Urbanization and Development: Emerging Futures*. UN Habitat, Nairobi.
- UN Habitat. (2013). *Planning and Design for Sustainable Urban Mobility: Global Report on Human Settlements 2013*. Routledge, New York.
- Urry, J. (2004). *The 'System' of Automobility*. *Theory, Culture & Society*. Volume 21(4/5). Pp. 25-39.
- Whitehand, J.W.R. (1967). *Fringe Belts: A Neglected Aspect of Urban Geography*. *Transactions of the Institute of British Geographers*. Number 41. Pp. 223-233.
- Wood, A. (2015). *The Politics of Policy Circulation: Unpacking the Relationship Between South African and South American Cities in the Adoption of Bus Rapid Transit*. *Antipode*. Volume 47(4). Pp. 1062-1079.
- World Bank. (2009). *World Development Report: Reshaping Economic Geography*. 43738. Washington, DC: World Bank.
- Yin, R. (2003). *Case Study Research: Design and Methods*. (3rd Edition). Applied Social Research Methods Series, Volume 5. Sage Publications, Thousand Oaks, California.
- Yin, R. (2009). *Case Study Research: Design and Methods*. (4th Edition). Applied Social Research Methods Series, Volume 5. Sage Publications, Thousand Oaks, California.
- Yin, R. (2011). *Qualitative Research from Start to Finish*. The Guilford Press, New York.
- Zegras, C., Stewart, A., Forray, R., Hidalgo, R., Figueroa, C., Duarte, F. & Wampler, J. (2016). Designing BRT-Oriented Development. in Munoz, J.C. (ed.) & Paget-Seekins, L. (2016). *Restructuring Public Transport Through Bus Rapid Transit : An International and Interdisciplinary Perspective*. Policy Press, Bristol.

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