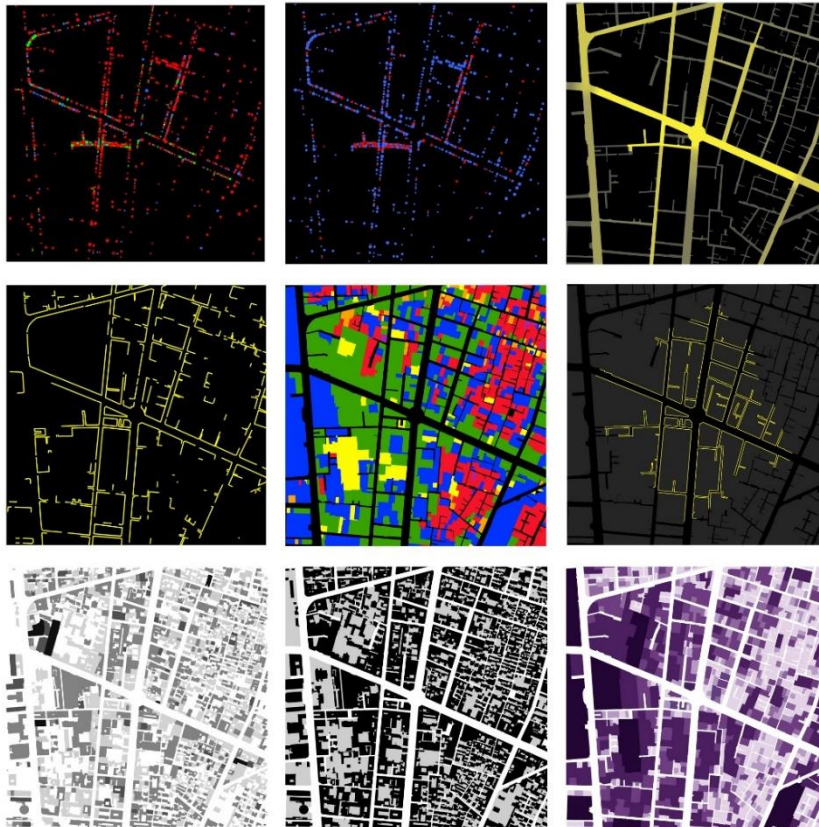


Transit and Urbanity in Tehran

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ABSTRACT

A key response to the challenges of car-dependency and urban sprawl has been to build dense, functionally mixed and walkable urban areas around existing and new transit stations – broadly defined as Transit-oriented development (TOD). While the concept of TOD has been extensively researched in Western cities, less formal and more congested cities lack empirical investigation, particularly in the ways TODs work in relation to micro-scale morphology, urbanity, informality and gender issues. This research explores the case study of Tehran to investigate synergies between urban morphology, transport modes and streetlife around five major transit nodes. It examines the ways that different modes of transport variously mesh or compete for the same networks and spaces. The study explores the relations of informal to formal transport and discusses on the prospects for formalisation. It documents the advantages that motorcycles have within this urban assemblage - capacities to slip through congested traffic and narrow streets and between different spatial networks. It also explores the ways that gender-based rules both constrain women's use of public transport and keep the system informal. Using comparative mappings of urban density, functional mix, streetlife, transport access and interfaces, the thesis explores both existing synergies between such properties and possibilities for urban design transformation.

DECLARATION

This is to certify that:

- i) the thesis comprises only my original work towards the degree of PhD,
- ii) due acknowledgement has been made in the text to all other material used,
- iii) the thesis is fewer than 100,000 words in length, exclusive of tables, maps, bibliographies and appendices.

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1. INTRODUCTION

Climate change has been broadly considered as a global concern that requires reductions in greenhouse gas (GHG) emissions from urban activities. A significant contributor to this problem are transport-related activities (Schipper et al., 2009). Addressing the challenge of reducing CO₂ emissions from a unit of transportation is not possible without understanding the prospects for transforming car-dependent cities. Much has been made of the fact that existing cities can be adapted or restructured to address the challenges of car-dependency and sprawling developments. A key response has been to build dense, functionally mixed and walkable urban areas around existing and new transit stations with the aim of reducing the reliance on the motorised private travel modes by making public modes of transport more accessible – what can be broadly defined as Transit-oriented development (TOD) (Bernick & Cervero, 1997; Calthorpe, 1993; Cervero, 1998; 2004; Curtis et al., 2009; Dittmar & Potichia, 2004; Duany & Plater-Zyberk, 1991; Jacobson & Forsyth, 2008; Loukaitou-Sideris, 2010; Newman & Kenworthy, 1999; Speck, 2013). TODs have long become one of the key urban design and planning strategies specifically in the Western cities that not only engages with transformation of the car-dependent and low-density urban morphologies, but also increases ridership by drawing more people out of their private motorised vehicles and into public transport service. Therefore, it is important to understand the ways in which urban designers and planners can most effectively engage with restructuring the built environment through intensified walkable transit nodes as a key model for a low-carbon future.

TODs are seen as significant contributors to successful urban design through interconnecting transport networks, built form and functional mix at multiple scales as well as creating public spaces with a certain level of urbanity (Dittmar & Potichia, 2004; Dunphy et al., 2004; Jacobson & Forsyth, 2008; Pojani & Stead, 2015; TCRP, 1997; Tiwari et al., 2011). To open up possibilities for intensive interactions and chance encounters around transit stations, urban environments need to be pedestrian-friendly, which requires a certain degree of density and mix of functions within a walkable distance to enable the desire to walk. To address these issues, TODs need to be considered as key nodes of local communities, a ‘place to be’ rather than only a ‘place to pass through’ (Bernick & Cervero, 1997; Bertolini & Spit, 1998; Cervero, 2015). Therefore, the research on integration of the built environment to transit networks has been developed by identifying some TODs-associated urban design features with significant impacts on encouraging

active mobility patterns, livability and place-making (Tiwari et al., 2011). Within the past few decades, a number of studies on transit-oriented developments have focused on developing urban design guidelines (see Cervero et al., 2002; Dittmar & Ohland, 2004; Dunphy et al., 2004; Ewing, 1996; Ewing & Bartholomew, 2013; TCRP, 1997). Following these studies, a large number of cities in the US and some in Canada and Australia have applied guidelines in TOD designs.

There has been an emerging view among urban scholars for reimagining the city by learning from 'a world of cities' and taking urban theory beyond 'the West' (Edensor & Jayne, 2012; Robinson, 2005, 2011). This way of thinking argues against any attempts that have remained entrenched in studying 'Western' cities, which often act as a framework against which other cities are judged (Edensor & Jayne, 2012). Building on this, the questions that become important are related to the ways in which learning from the developing cities of the global South can contribute to the debates on urban studies (Robinson & Parnell, 2012). Hence, studies on transit-oriented development (TOD) and its associated socio-spatial dimensions can be stretched to incorporate a wider range of cities, especially more densely populated and less formal ones, that lack empirical investigation.

Research gaps

The literature review identifies the following research gaps concerning transit-oriented development and urban design dimensions:

- Much of the discourse concerning TODs in the academic literature has been at the scale of policy or planning, which include factors such as scheduling and frequencies of transit services, public transport fare system, development mechanism, and regulations (Cervero, 1994; Curtis et al., 2009; Mees, 2010). However, there has been far less scholarly focus on urban design dimensions associated with TODs. Hence, investigating connections and synergies between transit-oriented built form, functional mix and walkability at an urban design scale is a significant line of inquiry that seeks further theoretical and empirical grounding.
- Of the limited studies that have constructed a good foundation for 'ideal' TOD models, often with a practical interest in their possible application through urban design, many originate from the United States (Calthorpe, 1993; Dittmar & Potichia, 2004; Dunphy et al., 2004; Ewing & Bartholomew, 2013; Jacobson & Forsyth, 2008; Loukaitou-Sideris, 2013; TCRP, 1997). Building such an understanding and specifying capacities for transformational change have been also identified as crucial in non-Western cities, particularly Asian cities (Barter, 2000; Cervero, 2013; Loo et al., 2010; Yang & Lew, 2009). However, there are limited empirical investigations in less formal and more congested cities, which struggle with the challenges of rapid urbanisation, car dependency and traffic congestion (Bocarejo et al., 2013; Kong & Pojani, 2017; Lyu, et al., 2016; Sung & Oh, 2011).
- Gender difference in the use of public spaces has been an issue of concern in the cities with large Muslim populations where gender boundaries are often framed, contested, and negotiated (Abbas, 2014; Alizadeh, 2007; Bagheri, 2014; Fadaee & Schindler, 2017; MirafTAB, 2007). Yet, there has been limited theoretical and empirical studies on transit-oriented urban design that take into account the spatiality of gender difference in relation to mobility patterns, intensities of streetlife and informal trading within public spaces around transit nodes.

- The capacity to produce intensification around major transit nodes is reliant on both existing and possible relations at different scales. Limited studies have attempted at achieving a multi-scalar and multi-disciplinary understanding of TODs, which links the shaping of urban morphology and public spaces at urban design scales to larger scales of metropolitan flows (Dovey et al., 2014; Jensen, 2014).

Research questions

The study focuses on the identified gaps and thus explores the relationships between urban morphologies, functions, transport modes and streetlife within various socio-spatial urban assemblages around transit nodes. Hence, the main question of this research is:

What are the synergies between urban morphology, functional mix, transport modes and streetlife around transit nodes in Tehran?

The study will also address the following lateral questions:

What are the existing morphological and functional mixes within walkable proximity to metro stations?

How do formal modes of public transport compete with informal modes of public transport around metro stations?

- What are the accessible areas for motorcycle taxis as the key informal mode of public transport?
- What are the accessible areas for formal public transport modes including car-taxis, BRTs and metros?

What are the existing forms of streetlife in public spaces around metro stations?

- What are the existing patterns of pedestrian flows in public spaces?
- How are public activities and gender differences manifested in public spaces?

What are the capacities for change that emerge from the interconnections between different urban design dimensions within walkable proximity to metro stations?

Research approach

This study conceptualises transit-oriented urban development as a complex adaptive assemblage. This section articulates the research approach drawing on two interlinked theories of assemblage and complex adaptive system, which are embedded in different steps of this study.

Theory of Assemblage

Assemblage thinking has its roots in the work of Deleuze and Guattari (1987). DeLanda (2006, 2016) further develops a philosophy of generation and elaborates a theory of social complexity based on Deleuze and Guattari's concept of assemblage. A more extensive notion of assemblage has been drawn from actor-network theory (ANT) (Latour, 2005) and further developed in urban studies (Farías & Bender, 2010). Drawing upon DeLanda's interpretation of assemblage theory – the ways in which assemblages of collective entities are constantly becoming – Dovey (2010, 2016) adopts this notion in urban design thinking. A review of the literature on assemblages illustrates that they are indeed contested notions, interpreted in many different ways, across various disciplines. This study undertakes assemblage thinking as a theoretical lens to better understand how transit-oriented urban environments work.

Assemblages are characterised by the relationships between parts and wholes over different scales. An assemblage is not simply a collection of parts, but rather a whole formed from the dynamic interconnections and flows between constituent parts (DeLanda, 2006). In this sense, the whole has properties of its own, which are irreducible to the properties of its component parts. In this study, a transit-oriented development as seen through the lens of assemblage thinking is dynamic – it is a socio-spatial cluster of connections and liaisons between built environment, people, traffic, activities, goods and transport services. This way of thinking with the primacy of flows and interconnectivities over 'things' is contrasted to linear and binary ways of conceptualising cities.

Assemblages are at once both material and discursive and defy any reduction to materiality or discourse (Dovey, 2010). The constant slippage between the physical forms and discursive practices of an urban assemblage requires a way of thinking that bridges between subject and object. Similar to the concepts of 'habitus' (Bourdieu, 1977) or 'structuration' (Giddens, 1984)

(see Chapter 3), assemblage thinking overcomes any separation between 'agency' and 'structure'. Structure as a stable and fixed framework can enable or constrain the capacity to act; there is an interplay between structure and agency. Sennett (2006) argues that agency in a city is in the interactions between physical creation and social behaviour. Assemblage theory takes this further by conceptualising entities such as stations, people and transport networks as heterogeneous bundles interconnecting at various scales. There is a complex series of connections and synergies within and between these elements that can both enable and constrain possibilities and capacities for change.

A key to assemblage thinking is the axis of 'territorialisation/deterritorialisation', which explains the ways in which socio-spatial boundaries are often framed, contested and negotiated. As Wise (2005, p. 79) puts it:

Assemblages create territories. Territories are more than just spaces: they have a stake, a claim . . . Territories are not fixed for all time but are always being made and unmade, reterritorializing and deterritorializing. This constant making and unmaking process is the same with assemblages: they are always coming together and moving apart.

In this sense, assemblages have on one hand territories that stabilise them and deterritorialisations that destabilise them, increasing their internal heterogeneity (DeLanda, 2006). Urban design can be seen as a territorialising process as it may embody inscribing spatial boundaries, constructing settlements and so on. Yet, deterritorialisation is a process through which territories are demolished or eroded.

The notion of the diagram in assemblage thinking can be conceived as an 'abstract machine' to show the complexities of urban assemblages as both products and processes. Diagrammatic thinking in this sense aims "to extract multiplicities from the systems in which they are actualised and mesh them together without reducing their heterogeneity (that is, give them consistency as a space)" (DeLanda, 2005, pp. 85-86). Diagrams are graphic representations of a set of relationships between different parts; patterns that connect a broad range of assembled outcomes (Dovey, 2013). Rather than representing existing objects or relationships, diagrams entail the specification of the yet to be realized connections (Allen, 1998). Likewise, mapping is considered as an abstraction that has the capacity to unravel what DeLanda (2005) calls a 'real

virtuality', which is a capacity that has not been 'actualised' yet. In this sense, while assemblage thinking focuses on the thick description of the connections that have assembled a particular urban environment, it opens up the 'space of possibility' (DeLanda, 2011). In the case of transit-oriented urban design, assemblage thinking can be adopted as an effective theoretical tool for interrogating the existing urban morphology, transport networks and urbanity within station areas and thus exploring possible forms and capacities for adaptation and transformational change.

Assemblage thinking is also a useful theoretical lens to understand the underlying processes of continuity and change in the city because it offers a series of twofold concepts – hierarchy/network, striated/smooth, tree/rhizome (Deleuze & Guattari, 1987; Dovey, 2010). What matters the most here is the dynamism between these twofolds as they cannot be separated. Formal/informal is one of the key conceptual twofold constructs that enables a rethinking of the transit-oriented urban design especially within more congested and less formal cities. Assemblage theory in this sense has the capacity to expose the in-between conditions where the boundaries between formal and informal are loosely defined. Formality indicates the ways tree-like hierarchies have been formed to generate 'striated' spaces. Informality by contrast is about the ways rhizomic structures emerge to create 'smooth' spaces. Informal and formal processes co-exist in a way that one folds into another. This also links to the demarcation proposed by Certeau (1984) between tactics and strategies. Hence, such a distinction can unravel the ways organised strategies of the state confront the self-organised tactics of citizens – what Bayat (1997) termed 'the quiet encroachment of the ordinary' – particularly in the less formal cities of the global South where informality is integral to the everyday life of cities (Dovey, 2012; McFarlane, 2012). One of the concerns of this research is to understand the ways in which the dynamics between informal/formal practices play out in everyday mobilities and urban life of transit-oriented urban environments.

Assemblage thinking has the capacity to stimulate integral approaches to design and planning through encouraging multi-scalar thinking. Understanding of urban issues in a given area is geared to the ways in which that area links with the city at various scales. For example, transport nodes and street networks are parts of transit-oriented developments, and cities are parts of larger states. Nonetheless, streets are comprised of bounding surfaces that allow different forms of flows that may be parts of larger urban networks. Hence, such assemblages can be scaled up

or down into other parts based on their functionality. Seminal to this way of thinking is that limiting any analysis of urban developments to a particular scale runs the risk of overlooking the interconnections to both smaller and larger scales. Therefore, exploring the interactions between social and spatial elements at and in-between multiple scales is significant to the most effective interventions in transit-oriented design projects.

Theory of Complex Adaptive Systems

This study also uses the theoretical lens of 'complex adaptive systems' to explore the ways in which adaptation, complexity and self-organisation play out in urban assemblages. This theory seeks to investigate the dynamics of complex systems where the system's functionality is geared to unpredictable relationships between constituent parts. As a body of theory, complex adaptive systems are associated with diverse fields of ecology, cybernetics, complexity theory, chaos theory, dynamic systems theory and resilience theory (Gunderson & Holling, 2002; Walker & Salt, 2006). A complex adaptive system is composed of numerous independent, yet interdependent agents, which behave in relatively contingent and unforeseeable ways; they are not centrally controlled so that they self-organise, responding to the other agents' behaviours. This resonates with Sennett's conception of the 'open city':

"Chance events, mutating forms, elements which cannot be homogenized or are not interchangeable – all these disparate phenomena of the mathematical and/or natural world can nonetheless form a pattern, and that assemblage is what we mean by an open system" (Sennett, 2006, p. 6).

He further argues that the thinking about complex adaptive systems is critical to animate our understandings of cities. Quoting Jacobs, "if density and diversity give life, the life they breed is disorderly" (cited in Sennett, 2006, p. 7), against the notion of closed urban forms, Sennett suggests:

"Places should become both dense and diverse, either in the form of dense streets or packed squares; such physical conditions can prompt the unexpected encounter, the chance discovery, the innovation which is the genius loci of cities" (Sennett, 2006, p. 7).

While the theory of complex adaptive systems has been broadly known and used, few applications of it appear in the studies on transit-oriented urban design and intensification of car-dependent cities. Transit-oriented urban assemblages work as complex adaptive systems in the sense that they cannot be settled into a stable structure, yet remain in a constant state of change and adaptation. Within these complex systems, the parts adapt to each other in unforeseeable manners – they self-organise. The outcomes of such complex systems cannot be forecast in advance, they ‘emerge’ from the interactions among the agents – self-organisation and adaptation (Johnson, 2002). At various urban scales including street, neighbourhood, district or city, an urban system is characterised by its emergent properties. Such an emergent regime often embodies a diversity of formal and informal processes and practices. Inherent unpredictability in systems refers to the fact that small-scale interventions can result in extensive transformations across the entire system whereas major plans for transformational change can be hindered by the system’s inherent resilience.

Rooted in ecological studies, resilience has long been defined as the capacity of a system to adapt to change without shifting into a new identity or regime (Walker & Salt, 2006). Holling (1973) makes a distinction between two different approaches to a system’s behaviour as stability and resilience. While the stability viewpoint puts emphasis on the persistence of a system close to an ‘equilibrium’ state, the resilience viewpoint indicates a dynamic behaviour of the system far from equilibrium and integration. In this sense, resilience refers to the dynamic capacity of a system to move between numerous adaptive conditions without crossing a threshold and flipping into another regime of behaviour (Gunderson, 2000).

There has been a growing interest among urban designers in using the concept of resilience to think about less vulnerable and more adaptable urban forms. Both disciplines of urban design and ecology consider resilience as a seminal metaphor to understand a city and an ecosystem (Musacchio & Wu, 2002). The extent to which urban design draws inspiration from ecology is reliant on the two key properties that cities share with organisms: recovery from a disaster (Vale & Campanella, 2005) and absorbing change (Hester, 2006). In both cities and organisms, recovery from a disaster calls for two paradigms: bouncing back to a previous state or transitioning to a preferred state (Pickett et al., 2004). The former indicates an equilibrium state attributed to capacity building and achieving normalcy. Exposure to risks has induced the need to lessen vulnerability and to promote adaptability in cities (Arefi, 2011). In this sense, post-

disaster recovery and rebuilding efforts are likely to reduce risks and vulnerability through capacity building (Musacchio & Wu, 2002). However, as argued by Pickett et al. (2004) a 'non-equilibrium' state aims to adapt to constantly changing internal/external processes rather than achieving a certain end point or maintaining a terminal status. Hence, the non-equilibrium paradigm has been outlined to suggest wider applications for the field of urban design by focusing on dynamics and processes rather than on structures and states. Within a non-equilibrium state, resilient forms are made up of parts that can adapt to new circumstances. In urban terms, a gentrifying neighbourhood might not necessarily revert to its previous status (in an equilibrium paradigm), might lose some previous residents and might find a new condition, a new character with its new residents (Arefi, 2011). In effect, this neighbourhood can adapt to new and changing set of forms, functions and forces, resulting from either top-down planned interventions or bottom-up processes (incremental changes).

Complex systems continually adapt through the cycles of change at different scales through four phases of rapid growth, conservation, release and reorganisation (Gunderson & Holling, 2002; Walker & Salt, 2006). In the adaptive cycle, 'Rapid growth' is a key phase of development. This phase gives way to the 'conservation' phase when there is a tendency to prevent further transformation. Formal codes may be enforced for protection, which produce rigidity and losses in resilience. This phase is followed by the 'release' phase when forces for change exceed the resilience of a place, codes of control are relaxed, and the place crosses a threshold and flips into a new regime. The chaotic release phase turns quickly to the 're-organization' phase where new orders start to appear. While complex adaptive systems often pass through an adaptive cycle following the discussed order, the sequence is not inevitable as they may adapt to change skipping some phases (Walker & Salt, 2006). The more predictable and stable phases of rapid growth and conservation are commonly referred to as the fore loop and the more uncertain and dramatic phases of release and re-organization as the back loop (Figures 1.1 and 1.2). The back loop is the phase of greatest potential for change and reform.

Figure 1.1. The four phases of the adaptive cycles in terms of fore and back loops (Walker & Salt, 2006, p. 82)

Figure 1.2. The possible transitions between the four phases of the adaptive cycles (Walker & Salt, 2006, p. 83)

Figure 1.3. The idea of Panarchy refers to the hierarchies of the linked adaptive cycles (Walker & Salt, 2006, p. 91)

These systems and their cycles of slow accumulation and renewal are entangled in multi-scale hierarchies – termed ‘panarchies’ (Gunderson & Holling, 2002) – both in time and space. In such hierarchies of scale, every cycle of change is interlinked with others at both lower and higher levels (Figure 1.3). Changes at larger levels are rather slow and not so frequent because their processes and structures are managed by slow variables. However, at smaller levels changes happen more frequently and faster according to the dominance of fast variables. For instance, in transit-oriented urban developments, macro scale interventions such as changes in the frequency of transit services, pricing, implementation mechanism and regulations have impacts on the ways in which a transit node operates at the micro-scale. At the smaller scales, any transformations in transit-oriented developments such as building height, functional mix and station accessibility can have impacts at the city level. Another example refers to the ways in which walking and cycling to/from station precincts at smaller scales may connect with public transport and cars at larger scales; or if formal transport services become inefficient in a given

area, informal transport services largely emerge to fill the gap. Hence, any change of these variables can have impacts or drive change at different scales. Such slow changes, whether with negative or positive impacts, might push the system towards a regime change (Walker & Salt, 2006, p. 113). In this way, the resilience of a complex adaptive system and its emergent effects demand a broad understanding of the dynamics of change within and across different scales. Systems can adapt to change by constraining or enabling change at larger or smaller scales of the system. The key challenge here would be to explore the existing connections and the capacities for transformations and adaptations.

Structure of the research

The research questions form the foundation for the study. The literature review chapters that follow this introduction provide a theoretical framework for empirical investigation of these questions. The first chapter presents a broad overview of literature on transit-oriented developments (TODs) and briefly discusses the challenges that more densely populated and less formal cities face. It then reviews the literature on urban morphology and functional mix, and the ways different functional and morphological properties can be measured. It also investigates their roles in mediating intensities of streetlife within various urban environments. The second chapter reviews the literature on spaces of everyday life, providing a brief summary of the arguments on both physical and social aspects of public spaces along with the everyday politics and gender difference in the use of these spaces.

Chapter 4 discusses the background of urbanism in Tehran, in two parts. The first part investigates the evolution of Tehran as a metropolis, addressing the ways in which urban form and social structure of the city have developed over time. The second and third parts briefly discuss the urban morphology and transport along with some of the key challenges that face the contemporary urban environments across the city, primarily car-dependency, informal transport services, traffic congestion, air pollution, gendered public spaces and socioeconomic inequalities.

Chapter 5 discusses the research design. The selection of the five case study areas and the key research methods including direct observation, fieldwork notes, visual recording (photographing and filming) and urban mapping (morphological, behavioural and isochrone) are discussed.

The findings of the study's empirical research are presented in chapters 6 to 10. Each of these chapters is based on the findings from a single case study – each telling the story of a particular urban socio-spatial assemblage. The existing synergies between urban morphology, transport modes and streetlife and embodied forms of potential for urban design transformation are explored within each case study area.

Chapter 11 brings together the key themes of the study emerging from the five case study chapters, and discusses their implications in a broader theoretical framework.

Contribution

The study contributes to urban theory by extending the existing knowledge on transit-oriented urban design beyond 'the West' and provides a solid starting point for further urban design and planning interventions. This study provides some insights from the city of Tehran that might work globally, shedding light on the issues of urban morphology, travel behaviour, urban informality, spatiality of gender differences and intensity of streetlife. The study shows that the ways TODs work in the city link to the synergies between urban morphology, transport modes, walkability and forms of streetlife at urban design scale that in turn link to the larger scale urban flows. Such a multi-scalar and multi-disciplinary approach disavows simple hierarchies, binaries and categories. It also suggests how informal modes of public transport gain advantages over other formal modes of public transport through greater capacities for transgression of formal codes. The findings of this study also inform the ways in which some urban environments have more possibilities for urban design transformation, while others have less. Therefore, no one 'formula' of transit-oriented development is applicable in all cases. The ways in which future urban areas around major transit nodes and corridors will address the complex environmental, social, infrastructural and economic challenges is geared to the understanding of the existing synergies and latent capacities for transformational change. Such an understanding thereby provides a starting point for how urban designers, planners, policy makers and local residents can balance their competing objectives.

2. TRANSIT, MORPHOLOGY AND MIX

The purpose of this chapter is to review the literature corresponding to the study aims and to focus on the ways in which research questions might be empirically investigated. As such, the literature review shapes the link between the problem statement and the methodological framework to empirical investigation. This chapter initially summarizes the existing literature on transit-oriented urban development and briefly reviews the challenges of everyday mobilities in the less formal and more congested cities. The second section of the chapter explores the literature on urban morphology and functional mix, and the ways in which each of these concepts and their associated key dimensions can be addressed within transit-oriented developments.

2.1. Transit-oriented developments

Since the 1980s, there has been an increasing interest among academics and practitioners in how existing cities might be restructured or adapted to become more socially, environmentally and economically sustainable. As such, the manipulation of physical form has been playing a crucial role in addressing the challenges of car-dependent and sprawling urban environments that characterised postwar planning. Until the late 20th century, the urban design model of the centralised compact city was congruent with the vision for a more sustainable urban form (Jenks et al., 1996). Yet, more recently, sustainable urban form has been conceived as a multi-nodal city where built environment and transit systems reinforce each other – what has often been referred to as ‘transit city’ (Calthorpe & Fulton, 2001; Newman & Kenworthy, 1999). In these cities, transport and planning policies encourage higher urban densities, functional mix and walkable urban villages, which can best be integrated with the major transit stations (Newman et al., 2009). In this way, the degrees of functional mix and urban densities are the highest around these transit nodes and decrease gradually as one gets further away from them (Calthorpe & Fulton, 2001; Dittmar & Potichia, 2004; Newman & Kenworthy, 1999). In this pattern, different parts of the city are interlinked across different scales via orbital and radial transit networks as illustrated in Figure 2.1.

Figure 2.1. Transit city (Newman & Kenworthy, 1999, p. 185)

One way to adapt the existing city to the urban village vision is through building dense, mixed use and pedestrian-friendly urban areas with attractive public spaces in proximity to existing or potential transit – which is often termed ‘intensification’ (Burgess & Jenks, 2002; Williams et al., 1999). Intensifying an urban area is more than simply densifying it through increasing built densities. It is about the more efficient use of urban land and the intensification of urban morphology, functional mix, activities and transport flows around existing and new transit networks. Strategies of urban intensification have been commonly promoted over the last few decades in North American, European and Australian cities. Intensified projects are typically mixed use with medium to high-density urban developments built into established areas, which previously had accommodated low-density developments or underutilised spaces such as warehouses, parking lots and abandoned industrial sites. Hence, where such projects are located within walkable proximity to major transit nodes and corridors, they are generally called ‘transit-oriented developments’.

2.1.1. Defining TODs

There are various terms referring to the concept of urban developments around transit. Spanning from neighbourhood to regional scales, these catch phrases include ‘pedestrian pockets’ (Calthorpe, 1993), ‘transit metropolis’ (Cervero, 1998), ‘transit-sensitive land use’

(Beimborn & Rabinowitz, 1991), 'transit villages' (Bernick & Cervero, 1997), 'transit-focused development' (Porter, 1998), 'transit town' (Dittmar & Ohland, 2004), 'network city' (Curtis, 2008), 'nodal/information city' (Newman & Kenworthy, 1999), etc. TODs are the most commonly used that have been formally introduced in the early 1990s by Calthorpe, an urban designer and the first board president of the 'Congress of New Urbanism'. He has defined and codified TOD in his seminal work, *'The Next American Metropolis: Ecology, Community, and the American Dream'*, which has since come to epitomise the theoretical and empirical TOD investigations (see Bernick & Cervero, 1997; Calthorpe & Fulton, 2001; Duany et al., 2001). According to Calthorpe (1993), TODs are a constellation of interdependent urban centres connected through high-capacity transit networks. His main contribution in redefining the conceptual models of urban and suburban developments conveys the urban design principles associated with TOD: "A Transit-Oriented Development is a mixed-use community within an average 2,000-foot walking distance of a transit stop and a core commercial area. TODs mix residential, retail, office, open space and public uses in a walkable environment, making it convenient for residents and employees to travel by transit, bicycle, foot, or car" (Calthorpe, 1993, p. 56). Since then, TODs have been promoted as an influential urban design and planning approach to transformational change, providing opportunities to resolve transportation and land use challenges at once (Dittmar & Ohland, 2004). While the term TOD is commonly used as a form of development close to or oriented towards rail services (including light rail, heavy rail or commuter rail systems), it may also be referred to as bus-based developments. In this sense, Bus Rapid Transit (BRT) systems have become increasingly crucial in the global campaign for their potentials in adding value to the whole network through intensified walkable transit corridors (Cervero, 2013). This is partly linked to the fact that BRT systems can be built at a more rapid pace and a much lower cost than the heavy-rail transit systems. In Latin America, for instance, investments in BRT services in recent decades have encouraged transit-oriented intensification in cities such as Bogotá, Curitiba, São Paulo and Mexico (Ratner & Goetz, 2013). In sum, while the language of TODs includes a wide range of catchphrases, no single and all-encompassing definition does exist that can represent this urban assemblage in its different forms. Cervero et al. (2002) argue that despite to the varying scope and details in TOD definitions, most share a number of common traits including mixed-use urban environments that are accessible and well served by transit. An important issue here refers to the fact that physical features of these developments are necessary, although insufficient, to achieve the extensive goals of TODs, which are not only focused on creating built environments, but also in

creating more vibrant public spaces with rich mix of activities and user groups (Dittmar & Potichia, 2004).

A key distinction that has been current in 'smart growth' literature refers to the differences between transit-oriented development (TOD) and transit-adjacent development (TAD) (Belzer & Autler, 2002; Cervero et al., 2002; Dittmar & Ohland, 2004; Renne, 2009; Vale, 2015). Both concepts of TOD and TAD indicate the area within walkable proximity (ca. 800 metres radius) to a key transit node (Renne, 2009). While a TOD refers to the station-area precinct that is functionally mixed, compact and transit accessible, and is translated into a higher mode share of transit, walking, and cycling (Hale, 2014), a TAD refers to a development, which is "physically near transit [but] fails to capitalise upon this proximity ... [it] lacks any functional connectivity to transit – whether in terms of the land use composition, means of station access, or site design" (Cervero et al., 2002, p. 6). Belzer and Autler (2002) argue that many US rail station precincts have "single-use development patterns, with conventional parking requirements, ... and designed explicitly to work with the automobile". Such a reality is further discussed by Renne (2009, p. 1) who suggests that most transit stations fall in a TAD-TOD spectrum and points out that "... nearly 97% of rail stations in the USA ..." are probably TADs, not TODs. In his study, some station precincts are selected along the TAD-TOD spectrum. The selected urban or suburban areas around existing rapid transit stations are more or less TODs. In sum, he concludes that urban design dimensions of station precincts are strongly correlated with the mobility patterns and vehicle ownership trends. Therefore, more TAD like station areas can be intensified to transition from a TAD into a TOD.

2.1.2. Transit-oriented urban design

Much of the discourse concerning transit-oriented developments in the academic literature has been focused on policy or planning, including factors such as scheduling and frequencies of transport services, coordination of land use and transportation, financing, development mechanism and regulations (Cervero, 1994b; Curtis et al., 2009; Dumbaugh, 2004). Others concentrate at the regional planning scale, pointing out that a TOD would only make sense through its connection to other TODs and to the regional urban centres (Calthorpe & Fulton, 2001). However, scholarly focus on urban design issues associated with transit-oriented developments has been relatively limited to date. Much of the key research in this context has

originated from the United States and is motivated by pioneering work of Calthorpe (see Dittmar & Potichia, 2004; Dunphy et al., 2004; Ewing & Bartholomew, 2013; Jacobson & Forsyth, 2008; Loukaitou-Sideris et al., 2013; TCRP, 1997). These studies do not consider a TOD as a simple transport-land use balanced area around a major transit node, but rather they have focused on the ways in which land use could be well integrated into the wider transit system through identifying the urban design features associated with TOD. This in a way promotes the use of active mobility modes over the use of motorised private modes and potentially creates vibrant public spaces. Within the past few decades, a number of reports were published on transit-oriented developments with a focus on urban design guidelines (see Cervero et al., 2002; Dittmar & Ohland, 2004; Dunphy et al., 2004; Ewing, 1996; Ewing & Bartholomew, 2013). Following these reports, a large number of cities in the US and some in Canada and Australia have applied guidelines in TOD designs (see City of Calgary, 2004; State of Queensland, 2012; TransLink, 2012).

There have been a number of prescriptive studies of policies to date in relation to TODs. However, limited comparative and systematic studies appear with the focus on fine-grained urban design issues inherent in TOD projects. Among the limited studies identified, a detailed TOD analysis has been undertaken by Jacobson and Forsyth (2008), who evaluated design guidelines for existing TOD projects and offered a set of 'good practices' for transit-oriented urban design with broader applicability. Informed by the existing literature regarding the post-hoc urban design operational definitions and measurement protocols (Ewing & Clemente, 2013; Porta & Renne, 2005), the study categorised the key urban design dimensions and practices of TODs under three key themes of 'development process', 'facilities' and 'urban place making'. Then, a subcategory of these themes was made under 12 dimensions, which often borrowed from the principles common in Neotraditional and New Urbanism such as intermixing of functions, permeable access networks, moderately high-density developments, safer and more pleasant walkways from and to the stations and priority for using active modes of transport. A study in Netherlands showed the extent to which TOD elements can be translated into urban design in a Dutch context (Pojani & Stead, 2015), using a similar approach to Jacobson and Forsyth (2008). The findings of this study show that while the 'ideal' transit-oriented urban design in Netherlands reflects in part its global counterparts, some culture- and context-sensitive issues appear that may impede the direct transpose of design guidelines from place to place. Another comparative study has been undertaken by Loukaitou-Sideris et al. (2013), which

seeks to identify design interventions that can help elevated and freeway-median light rail transit (LRT) stations better connect to their surrounding urban fabric. The study proposes a fine-grained typology of elevated LRT stations according to a mix of built form variables and a 'thick description' of each station and its adjacent developments. It then develops design remedies based on a review of urban design interventions across various contexts that have been successful in integrating elevated LRT stations with surrounding built environments and increasing their level of accessibility. While all these references at urban design scale offer valuable insights on the future TOD projects, emphasizing social, formal and functional diversities in the design process, their applicability outside Western cities lack empirical investigation.

2.1.3. Challenges to everyday mobilities in the cities of the global South

The mobility challenges in today's cities of the global South are significantly different from those in Western cities, and so are the challenges to integrating urban design issues and transport networks. As argued by Ewing and Cervero (2010), the 5 Ds – density, design, distance to transit, destination accessibility and diversity – have gained popularity over the past decade for investigating the ways in which built environment can have impacts on travel behaviour especially in cities in the US. However, far less is known on this subject in more congested and less formal cities. There are some significant issues in dealing with transit-oriented urban design within the cities of global South that are briefly addressed here.

Central to the mobility challenges in the cities of global South is the use of informal motorised modes of transport and their relationships with formal modes, which remain enduring yet relatively under-investigated. In these cities, informal transport services have become the burgeoning form of mobility with motorcycle-taxis as the most common public transport (Cervero & Golub, 2007; Kumar & Barrett, 2008). The proliferation of informal public transport in the developing cities of the global South is in part the result of the inefficiency of the formal public transport services (Silcock, 1981; Sopranzetti, 2013). The informal transport vehicles are often formally registered, yet are not formally approved for providing transport service to the public. In most of such cities over half of everyday mobilities are informal (Cervero & Golub 2007). Prominent informal types vary from motorcycle-taxis and three-wheelers to vans and minibuses. Despite the fact that these services are often unsanctioned, they thrive in the

developing world, and their rapid growth can outpace that of formal public transport services (Sengers & Raven, 2014). They not only play a significant role in facilitating everyday mobilities but also constitute a key part of a much broader informal economy as they provide job opportunities for the poor and low-skilled rural-to-urban migrants (Sengers & Raven, 2014; Tiwari, 2005; Peters, 2013). Despite their centrality to the ways in which many TODs work in the cities of the developing world, their relationships with formal modes of transport remain enduring yet relatively under-studied.

Motorcycle-taxis are one of the fastest growing informal modes of transport in recent decades; this increasing popularity is geared to their capacity to fill the gaps of the formal public transport services, offer a fast and on-demand mobility, charge reasonable fares, and adapt to market demands (Cervero & Golub, 2007; Guillen & Ishida, 2004; Oshima et al, 2007). Their initial role of being a 'gap filler' in many developing cities, has turned into an established practice, operating as the backbone of some urban transport systems (Peters, 2013). A key advantage of motorcycles over the formal transport services relies in part on their capacity to circumvent regulations and transgress the formal codes of the city. Self-organised motorcycle-taxis are often more flexible to shifting market demands as they easily alter routes and schedules (Cervero, 2000; Guillen et al, 2013; Sengers & Raven, 2014). The ability to manoeuvre through congested traffic, sidewalks and narrow laneways provides further advantages.

Motorcycle-taxis also contribute problems such as air and noise pollution, traffic chaos and congestion (Barter, 2000; Godard, 2011; Guillen & Ishida, 2004). They can increase the chance of road accidents and pose a threat to vehicular and pedestrian traffic safety (Kisaalita & Sentongo-Kibalama, 2007). Motorcycle-taxis are a highly gendered mode of transport with drivers almost exclusively male (Peters, 2013). The association between motorcycle driving and masculinity is one of the most common practices of motorcycle use in everyday life, as argued by Pinch and Reimer (2012). Patrons are of mixed gender in most cities (Cervero, 2000; Oyesiku & Odufuwa, 2002) but there are often sanctions against the female use of motorcycles in cities with large Muslim populations (Peters, 2013).

2.2. Functional mix

Functional mix or land-use mix is about the flows and synergies between different uses of housing, working and amenities (Dovey & Pafka, 2017; Hoek, 2008; Nes, et al., 2012; Yu & Nes, 2013a, 2013b). Conzen identifies functional mix as a basic layer in town plan analysis (Moudon, 1994). The literature has seen the call for connecting the mix of functions, building ages and lot sizes in urban environments to different conditions of urbanity and socio-economic productivity for over 50 years. In this sense, Jacobs (1961) argues that a mix of primary and secondary uses and different forms of co-functioning between them are necessary to maintain streetlife vitality as it assures the ebb and flow of pedestrians over a given streetscape at different times throughout the day. She furthers her discussions by criticising zoning and the damage to the city by modernist planning by designating large areas for single functions.

Jacobs' thinking motivated a wave of urban planners such as new urbanists who stressed the significance of functional mix within North American planning (Grant, 2002). More recently, there has been an increasing interest from researchers in transport planning and public health who attempt to outline functional mix as a key condition to neighbourhood walkability and physical activity (Cervero & Kockelman, 1997; Frank et al., 2005). Functional mix has been also seen as a key criterion of urban design and planning necessary for the success of TODs in global literature. Accordingly, it has been broadly argued that a higher degree of functional mix and a better integration of that with transport nodes often encourage a higher use of active transport modes and reduces the dependence on private vehicles in station precincts (Belzer & Autler, 2002; Calthorpe, 1993; Cervero et al., 2002; Chatman, 2013; Curtis et al., 2009; Dittmar & Potichia, 2004; Holtzclaw, 1994; Krizek, 2003; Newman & Kenworthy, 1999; Renne, 2009). A study showed that station sites with rich mix of retail activities can produce the most walkable urban areas (Loutzenheiser, 1997). In sum, a sophisticated understanding of the functional mix across different scales and within different urban morphologies can be useful in promoting public health, transport, urbanity and socio-economic productivity in cities.

Functional zoning codes generally demand separation of residential from other uses and limit mixed-use developments potential for encouraging local retail and transit connectivity across the metropolitan scale (Knaap & Nelson 1992). Frank et al. (2006) argue that subdivision controls often support less permeable street networks with cul-de-sacs over more permeable grid

layouts. This condition results in long distances between areas people work, live and visit, which is often associated with a significant increase in the number of private vehicle journeys as well as levels of air pollutants. Hence, encouraging mixed-use development along transit corridors matters fundamentally to reclaim cities from automobiles, which relies on introducing mobility strategies beyond the private vehicle. Hence, the mobility choices of walking, cycling, or using public transport to mixed areas of work, shopping and housing encourage people to forego costs of buying and maintaining a private vehicle and reduce its potential adverse environmental impacts.

It is not an easy task to categorise, quantify and map functional mix in the city. There have been many attempts at defining this mix in different ways such as primary (e.g. employment, residential and service) and secondary functions (e.g. restaurants, shops, pubs, etc.) (Jacobs, 1961); live, work, recreation and infrastructure (Corbusier, 1957); residential and non-residential (Hoek, 2008). To map the mix of uses, standard categories generally incorporate residential, commercial, industrial, education, retail, entertainment, etc. with many possible subdivisions (Schwanke, 2003). There are many challenges with the traditional functional categories, often derived from modernist zoning principles and designed to separate uses (Dovey & Pafka, 2017). One of these challenges is about the ways in which different uses are categorised. There are often overlappings between different functions and thereby drawing a line between various categories may not be a straightforward task. Another challenge refers to the number of categories as the application of many categories cannot be useful in producing legible maps. There have been few attempts that considered the issue of the vertical mix in the produced two-dimensional maps, which is another challenge in mapping functional mix. Among the limited studies identified, Hoppenbrouwer and Louw (2005) developed a typology of mixed-use urban development focusing on the dimensions of vertical/horizontal (vertical vs. horizontal functional mix), time (different functions throughout a day, week or year) and shared premises (various functions in the same space). This links to the fact that the term 'functional mix' is favoured over 'land use mix' in this study. Further, 'land use' indicates the idea that each land parcel incorporates a single use and favours the larger scale over the smaller one (Dovey & Pafka, 2017).

Functional mix as a generator of flows and synergies between different uses is a multi-scalar and multi-criterion concept. This means that while functional mix can be examined at the

neighbourhood scale (Jacobs, 1961), it can also be measured at the larger (e.g. district and metropolis) and smaller scales (e.g. lot), which may produce different results.

Measuring functional mix (entropy, dissimilarity, destination-based and MXI)

There has been a recent interest among researchers in using computational approaches to quantify various degrees of functional mix. The measure of 'entropy' has been often used in transport planning and public health studies (Cervero, 1989; Cervero & Kockelman, 1997; Frank & Pivo, 1994). This measures the extent to which the distribution of floor areas among several functional categories is even in a given area (Frank & Pivo, 1994). The studies that have used this metric generally measure functional mix within a 'network buffer' or a commuting distance and select various categories such as single housing, multiple-family housing, office, retail, entertainment, institutional and manufacturing (Cervero & Duncan, 2002; Frank & Pivo, 1994). While entropy is a measure of balance between different functions (Kockelman, 1997), it has been criticised for not accounting for the type and degree of functional mix (Krizek, 2003). This means that the metric does not differentiate between a mix of retail and service-based functions and a mix of office and manufacturing functions. Similarly, a study area with 30 percent housing and 70 percent retail or any service-based function would be treated the same as if those uses had reverse proportions (Hess et al., 2001).

The 'dissimilarity' index is another metric developed by Cervero and Kockelman (1997), which assigns a dominant function to each hectare of the city and quantifies its degree of difference from the adjacent hectares. In a 3x3 grid, the larger the number of neighbouring squares with functions different from that of the central square is, the larger the dissimilarity value of the central square is. Nevertheless, Hess et al. (2001, p. 18) argues that "the index is a measure only of whether adjoining squares are different (or not) from the central square and therefore is insensitive to the number of uses that are different from that of the central square". A contradiction here is that a consistent mix of functions including residential, industry and retail throughout the 3x3ha would result in the lowest dissimilarity value (Dovey & Pafka, 2017); or a mix of office functions in a 3x3 grid with a central residential function would produce a high dissimilarity value.

Destination-based measures consider functions as potential destinations and focus on their density and average walkable catchment (Brown et al., 2009). A wide range of the walkable destinations such as transport stations (Brown et al., 2009), retail employment centres (Krizek & Johnson, 2006), parks and other recreations (Giles-Corti et al., 2003) have been argued to encourage walking and physical activity among residents. The destination-based approach does not treat all the different functions the same as their degree of attraction is not even. For instance, office establishments attract lower flows of residents than retail/employment spaces (Brown et al., 2009). In sum, it is not an easy task to specify in advance a succinct set of destinations that correlate with increased walking. Therefore, reducing all the complexity inherent in destination-based thinking to a simple metric can be controversial (Dovey & Pafka, 2017).

To provide a way to describe, compare and measure functional mix across different urban environments, Hoek (2008) suggests the concept of Mixed-use Index (MXI). He reduces the complexity of functional mix in any given area to a single index, using a quantitative approach in terms of the proportion of housing functions vs. non-housing ones by floor space. The MXI value varies from 0 to 100. He compares urban areas in Amsterdam with varying development periods, arguing that there is a strong connection between the centrality of urban districts, their character and the MXI. In this way, he concludes that within the 19th-century urban districts, the MXI can reach the range between 70 and 80. The late 19th-century urban areas get an MXI of about 85. The more modernist suburban developments will have an MXI of 90/95. Indeed, he suggests a proportion of 50/50 to create a vibrant urban district. The MXI index was later developed (Mashhoodi & Berghauser Pont, 2011; Nes et al., 2012; Yu & Nes, 2013a) using a triangle-shaped model of functional mix with the three main categories of working, dwellings, work and amenity. The triangle entails primary colours (mono-functional areas), mixed colours (bifunctional areas) and the mix of three main functions (multi-functional areas) (Figure 2.2). In this index, dwellings are where people live (red), industries and offices are where people work (blue) and parks, theatres, shops and mosques are places of visitation (yellow). However, four other mixed conditions also exist: workshops are primarily places where products are produced and sold (green), schools and offices are publicly accessible amenities (green); dwellings are mixed with retail (orange) or with business (purple). Figure 2.2 shows an example of the degree of urban mix between various functions in a case study within the city of Rotterdam (Nes et al., 2012). Dovey (2016) has further developed this method, arguing for the replacement of the

generic term of ‘amenities’ by the concept of ‘visit’ as ‘amenity’ can incorporate both living and working areas. He argues that this model is a simple yet innovative method compared to the previous measures as it can differentiate between various kinds of mix. While the suggested mapping index is successful in unravelling productive differences between various functions and in addressing most of the problems with previously mentioned metrics, some limitations may arise that needs further investigation. For instance, this model does not differentiate between different uses in terms of their level of attraction or intensity of use. In effect, the method does not capture entries to various functions as sources and destinations of pedestrians. Some functions may not easily fit in one of the specified categories of working, housing and amenities using the MXI diagram.

Figure 2.2. Functional mix triangle (left); the degree of mix between amenities, working and housing in Rotterdam (right)
(Nes et al., 2012, pp. 7-16)

2.3. Urban morphology

Discussions of urban morphology have intrigued most urban theorists linking urban form with city life. Urban morphology plays a seminal role in shaping urban environments, dealing with the spatial composition, access networks and emergent urban intensity at different scales, generally through the instruments of design and planning codes. Urban morphology in its broad explanation involves the articulation of both urban form and structure as argued by Marshall and Caliskan (2011). Drawing on Moudon (1997, p. 7), a city “can be read and analysed via the medium of its physical form”, which can be studied for explanatory/descriptive, prescriptive and critical analysis purposes. Similarly, Marshall and Caliskan (2011) address the main applications of urban morphology as explanatory/investigative, evaluative/diagnostic and identificatory. It is the latter of these three that helps to identify elements, types and patterns of the urban form

used as design units. Therefore, a poor understanding of urban morphology can result in poor design interventions (Marshall & Caliskan, 2011; Talen, 2014).

In her seminal book, Jane Jacobs (1961) identifies four key conditions – mixing of primary and secondary uses, aged buildings, short blocks, and concentration – that maintain diversity and mediate social encounters. Later studies by Whyte (1980, 1988) and Gehl (1987) provided detailed and clear analysis of the features of those public spaces that attract people and make them want to linger. More recently, Yu and Nes (2013a) propose a combination of different ranges of functional mix and morphological elements including density and street network configuration, which has impacts on the degree of urbanity within urban environments (Figure 2.3). In sum, a sophisticated understanding of the interrelations between density, access network and mixed-use is likely to provide a more objective basis for the further urban design intervention and the process of decision making (Mashhoodi & Berghauser Pont, 2011).

Figure 2.3. Different ranges of functional mix and urban morphology that mediate socio-economic performance of an urban area.
Source: adapted from Yu & Nes (2013a, p. 20).

As the history and application of urban morphology extends much further back in history, this study provides a summary of the systematic studies of urban form with a focus on

the English, Italian and French morphology schools. The study will then review the literature on the relationships between functional mix, density, access network and intensity of streetlife drawing on Jacobs' (1961) framework.

Three schools of morphology, initiated separately in England, Italy and France in the mid-20th century to provide a foundation for transdisciplinary studies of urban form and expand opportunities for laying a common theoretical grounding for urban morphologists around the globe. The separate evolution of these schools due to the language barriers changed into intensive international exchange by the start of International Seminar on Urban Form (ISUF) since the 1990s to address the concerns of city buildings (Moudon, 1997).

The English school came into existence as a result of the seminal contributions of German geographer, M.R.G. Conzen, who emigrated to England before World War II. The detailed and rigorous town plan analysis of Alnwick is among his most influential works, which opened up a new conceptual pathway of research (Moudon, 1997). His work offers a new and complex theoretical conception of "morphological evolution, structure and interrelationships between the townscape's basic elements" (Larkham and Conzen, 2014, p. 7). While his work does not include the normative dimension of design and planning in contrast to the Italian and French schools, it primarily focuses on the research-based analysis of urban form. As his legacy, Conzen identifies three key elements of morphological analysis as buildings, lots and streets (Moudon, 1994). His studies also include the analysis of town plans over time and explaining them as multi-layered stratifications of urban form patterns due to differences in socioeconomic settings as well as their historic formations.

The Italian school emerged following the architect Muratori, whose most seminal contribution lies in the historical typomorphological analysis of Rome and Venice (Moudon, 1994). His student, Caniggia, continued the Muratorian legacy, extending his research to a wider range of cities within Italy and Northern Africa. He used a multiscale approach to identify the key built objects, including building, a group of buildings, city and region. Each of these is conceptualised as a complex assemblage of elements, systems and structures. He suggests studying the built objects from the scale of a single building to the scales of the territory to better understand the links between urban morphology and design practice. Such thinking is linked to the distinction between "individual objects and aggregate of parts", which is seminal to the understanding of

“urban morphological concept of the hierarchy of elements (levels of scale)” (Kropf, 2014, pp. 315-316). This distinction has been seen in both Conzen and Caniggia’s works. The Muratorian school principally influenced architects such as Rossi, Aymonino, Scolari and Gregotti (Moudon, 1994).

While the two early schools of urban morphology in England and Italy respectively involved human geographers and architects, the French school emerged in a distinctive intellectual environment at Versailles (Moudon, 1997). In this sense, geographers, planners, historians, sociologists and architects worked together to achieve a better understanding of the ways in which the city works. While the Versailles school evolved out of a reaction to the modernist morphologies and their rejection of history with close links to the typomorphological Italian school of urban analysis, it remarkably benefited from broader theoretical discourses on everyday life, which was raised by the seminal work of Henry Lefebvre (Panerai et al., 2004). His work inspired many architects and urbanists such as Castex, Panerai and Depaule calling for an approach that emphasises a socially responsive and responsible architecture (Moudon, 1994). Theoretically, there are some issues that the French school seeks to address: the possible relationships between the objective (material) structure of form and the subjective (experienced) aspects of that, and the distinction between historical urban types (consecrated types) and the modernist prototypes (typical plans) (Moudon, 1994). While the types incorporate a mix of formal solutions in response to the functional problems in different periods of history, the typical plans are basically a mix of standards and norms proposed to guide the future production (Moudon, 1994, p. 305).

2.3.1. Urban density

The concept of density in urban research indicates the relationships between an area and certain entities in terms of dwellings, people and floor space (Berghauser Pont & Haupt, 2010). Urban density has been largely addressed in urban theory and practice, yet poor understanding and confusion about this concept have led to various applications (Berghauser Pont & Haupt, 2010; Nes et al., 2012). It has been argued that despite the wide range of research on density, there have been fewer attempts that could compare different measures of urban density and connect them with urban studies (Dovey & Pafka, 2014). Jacobs’ (1961) work has been seminal to the understanding of the links between dwelling, internal and streetlife densities. In her work,

density is identified as a key condition for urban diversity. She takes this further by arguing that a density of nearly 250 dwellings per hectare is a necessary yet insufficient condition that encourages a high volume of streetlife and walkable access to mixed-use urban developments. She also suggests a high lot coverage of 60 to 80 percent, suggesting that densely built, low-rise urban morphologies can bring more people out into the streets relative to high-rise modern developments.

Berghauser Pont and Haupt (2010) have proposed a 'space matrix' as a three-dimensional model of density arguing that a single measure of density cannot fully describe city areas. Therefore, in their definition, urban density has been identified as a multi-scale and multivariate phenomenon, incorporating the correlations between network density, floor area ratio and land coverage. These measures describe the typomorphology of urban areas, capturing the building types and street patterns. Berghauser Pont and Haupt use a two-dimensional representation of the model (Spacemate) as the three-dimensional projection was not useful. Hence, they added a set of co-dependent measures including building height, open space ratio and the size of urban blocks to the FSI/GSI spacemate, which could facilitate the representation of the correlations between built density and urban form. The key issue here indicates that density is not a single measure that matters, but rather is a part of a larger assemblage wherein formal, functional and social mixes as well as access networks and socio-cultural contexts are of great significance.

Dovey and Pafka (2014) conceptualise urban density as a multiplicitous assemblage that cannot be reduced to any particular entity such as populations, buildings or public open space (Table 2.1). Their main objective is to develop a model, which can inform the ways in which density and urban intensity are correlated. Such a model enables comparison across different cities of global North and South as well as formal and informal housings. The diagram in Figure 2.4 represents the ways in which various measures of density are contrasted across different urban morphologies at the scale of one hectare. There are four different dimensions incorporated in building density, two in people density and one in open space density. There are also four different morphologies including informal, formal, urban and suburban. In sum, this multi-dimensional diagram illustrates that there are many variations between different density measures, noting that no single measure can predict another measure or a distinct urban type.

Table 2.1. Common measures of density based on Dovey and Pafka (2014, p. 2).

Figure 2.4. Comparing density measures profiles across different urban morphologies (Dovey & Pafka, 2014, p.74).

The ways in which the boundary of an area is defined can become problematic in measuring density (Berghauser Pont & Haupt, 2010). Linked to the discussion of the boundary are the questions of scale and streetlife intensity. In this sense, all measures of density, which are categorised into buildings (height, floor space index, dwellings/ha and footprints), people (jobs/ha, residents/ha and visitors) and open space (streetlife) can become ambiguous and

subject to change from place to place unless one defines the scale at which such measures are examined and distinguishes between gross and net densities (Dovey & Pafka, 2014; Berghauser Pont & Haupt, 2010). While density measures of floor area ratio and dwellings per hectare are broadly adopted at both gross and net scales within various contexts, a key issue here is that these two should not be confused with each other. Jacobs' (1961, p. 211) call for a dwelling density of nearly 250 dwellings per hectare (100 per acre) to produce urban diversity has often been the source of misunderstanding – this was a net measure yet she was discussing for a gross outcome under conditions of functional mix, permeability and small grain morphologies (Pafka, 2014).

It has been argued that while density measures of floor space index (FSI), ground space index (GSI) and open space ratio (OSR) can indicate the housing typologies, they cannot predict the degree of urbanity (Hoek, 2008). Dovey and Symons (2014) take this further by outlining the syndrome of 'density without intensity' – the potentiality for intensive streetlife might be constrained by the reduced or dismissed relationships between density, functional mix and street networks. In an urban design context, density differs entirely from intensity where neither of them can necessarily stand in for the other. While density indicates the degree of concentration by buildings, people and activities, intensity is about the 'temperature' of cities that is not quantifiable (DeLanda, 2002). Intensity refers to an emergent effect (DeLanda, 2006; Marshall, 2009), which arises from differences, alliances and synergies between the people, urban morphology and activities.

Many studies have long recognised that seminal to the creation of TODs is increases in density above the average density found in suburban morphologies. In simple terms, "mass transit needs mass" (Bernick & Cervero, 1997, p. 74). A number of studies have argued that medium- and high- density station precincts are more likely to contribute to the successful TODs as they induce people to walk, cycle and use public transport (Cervero et al., 2002; Frank & Pivo, 1994; Moudon et al., 1997; Newman & Kenworthy, 2006). In a study that investigated the relationships between different variables such as job densities, functional mix and everyday travel patterns, Cervero (1994a) showed that at higher density working areas, transit users had a higher share of walk journeys. In their seminal work, Newman and Kenworthy (1999) argued that urban densities within different urban developments are significantly correlated with transport-related carbon emissions.

New Urbanism and Smart Growth have been among the most influential movements that emerged as a reaction to high-rise modernist developments and low-density suburban morphologies emphasising on the notions of creating mixed urban social densities and building extensive city-oriented coalitions. Duany and Plater-Zyberk (1994) argued that such an approach considers the new logic of urban density as a social value, often derived from a mix of building types, people, functions and open spaces in walkable neighbourhoods. From this perspective, density in most North American cities is narrowly connected to the economic benefits – particularly parking-related incomes; as argued by Duany “Density is parking, parking is density, parking is profits, parking is power: everything is controlled by parking” (quoted in Fainstein & Campbell, 2002, p. 370). For Duany, this form of density needs to be replaced with a form that encourages the use of public transport services rather than private motorised vehicles. For the aim of this research, the intersections of density as constituted from a mix of mixes (buildings, groups of people, activities, transport networks, etc.) with other urban design properties are where existing synergies and capacities for transformational change are to be explored.

2.3.3. Access network

Accessibility answers the key question of how people navigate the urban movement network. Since urban morphology mediates different flows and movements, it is critical to understand the spatial structure of access networks. This argument parallels what Hillier (1996) calls “movement economies” in which the visibility and nature of spatial relations condition movements with the latter generating socio-economic activities. The correlation between the spatial configuration of street networks and urban movements contributes to socio-economic initiatives in the development of cities. At the neighbourhood scale, a mix of different mobility modes including pedestrian movement become important. It is at this scale that building footprints and public open space networks mediate accessibility. In this sense, Marshall (2005) outlines permeability as the degree to which a particular urban area is ‘permeated’ by publicly accessible space. This concept refers to the ease of pedestrian movement within the urban fabric and ensures that pedestrians have multiple route choices between any two places. For Jacobs (1961) access is more about the permeability enabled by ‘short blocks’, which enables walkable access to diverse urban attractions; from her point of view, multiple options of public spaces with intensive interconnections encourage intensities of streetlife and economic productivity.

An effective urban pedestrian network is often normatively identified by block length of about 60-90 metres (Whyte, 1980, p. 318) and a maximum of about 100 metres (Jacobs, 1961, p. 184) in Western studies. An important issue here is that very small block lengths would inhibit potentials for density and active urban frontages as argued by Pafka and Dovey (2017). The concept of neighbourhood permeability is linked with the notion of 'pools of use' coined by Jacobs (1961). This notion refers to the functions accessible within a walkable catchment of a specific location measured by time or distance.

Measuring access networks

The early attempts to measure accessibility of a pedestrian network incorporated the average block area (Hess, 1997; Krizek, 2000; Schmidt, 1977), perimeter (Fowler, 1987), length (Cervero & Kockelman, 1997), diagonal (Stangl, 2015) and number of blocks within a given area. Such measures that assume a morphology based on 'blocks' can become problematic when it comes to studying different urban morphologies. Other popular metrics for measuring the connectivity of the walkable environments indicate the total length of streets per area (or 'network density') (Berghauser Pont & Haupt, 2010) and the total number of intersections per area (or 'intersection density') (Handy, 1996; Cervero & Kockelman, 1997). The former of these measures has been criticised for not differentiating between various types of access networks in terms of their interconnectivity levels and the latter for not differentiating between various intersection types (e.g. difference between a 4-way intersection and a T-junction) (Pafka & Dovey, 2017). Another measure has been introduced by Pafka and Dovey (2017) as the 'area-weighted average perimeter' in a given area, which is calculated by multiplying each block's perimeter by its area and then averaging the outcome across a given area. This method considers both the block's area and perimeter and minimises the impact of obscured long impermeable blocks in the average. To calculate permeability, dead-ends need to be excluded from the analysis. Hence, urban morphologies with many dead-ends will be treated the same as the ones with limited or no dead-ends. Since the method focuses on the impacts of block area and perimeter to describe a given area's permeability, the differentiation between various types of open space such as parks, lanes and high-speed motorways is not possible. To focus merely on permeability is not sufficient given the fact that the level of permeability will be the highest within an area with no blocks. Thus, Pafka and Dovey (2017) have argued that any attempt to quantify permeability

needs to consider measuring what they have termed 'interface catchments' to understand the capacity of the pedestrian network that enables and inhibits access to the urban attractions.

The mentioned measures as well as a range of newly developed metrics in the fields of public health (Leslie et al., 2007; Moudon et al., 2006) and urban design and planning (Hillier, 1996) have become the prime concerns for studying the connectivity of pedestrian networks. However, less focus has been placed on measuring the accessibility of transit-oriented developments (Loukaitou-Sideris et al., 2013). The spatial structure of access networks and their patterns of connectivity offer different densities of the interface between public spaces and various premises, therefore different opportunities to walk from/to the major stations. A finer-meshed grid street network is shown to create various opportunities for meeting users' everyday journey needs. Cervero and Gorham (1995) argue that 'transit neighbourhoods', built in proximity to major rail stations with higher degrees of grid access networks, encouraged more walking as transit access mode choice than did their car-oriented counterparts. Hence, people are less likely to use private cars and more likely to walk, cycle and use public transport in well-structured and more accessible street layouts. While the morphological dimensions of permeability and pedestrian catchments would seem to be rather simple, the metrics applied vary across different studies based on the morphology of the study areas, scale and the line of inquiry.

Catchment indicates the area of walkable access from a specific location measured by time or distance. This notion has developed from what Jacobs (1961) termed 'pools of use'. It is a particular focus for those researching accessibility of transit-oriented developments (Porta & Renne, 2005; Schlossberg & Brown, 2004; Vale, 2015). Pedestrian catchment areas, or 'pedsheds' (Thadani, 2010) are captured within a specific timeframe from a transit node to measure the station connectivity to the surrounding street network. A metric of pedshed is the total length of streets that are accessible within a given area or a given time from a specific location. This is often termed 'metric reach' (Peponis et al., 2008). A problem here refers to the fact that the differentiation between a highway and a laneway is not identified. Porta and Renne (2005) have mapped walkable catchments around transit nodes using 400-metre and 800-metre circles. The pedshed here indicates the percent of each circle that can be accessed based on street layouts and sidewalk connectivity. Yet this method treats all the streets the same (i.e. lanes and highways are equally accessible for pedestrians) and does not take into account the

effect of different block morphologies. Schlossberg and Brown (2004) introduced a more detailed method combining a visual spatial analysis along with a quantification of morphological characteristics to evaluate the walkability of existing or potential TODs. This approach incorporates the classification of access network in TODs, mapping pedestrian catchments over 5 and 10 minutes from rail stations and identification of impedances to pedestrian access to compare levels of accessibility in different TOD sites. The broader use of distance (400- and 800-metre around a certain location) relative to time is often linked to data availability (Dovey et al., 2017). Nevertheless, any multi-scalar approach for analysing access to transit must consider both time and space elements.

3. SPACES OF EVERYDAY LIFE

Introduction

An approach towards a TOD requires not only the integration of the built form and functional mix to public transport, but also the attainment of a certain degree of urbanity within pedestrian spaces around major transit nodes (Bertolini, 2006; Dittmar & Potichia, 2004; Jensen, 2014; Tiwari et al., 2011). Such public spaces serve as places where a large number of strangers often gather together and diversify the uses of the street spaces due to the flows of various public transport modes. Hence, exposure to new experiences and capacities of urbanity through a wide range of actions and appropriations is likely within station areas. This is particularly the case in the station areas of more congested and less formal cities where spontaneous activities such as street trading variously emerge from outside the control of the state (Bell & Loukaitou-Sideris, 2014). Gender bias in the use of public space has also been an issue of concern in creating spatial conditions for social diversity and productive urbanity around transit nodes in such cities (Fadaee & Schindler, 2017). Therefore, this chapter is divided into four sections, starting with a brief review of the literature on public space with a focus on anonymity, sense of freedom and looseness. This section will be followed by the questions of affordance and how urbanity is structured in public space. The last section summarizes the ways everyday politics and gender differences are manifested in the use of public space. It also reviews the literature on the role of gender in everyday mobilities with a particular focus on women's travel behaviours.

3.1. Public space

The term 'public space' in this study refers to the idea of space that is accessible to public use; it links to public (or communal) use rather than land ownership (Altman & Zube, 1989). A city incorporates a mix of public spaces that are open to all forms of urbanity, which broadens the right to perform one's desired activities while identifying other people's presence and rights (Lynch 1981; Carr et al. 1992). This lends itself well to Lefebvre's (1996: 173) call for the 'right to the city' that comprises the "right to freedom, to individualisation, to habitat and to inhabit" along with the right to use and appropriate.

The capacity of individuals to have a sense of freedom and to be engaged in public activities has a close connection with the ways anonymity might arise in public spaces (Lofland, 1989). This

resonates with what Simmel (1903) describes as 'the blasé attitude', indicating that strangers are less apt to constrain others' activities in public space. In this sense, Franck and Stevens (2007) note that within public spaces one can escape from the judgments and constraints that are linked with small communities where there is no anonymity. In such public areas, most people are known and controlled by others. Users of a public space in large cities are often civilly inattentive: as sometimes entrance into an encounter with strangers becomes risky and hence strangers often need a reason to accost each other for what they are doing (Goffman, 1982). For most urban dwellers, being free from judgments by others is considered "as a major pleasure of being out in public" (Lofland, 1989, p. 464). In his article, Karp has summarised these argument:

The quality of urban life is seen largely as a manifestation of the thorough anonymity of the city. The result of urban man's anonymity vis-a-vis his fellow urbanites is a slackening of social control, a high degree of personal disorganization, and an increased indifference to the personal needs of others . . . Urbanites are seen as interacting "almost subliminally, demanding nothing of each other, making no contacts with each other, merely passing near each other" (Strauss, 1961: 63-64). The city, in short, supports a degree of non-involvement, impersonality and aloofness not to be found elsewhere.

(Karp, 1973, p. 431)

For Young (1990, p.240), the heterogeneity of urban dwellers is often manifested in its public spaces where individuals of different gender, age, social status, culture and ethnicity mix seamlessly with others. New opportunities may arise and the looseness of space can become likely by the mixing of actions any one person may pursue (Low, 2000; Whyte, 1988) as well as the density of unexpected encounters (Franck & Stevens, 2007). While such juxtapositions are fleeting, they cannot be avoided: people encounter strangers and other people who are different. The conviviality this demands allows people to have more freedom and a degree of 'tolerance' is likely to be promoted (Madanipour, 1999; Sennett 1971).

When urban public spaces are open to a wide range of actions beyond the ones intended, looseness is likely to emerge. It is often in these areas that cities exhibit the primary conditions of urbanity: freedom of use (Proshansky et al., 1974), accessibility and a diversity of users and uses. It is important to note that it is people who make use of various social and physical

opportunities in their everyday activities to fulfil their needs. For Franck and Stevens (2007), the emergence of looseness is reliant on: firstly, individuals' recognition of the possibilities in a public space and secondly, the degree of spontaneity and creativity in making use of what is present and the possibilities for alterations to the existing elements in public space. While some acts of appropriation might be unpredicted and spontaneous others may take place on a more regular pattern – everyday activities. Such appropriations can transform public spaces into what Watson (2006, p.19) has termed, “a site of potentiality, difference and delightful encounters.” In some cases, the more or less temporary appropriations loosen up the existing urban codes and become more broadly transgressive. Such appropriations also test the boundaries of what is socially acceptable about use of public space.

Humans explore the potentials that are offered by the physical features of a public space to structure their interactions in space; many fixed objects placed in public setting for a specific purpose can make it possible to serve and stimulate others (Whyte, 1988). Fences, bollards and walls that are intended to constrain some particular behaviours, can be leaned on, climbed over, appropriated to show goods and products for sale. This condition creates looseness in space, which is linked to the affordances such boundaries may offer.

3.2. Affordance

The concept of ‘affordance’ was coined by Gibson (1977) in the field of environmental psychology. This concept seeks to explain the links between physical features of an environment, the perception of those features and human action. For Gibson (1977, 1979), the affordance of an environment is “what it offers to an animal or person; what it provides or furnishes, either for good or ill” (Gibson, 1979, p. 127). Affordances are also defined as “whatever it is about the environment that contributes to the kind of interaction that occurs” (Greeno, 1994, p. 338). As Heft (1997) puts it, affordance may either encourage or constrain actions, without triggering a certain outcome.

An affordance is neither an objective property nor a subjective property; or it is both if you like. An affordance cuts across the dichotomy of subjective–objective and helps us to understand its inadequacy. It is equally a fact of the environment and a fact of

behaviour. It is both physical and psychical, yet neither. An affordance points both ways, to the environment and to the observer.

Gibson (1979, p. 121)

Affordances are always there to be perceived by observers, whether the observers act on their perceptions or not (Townshend & Roberts, 2013). Gibson was interested in the way in which individuals would react to the environment in both behavioural and psychological terms. Therefore, the theory of affordance suggests a way of investigating both the physical features of urban environments and the behavioural/ psychological response of humans to those environments. It offers a baseline for exploring what and how actions are encouraged by certain environments for certain people.

Affordances are distinctive to individual humans and/or to groups of humans who are observing the environments. Yet, this issue has been left rather unclear in Gibson's work. Gibson (1979) makes a distinction between animate and inanimate objects of the environment whereas the former is linked to the social affordance and the latter to the physical affordance. According to the interactions between humans, the 'richest' affordance is the one offered by other humans – "behaviour affords behaviour" (Gibson, 1979, p. 127). Nonetheless, Gibson and much of the subsequent studies often focused on the physical affordance and thus social affordance remains subject to debate (Townshend & Roberts, 2013). An observer looking at the entry steps of a building may explore different qualities of affordance. Different groups of users especially the young users may observe and use urban spaces in ways that are beyond the expected norms. For instance, skateboarders perceive walls, ledges and benches as objects affording the performance of stunts (Woolley et al., 2011). Kyttä (2002, p. 109) points out that affordance is inherent in public spaces and differentiates between four levels – potential, perceived, utilized and shaped.

There is another key issue here regarding the ways environmental affordances are connected to particular groups of people, which is yet to be explored. Among the limited studies found, Heft (1988) focused on the links between physical affordances and children's activities. He points out that the affordance of environmental features is more apparent in children who are more receptive to opportunities in urban environments. This raises questions about other groups of humans especially women (especially those in cities with large Muslim populations) whose

activities in public space are not only subject to the physical affordance of built form, but also to what is and is not socially acceptable. It is also important to understand that humans' perception of affordance and behaviours can be altered by the presence or absence of other people in urban environments. It can be argued that in this condition people play the role of 'mediators' (Clark & Uzzell, 2002).

The key role of urban design is to maximize affordances in public space rather than determining them (Dovey, 2016). The range of urban public spaces incorporates those that are intended for certain assigned activities yet accommodate other uses as well; it also incorporates other types of public spaces without assigned activities that accommodate a range of unplanned and unexpected uses (Franck & Stevens, 2007). Hence, affordances can be unexpected and collateral to the assigned intention. Examples for this are station entries or stairways that are designed to enable certain form of activities, yet they can also serve a wide variety of unplanned activities such as seating, informal trading, performance, play and so on. These engagements resonate with Giddens' (1984) theory of structuration.

Structuration theory is an attempt to understand the complex interplay between structure and agency. The theory describes the ways structural properties of society frame the everyday actions of individuals yet at the same time are constructed and modified by those actions – human action cannot be conceived outside the already established social structures. In this view, “the structural properties of social systems are both medium and outcome of practices they organize” (Giddens, 1984: 24). Thus, the interplays between structure and agency are basically those of ‘enabling’ and ‘constraining’. This means that structure can both enable and constrain certain types of agency that are possible. In this sense, structures indicate rather stable frameworks within which agency or activities occur. One of the key propositions of Giddens's (1984) theory of structuration is that it accounts for the links between ‘rules’ and ‘resources’. Rules indicate “methodological procedures of social interaction” (pp. 18-19) and ‘resources’ is about an actor's power to achieve intended outcomes; rules and resources can enable or constrain human actions in space. A crucial proposition to the concept of structuration is the duality of structure:

The constitution of agents and structures are not two independently given sets of phenomena, a dualism, but represent a duality. According to the notion of the duality

of structure, the structural properties of social systems are both medium and outcome of the practices they recursively organize. Structure is not 'external' to individuals . . . it is in a certain sense more 'internal' than exterior to their activities . . .

Giddens (1984, p.25)

Another body of sociological thought that is parallel to much of Giddens' theory is Bourdieu's (1977) socio-spatial concept of the 'habitus'. The notion of habitus constitutes both habit and habitat, structuring the taken-for-granted experiences and practices of everyday life. In this sense, 'habits', which are repeated unconsciously are geared to 'habitat', which is the place accommodating those habits. Habitus is generated and reproduced without any deliberate pursuit of coherence (Bourdieu, 1977). This is to say that habitus is an implicit feel for the game¹ of everyday life – a feel rather than a mindful awareness (Bourdieu, 1990). Bourdieu argues that this is informed by acquired experiences and dispositions ingrained in the habitus that guides action within different social settings (Bourdieu & Wacquant, 1992). 'The Logic of Practice' provides with the most succinct definition of habitus:

The conditions associated with a particular class of conditions of existence produce habitus, systems of durable, transposable dispositions, structured structures predisposed to function as structuring structures, that is, as principles which generate and organise practices and representations that can be objectively adapted to their outcomes without presupposing a conscious aiming at ends or an express mastery of the operations necessary in order to attain them.

(Bourdieu, 1990, p. 53)

3.3. Politics of public space

The ways in which spatial boundaries are inscribed are linked to "the production of social space and the politics of our everyday lives" (Low, 2000, p. 155). The practices of everyday life indicate that different groups of people use public space for different purposes. These purposes may contest others or the goals of those who project power over the space. In this section, the ways in which everyday politics are spatially manifested in the use of urban public spaces are briefly

¹ "le sens pratique".

discussed; the ways in which people mark territorial boundaries in their use of public spaces in two manners: control and contest.

The idea of spatial control has been explored by Lynch (1981), showing how people regulate the use of public space in everyday life. He writes that “man is a territorial animal: he uses space to manage personal interchange and asserts rights over territory to conserve resources. People exercise these controls over prices of ground, and also over volumes that accompany the person” (Lynch, 1981, p. 205). For him, the control over human space is fused with questions of power and social status. He further identifies different forms of spatial rights associated with the degree of spatial control: ‘presence’, ‘use and action’, ‘appropriation’ and ‘modification’ (pp. 205-207). The first spatial right refers to the right to get access to a place without any social exclusions. The second indicates using facilities and doing activities freely in a place without appropriating it or constraining the use and action of others. The third right refers to appropriating and monopolising the benefits of a place as well as preventing its use by others. The fourth right is modification incorporating any changes to the place as one sees fit. The right of presence is a precondition for the other three. Among all the rights, the right to action and appropriation are the most seminal to the emergence of intensive streetlife and productive urbanity as they are more concerned with socio-political freedoms in urban public space. Yet, their contribution is subject to the presence and access in public space.

For Habraken (1998, p.7), “to use built form is to exercise some control, and to control is to transform”. This quote outlines two primary ways of exercising control – in the production and transformation of built environment and in the use and appropriation of the space produced. However, control is not necessarily in congruence with the users (Habraken, 1998; Lynch, 1981). It is expanded when different people exercise their power over the space to regulate its access and use.

With different people exercising control over the same space, contest and conflict among individuals and groups seem unavoidable. Various forms of contest are spatially manifested in urban public space. Spatial, behavioural and representational possibilities and constraints in public space often result from constant negotiations and contestations as users perform actions and as state authorities allow or forbid those actions (Mitchell, 2003). Donley-Reid (1993) argues that the problem of social exclusions from urban public spaces is geared to the

contestation and negotiation of power. The term power here does not necessarily refer to the official authority, but to the control over the everyday use and appropriation of public space. Public space is a site of contested activities and meanings where a particular activity or a meaning can predominate over the existing ones; for instance, the contest between vehicular traffic and public life vitality (Appleyard, 1981), women's and men's use of public space (Massey, 1994; McDowell, 1983), informal trading and the top-down establishment (Brown, 2006; Middleton, 2003), etc.

3.4. Gender difference in public space

Places are constituted through relations of power, which construct certain rules which form multiple and changing boundaries (McDowell, 1999, p. 4). Such social and spatial boundaries specify who is likely to become included or excluded, and define the locations and sites of the experiences and actions. Feminist geography then aims to bring to the fore the relations between spatial divisions and to challenge the ways in which such divisions may appear as natural (McDowell, 1999, p. 12). Therefore, gender mix has been an issue of concern in urban public spaces where gender boundaries are framed, negotiated and contested. The ways in which gender differences play out in public space have considerable significance for social diversity and intensity of streetlife. Drawing on what Lefebvre calls 'the right to the city', a diverse range of people including men and women have the "right to freedom, to individualization, to habitat and to inhabit" (1996, p. 173) as well as rights to engagement, use and appropriation. Hence, any approach to addressing the discourse on gender difference in public space requires a focus not only on the socio-political practices but also on the spatial manifestation of men and women whose participation and use characterise the same locale differently.

Calling for a feminist approach to urban design, Day (2011) argues that city design and planning have often overlooked women's needs and their everyday lived experiences. Hence, understanding the relationships between women and the built environment in public spaces has been a primary line of inquiry since the 1990s to bridge the gap between designing urban environments and planning for a more just and equitable city for women (Altman & Churchman, 1994; Franck & Paxson, 1989; Kallus, 2003; McDowell, 1983; Mozingo, 1989). Although there are a number of studies focusing on the ways in which gender identities and everyday experiences

of women are shaped in urban environments (Day, 1999, 2000; Massey, 1994), there are fewer studies that address the constraints to women's use of urban public space (Law, 1999). Scholars in the field of urban design have often focused on the question of place and lived experiences of people who participate and appropriate public space. However, overlooking gender differences in such studies may disguise major differences in human needs, activities, perceptions and experiences of everyday life (Day, 2000; Rakodi, 1991). If urban public spaces seek to prioritise the needs of a specific user group, this will likely exclude other individuals that are not motivated by those needs (Mean & Tims, 2005).

Spain (1992, pp. 28-29) argues that there is a reciprocal relation between gendered spaces and everyday activities in the sense that gendered space can both frame and be framed by certain types of actions. Therefore, the ways in which gender differences play out spatially in urban environments are geared to the patterns of action and appropriation. Day (2000) and Lofland (1984) take this further by noting that women's use and appropriation of public spaces and the created opportunities may pose more challenges relative to men. In this sense, McDowell (1999, p. 156) articulates that even with the freedom of city life, women are "subjected to and constrained by the intrusive male gaze and, on occasion, actual verbal or physical harassment". This is closely linked to the ways women may temporarily escape to department stores from the limits of domesticity and male domination in terms of presence and control (McDowell, 1999). In such areas, solitary women are afforded with opportunities to linger and gaze at the goods in a way reminiscent of the flaneur. This is congruent with Van Eeden's (2006) argument that within quasi-public spaces such as shopping malls, women are afforded anonymity and the freedom to stroll and socialise. That is why gender consideration can both complicate and enrich scholarship in urban design as argued by Day (2011). Feminist approaches to urban studies have argued that the flaneur- a solitary observer of the everyday life, strolling through the public spaces in a casual yet alert manner - has never been a woman (Clarke, 1997; Day, 1999; Wilson, 1992). This means that city scenes have generally been depicted from a male dominated point of view while women were possibly navigating urban public spaces as objects of observation (Gardner, 1980; Rendell et al., 2000).

While it has been noted that women can benefit from the opportunities expanded by urban diversity and heterogeneity of an urban public space, they can be negatively impacted not only by how male domination has been intensified in urban settings but also by the ways in which

zoning patterns are often based on stereotyping gender identities and roles (Darke, 1996). The dichotomies of work/home, public/private and urban/suburban have been questioned to an increasing extent in the literature on women and designed environments (Rothschild & Cheng, 1999, p. 7). Day (2011, p. 152) identifies such rigid boundaries in conceptions of space as “meaningless and constraining” that can impede women in multiple ways. Hayden (1984) has also outlined some problems that are common to today’s urban design and planning – the lack of public transit accessibility to everyday destinations, large distances between the sites of live and work and the lack of nearby places of visit particularly shopping areas. Further to this, the ways traditional low-density suburban morphologies in the global North have increased consumption and constrained females in performing their multiple tasks as both mothers and workers, have been outlined by Hayden (1984) and Murray (2008). These problems also resonate with the ways in which feminist perspectives have been absent from the recent movements such as New Urbanist, Smart Growth and so on (Day, 2011). Furthermore, the so-called ‘Green’ movements that encourage high densities, mixed uses and permeable street networks have been criticised for not considering the needs of all women (Hill, 1996; Roberts, 1998). In this way, to propose better visions for the future requires looking deeply into the ways in which the present city works in relation to gender differences, everyday mobilities, built form and socio-cultural backgrounds (Roberts, 1998).

Much has been made of the fact that different social groups have not been provided with similar mobility opportunities. Since the 1970s, there has been a surge of interest among feminist scholars in understanding the role of gender in daily mobility patterns and the implications of females’ travel choices for designing cities and transit networks (Cresswell & Uteng, 2008; Guiliano, 1979; Rosenbloom, 1978). Their interest was primarily piqued by the fact that the capacity of people to move across the city without constraints denotes freedom (Loukaitou-Sideris, 2016). Questions of gender differences in everyday mobilities especially the links between women and their travel behaviours have been a key focus in the studies of Western cities (Law, 1999). The findings from these studies outline the constraints on women’s travel such as gendered attitudes about women’s daily mobility and separation of land uses (Day, 2011; Law, 1999). Women’s mobility and use of transit systems have been also constrained in the rapidly growing cities of the global South, mainly due to religious and cultural norms (Loukaitou-Sideris, 2016). The authorities of such cities have been less able or willing to resolve such concerns (Roy, 2009). Gender issues associated with different travel choices including formal

transport and informal transport lack empirical investigation particularly in the global South even though gender bias is more accentuated in these cities (Loukaitou-Sideris, 2016; Rakodi, 1991).

Criticizing how the classic studies on gender and planning have often focused on experiences of the middle class, white women, Miraftab (2007) argues that the experiences of women in third world cities are often shaped by race, class, locally established social hierarchies, ethnicity, and the ways in which informality works in such contexts. Yet, gender issues in urban design and planning in the cities of the global South remain subject to lack of empirical studies. Of the limited research conducted in recent years, Mazumdar and Mazumdar (2001) note that religious conceptualisations play a seminal role in the use and understanding of public/private sphere, and how inclusion/exclusion has been experienced by different gender groups. Amir-Ebrahimi's (2006) study of women's experiences in public spaces reveal the ways in which modernity competes yet co-exists with Islamic codes and social norms in most Muslim cities. Alizadeh (2007) explains that in such urban environments public/private boundaries are often contested and negotiated across different socio-economic and environmental conditions of women. In a similar vein, Bagheri (2014) aims to criticise the binary categorisations of traditional/modern, religious/secular and public/private in urban studies by drawing attention to the everyday experiences of women in urban public spaces.

4. TEHRAN

Introduction

The previous chapters reviewed the literature, considering how the research questions could be investigated empirically. However, most of the identified theories have been grounded in empirical research from Western cities, which often act as a framework against which other cities are compared. This study seeks to stretch the debates on urban studies 'beyond the west' and contribute to more theoretically and empirically broader foundations.

Tehran, the capital of Iran, is home to about 9 million people (within its main boundaries). The city exhibits a distinctive spatial structure, which is linked in part to its geographical, socio-political and historical context. Tehran's spatial structure is not only expressed in its urban form and functional mix, but also in its practices of everyday public life. Therefore, this chapter aims to sketch the socio-spatial transformation of Tehran to provide specific information for interpreting the findings of this study. The first subsection will be followed by discussions about urban morphology and transport in Tehran and some of the key challenges it faces: car-dependency, traffic congestion, air pollution as well as gender bias in public space and socio-economic inequalities.

4.1. The evolution of Tehran

Tehran was a small village², outside the ancient city of Ray, its predecessor, yet today a southern suburb of the metropolitan area. A key feature of this urban settlement has been its strategic location at the intersection of two international trade routes; the Caspian Sea-Persian Gulf (North-South route) and the Silk Route (East-West route). The Silk Route crosses through the area in-between the Alborz Mountains (in the North) and a central desert of Iran (in the South), where Tehran emerged. While Tehran grew in size by the early 15th century, it gained much attention in 1553 when a polygonal-shaped town wall with four gates and a bazaar was constructed (Minorsky, 1987, p. 715). In the late 18th century, Tehran found its significance when the founder of the Qajar dynasty proclaimed it as the capital of the Persian Empire (Bayat, 2010). The city of 15,000 inhabitants became rapidly populated within about a decade reaching almost

² Tehran was mentioned for the first time in history in the 11th century (Madanipour, 1998).

50,000 people in 1807 (Curzon, 1892, p. 303). The population increase coincided with the growth in the number of houses, public buildings and public squares (p. 304). Once Tehran was chosen as the capital, the city turned into a field of multiple intersecting desires and forces – the poor, elites, foreign influences and global capital (Bayat, 2010).

Figure 4.1. Tehran in 1858. Source: drawn by Madanipour (1998, p. 30) from the original mapping by August Kržiž.

By the mid-19th century, an axial spatial structure was shaped with a functional organisation including a political authority (citadel), economic focus (bazaar), religious centres (Shah and Friday mosques) and four residential quarters clustered around the axis (Madanipour, 1998) (Figure 4.1). The city's social structure was characterized by quarters³ where urban spaces were shaped by ethno-religious divisions rather than a particular social class, meaning that people with the same ethnic background or religious affiliation regardless of economic status were housed in the same quarter (Bayat, 2010). Two key spatial elements formed the city's focal points at the intersection of Citadel and bazaar – the *Meydan-e Arg* (Citadel Square) and *Sabzeh Meydan* (Herbs Market). The city was granted limited control during this period as it was assembled by loosely linked provinces with rather self-sufficient agrarian economies and ethno-religiously stratified communities (Madanipour, 2011).

During the 19th century, Tehran lost a part of its territory to the advancing Russian and British governments and export goods replaced subsistence goods, which thereby triggered the emergence of a new capitalist economy in Iran (Madanipour, 2011). From 1868 on, attempts of

³ *Mahalleh* system

modernisation significantly transformed Tehran where the urban area grew by about four and a half times and new walls and gates were constructed as well as new streets, buildings and neighbourhoods (Figure 4.2) (Curzon, 1892; Madanipour, 1998). In the more favourable Northern sector of the capital were located the new buildings with international significance and the new quarters occupied by embassy compounds, aristocracy and houses of elite foreigners (Costello, 1998; Madanipour, 1998). This period is considered as a key phase in the urban history of Iran where the number of cities and inhabitants increased respectively from 30 and 850,000 to 58 and 1.88 million in the early 20th century (Gilbar, 1986, p. 85). The capital was not an exception to this trend where the population rose to about 280,000. Bayat (2010) argues that among the main drivers of these major transformations were “the need to integrate the growing numbers of ‘outsiders’—not only migrant poor but also elite Persians and foreigners—and to control riots, which would frequently erupt in protest at bread shortages” (p. 101). The construction projects were also inspired by the desire for a national identity and a vision of a ‘modern city’ derived mainly from Haussmann’s transformation of Paris (Bayat, 2010; Curzon, 1892). Hence, the construction of the first railway line of approximately 12.9km was carried out in 1888. Metalled roadways of over 804km were constructed, which were financially supported by the Russian government (Gilbar, 1986). Furthermore, a tramway extended for a distance of approximately 8km through the main streets of the capital (Curzon, 1892, p. 618) and the additional projects to promote the country’s transport system were mostly undertaken by Russian and British firms as well as the central and provincial authorities (Gilbar, 1986). The construction works carried out in Tehran, as the commercial and service hub of the country, attracted a large number of unskilled labourers from the rural areas to the southern section of the city (Gilbar, 1986). They were generally housed in the lower stratum of the civil society, which tended to have the greatest effect on the socio-spatial stratification of the capital. The 1868 physical transformation altered the underlying quarter system and introduced a new north-south division that has been the key feature of Tehran ever since (Madanipour, 1998, p. 32). The polarising social structure established a new character for Tehran due to which the poor and rich were increasingly segregated in the northern and southern sections of the city (Madanipour, 2011). This social inequality was reinforced by land speculations of the early 20th century (Bayat, 2010).

Figure 4.2. Urbanisation growth of Tehran.
Maps of 1891-1994 are traced based on Tehran Municipality and Tehran University, 2011.
Map of 2016 is traced based on Google Earth.

Tehran was a place of tension at the end of the 19th century, which would unfold in years of social insecurity and revolutionary struggles (Madanipour, 2011). Tehran was among the key sites of a democratic revolution, which led to the formation of a parliament and a constitution. Yet, the economic crisis and the outbreak of World War I hindered the effectiveness of the revolution and its new establishments (Madanipour, 1998). From the early 1920s, Tehran underwent a radical change in its social and spatial structure due to the intense Western influence and modernisation engendered by Reza Shah – officer of the Cossack Brigade. This was when he took over the premiership in 1923, after a British-engineered coup (Bayat, 1998; Madanipour, 2011). He founded the Pahlavi Dynasty (1925–1979) and built a strong autocratic state on the image of the West and its Middle Eastern counterpart, the Turkish Republic led by Kemal Atatürk (Bayat, 1998). Reza Shah immediately attempted to centralise authority and create a new army and a new bureaucratic government. As Banani (1961) argues, any manifestation of Westernisation in the city dates back to the Reza Shah era. According to Abrahamian (1982, p. 148), “The past with administrative inefficiency, tribal anarchy, clerical authority, and social heterogeneity” was to be replaced by “a future with cultural uniformity, political conformity, and ethnic homogeneity”.

The city underwent a radical change in its socio-spatial structure during the 1930s. The city walls were demolished entirely and attempts were made to inscribe a national identity and modernise the city by imposing a network of wide and straight streets that cut through the dense, old fabric of Tehran (Figure 4.3) (Lockhart, 1960). While the first phase of Tehran's transformations (in the 1860s and 1870s) was more about building new walls and quarters, the second phase (in the 1930s) was an attempt to radically transform the morphology of the entire urban environment (Madanipour, 1998). The 'quite ruthless' treatment of the city in this era (Elwell-Sutton, 1941, p. 108) put an end to the quarter system through imposing a new zoning pattern, which was significantly based on class stratification (Bayat, 2010). It has been argued that the main purpose of the wide streets in southern areas of Tehran was to provide easier access to suppress opposition (Mazumdar, 2000) since the bazaar and the Muslim clergy were identified as the main opposition to Reza Shah. The modern establishments and boulevards were generally designed by European and European-educated architects (Bayat, 2010). Some new palaces were erected and the old royal compound was replaced by a government quarter, accommodating finance and justice departments (Elwell-Sutton, 1941). The new street network in Tehran became the main channel of mobility that could facilitate military movements and higher volume transportation of goods and vehicles across the unified urban areas (Madanipour, 2011; Mazumdar, 2000). The older squares also turned to traffic nodal points, which were completely different from their former functionality – a place for communication and social interactions (Madanipour, 1998). Thus, Tehran was changed into an open matrix identified as a key phase in laying the foundation for further modernisation and future urban expansion. Two primary streets, Pahlavi (currently known as Valiasr) and Shah Reza (currently known as Enghelab) shaped the north-south and east-west axes of the new urban structure. Pahlavi Street was almost 20 km long, linking the main railway station in the south to the northern section of the city. The second axis, Shah Reza Street intersected the Pahlavi Street at right angles and along that were laid out new modern establishments such as Tehran University.

Figure 4.3. Network of wide streets cutting through the old urban morphology in Tehran. Photo by: Orlygur Hnefill (2007)

After World War II, the city grew in an unstructured and unprecedented fashion in all directions, following a radial expansion along the outgoing road network (Figure 4.2). The population rose rapidly and passed the one million mark by the 1950s. This rapid and unregulated urban growth integrated suburban villages and satellite towns into the city fabric without much authorised control over urban land (Madanipour, 1998). A number of suburban townlets developed on a speculative basis as a response to high levels of housing demand in the capital. The shaping of suburban settlements was based primarily on the spatial segregation of different social classes, which led to an intensified north-south social divide. A walk along a north-south urban transect reveals that the distinctions of culture, ethnicity and social class involved different spatial structures. Bayat (2010, p.103) argues that “Tehran became a site of ever-increasing consumption, as new spending patterns and Western lifestyles were adopted; restaurants, cafes and exclusive uptown neighbourhoods appeared. The Shah’s regime sought to reshape Tehran into a decentred LA-type suburban entity.” In the mid-60s, the first Comprehensive Plan of Tehran (CPT) (drawn by Farmanfarmaian and the American architect Victor Gruen) envisioned the city’s development plan for the next 25 years (the plan’s implementation was hindered by the Islamic Revolution and war and its lifespan came to an end in the early 1990s). This plan portrayed the city as ten large and independent districts of 500,000 people, connected through

a transportation network including freeways, bus routes and rapid transit services (Bayat, 2010). The mass migration that followed the land-reform programme of the 1960s⁴ and 1970s swelled Tehran's population. Hence, about three million landless peasants were relocated on the margins of Tehran, often at the southern end, and gave rise to numerous informal settlements, satellite and dormitory communities. Hence, on the eve of the 1979 Islamic Revolution, the metropolis was home to about 5 million people, representing a distinctive class segregation exhibited not only in cultural and socio-economic terms but also in its spatial structure. The plan's impacts on the reorganisation of urban districts and neighbourhoods were limited (Madanipour, 2011) although it served as a foundation for infrastructure developments (e.g. road network developments since the 1990s). A new plan for Tehran was prepared in the 1990s. While this plan aimed at promoting polycentric development, decentralisation, development of satellite town and increasing residential density across the city, its impacts were negligible. Another comprehensive plan was envisioned in 2006. Figure 4.4 shows Tehran's population density in 2006 with a population of 7.7 million. The new plan proposed to maintain clear urban boundaries, to control density across the city, to consolidate the population at about 8.6 million and to improve transport services and so on (Madanipour, 2011). According to the complexity within the city's institutional structures, it is not entirely clear whether the new plan and the broader urban planning procedure can address the challenges of achieving a more transit-oriented and livable city.

⁴ In the early 1960s, land reform curtailed the power of feudal landowners and turned the peasantry into smallholders (Bayat, 2010).

Figure 4.4. Population density in Tehran. Modified from Mehryar (2012, p.10).

4.2. Morphology and mix

The key patterns of the city's spatial structure that will be discussed in this section incorporate a north-south dichotomy, the decline of the centre and the growth of the suburbs, an axial order, access network and functional mix.

Tehran is located at an average altitude of approximately 1200 metres on a slope running south from the Alborz Chain Mountains (Costello, 1998). To the north, is located the Tochal Summit (3933 m), dominating the city. The outward growth of Tehran has given rise to the formation of satellite settlements and major urban development agglomerations, which have been merged into the expanding metropolis, creating a fragmented and sprawling spatial structure (Madanipour, 1999; Zamani & Arefi, 2013). The growth of the city has been inhibited by the desert at the southern end and by the wall of mountains at the northern and eastern ends (Madanipour, 1999). Yet, it is to the west that the city faces no natural barriers and the built-up areas have expanded gradually towards the neighbouring city of Karaj (Madanipour, 1998).

The north-south downward slope in Tehran has had major implications for the process of social stratification. This has been a long-established practice in Tehran's spatial structure due to which the residents of the northern end of the city have often been privileged in terms of better access to natural resources, a better climate and a visual supremacy over the southern end (Madanipour, 1998, p. 103). This distinction has also been "unequivocally registered in the language and the popular imaginary" (Bayat, 2010, p. 104) due to which people have an image of an affluent north that corresponds with more liberal ideologies, increased religious openness and higher classes. As Navai (2014, p. 2) puts it, "the lives of the people at either end seem centuries apart." There is a further key issue here, which indicates the self-selection bias resulted from the north-south divide. In this sense, northern Tehran often attracts high-income citizens with similar characteristics and interests and the south, by contrast, often houses working- and middle-class people with limited freedom of choice.

The north-south divide also has reasserted itself in Tehran's urban morphology. The dividing line between *bala shahr*, 'the upper city', and *paen shahr*, 'the lower city', has been shaped by a street called Enghelab (Revolution Street) (Bayat, 2010). The northern edge of the city is dominated by large-grain single dwellings, high residential densities and high-rise luxurious apartment buildings (Figures 4.4 and 4.5), tree-lined street networks, high green space concentration, modern facilities and infrastructure and a more diverse skyline (Bayat, 2010; Costello, 1998). By contrast, the south is located at the opposite end of the spectrum. There is also a much lower internal density in the north than other areas in the city, which is strongly mediated by the larger dwelling sizes in its wealthier neighbourhoods (Figure 4.6). In contrast to the luxury housing of the north, the poorer south has higher internal density that is linked to its smaller houses. Although some attempts have been made by the revolutionary authorities to address the north-south duality, issues of gender bias in public space, homelessness and informality remain major challenges.

Figure 4.5. North of Tehran. Photo by: Hamed Masoumi (2008)

Figure 4.6. Consumption of space (square metres per person) in Tehran. Modified from Tehran Municipality and Tehran University, 2011.

There is also a clear distinction between the core of the city and its peripheral areas. The central districts in Tehran, including the old fabric and its northward extensions between the 1860s and World War II, accommodate business-related functions and services (Madanipour, 2011). After World War II, the demolition of city walls and increased patterns of car use gave rise to the dramatic suburbanisation of Tehran. The state significantly encouraged this process by implementing policies such as decentralisation (Madanipour, 1998). The post-World War II suburbs with a predominant housing use were often developed by the private sector on a speculative basis (Madanipour, 2011). The city evolved at such a pace that the needs of the new neighbourhoods and the increasing population density could not be met by the limited services and infrastructure of the old city. Enforcement of the growth containment policy within the municipal urban boundaries also encouraged more concentration of facilities in the centre (Madanipour, 1998). In the context of rapid urban growth, development agencies were largely engaged in the production of space for exchange purposes. Their competition for the desirable locations in the central areas coincided with the outward expansion of the urban fabric, resulting in a clear core-periphery relationship. This change also had significant impacts on the patterns of the functional mix in central Tehran. The concentration of the economic-based functions increased rapidly, pushing the residential developments towards the periphery of the city or clustered them inside the centres of urban blocks. However, following the initial phases of concentration in the centre, suburbanisation as well as decentralisation were increasingly supported by both private and public agencies. These processes of change contributed to the environmental decline in central Tehran and the gradual expansion of the peripheral sub-centres (Madanipour, 1998, 2011).

Another key morphological feature of Tehran's spatial structure is its strong axial structure (Madanipour, 1998): the old urban centre with its northward expansion forms the core of an axis, which links the south to the northernmost districts. Clustered along this axis, are many jobs and amenities where land prices are the highest. This axis incorporates a number of street networks among which Valiasr Street predominates. This street is over 17km long and connects north Tehran to the south where the city's main railway station (Rah Ahan Square) sits. There is also a second key axis in the city, which intersects with the north-south axis at right angles and centres on Enghelab Street. Along the two key intersecting axes are the main public squares, which are considered Tehran's focal points.

Tehran's morphology is characterised by varied patterns of street networks from traditional to modern (Figure 4.7). The traditional street layout is the one formed to accommodate pedestrian mobility, following a hierarchical pattern of narrow, partially roofed, twisting streets with numerous dead-ends (Madanipour, 1998) (Figure 4.7a). The introduction of motorised vehicles and the rapid increase in their ownership levels across the city were the factors that contributed to the transformation of the street patterns from pedestrian-based to vehicular-based. A new urban plan for the city was authorised by the 'Street Widening Act of 1933' (Mazumdar, 2000). This plan aimed for imposing an orthogonal pattern upon the traditional access network, which gradually eliminated dead-ends (Cronin, 2003; Madanipour, 1998). The newly introduced standardised street network (Figure 4.7b) aimed to better correspond with flows of cars and people.



Figure 4.7. Street network

Associated with the new access networks were the new patterns of formal and functional mix. There has been a change in built form from low-rise courtyard houses to extroverted medium to high-rise buildings. Yet, in some old parts of the city especially in the southern and central neighbourhoods, the patterns of courtyards remain predominant. The transition of building types incorporates two key phases: from the courtyard to single-household row housing and from row housing to row apartment building. The major driving forces for the first phase of the transition in the 1940s were not only the desire to modernise the urban fabric but also, more importantly, the tendency to increase the vehicular accessibility (Shayesteh & Steadman, 2016). For urban planners, the old building types and street networks were not able to adapt to the

newly established modern lifestyle, which entailed a higher level of car ownership per household. Thus, a planning code was introduced, which oriented buildings to the north of plots and restricted ground coverage to the maximum of 40 percent. Hence, regular grid patterns were laid out on long and irregular blocks. This pattern limited the width of blocks to about two plots, which could facilitate a better vehicular accessibility to all plots (Shayesteh & Steadman, 2016). The second phase of the formal change was in part the outcome of planning codes associated with density restrictions in the 1960s. Planning codes were changed to accommodate the increased ground coverage of 60 percent (Farmanfarmaian & Gruen, 1968). With a rapid increase in housing demand in the 1990s, a new planning regulation relaxed floor area ratio (FAR) controls and allowed higher built density through bonus zoning (Madanipour, 2006). Developers could build high-rise buildings by merely paying the construction fines (a policy best known as selling density) to the municipality without considering the consequent impacts on the adjacent urban environments (Madanipour, 2006). Therefore, the resulting constructions on the already built-up areas led to a chaotic skyline.

While Tehran accommodates a rich mix of functions in its central areas, its peripheral areas are often dominated by single functions. The areas to the north and east, are largely characterised by residential use, the western and south-western areas of industrial use and the central areas by commercial, retail and office uses (Madanipour, 1998). The patterns of functional mix, as distinct from the old spatial structure where zoning predominated, have changed to accommodate more mixed-use developments over time. The state supported commercial use to stretch out of the central core of Tehran towards the newly laid out access networks (Madanipour, 1998). With the rapid urban expansion, central Tehran witnessed a change in the pattern of functional mix. The commercial, retail and office uses that were clustered along the edges in the old core, encroached towards the centre of the surrounding residential urban neighbourhoods (Madanipour, 1998).

4.3. Transport

Urban transport in Tehran can be divided into four types from which most residents choose for their everyday mobilities. Figure 4.8 shows the ways various transport modes can be categorised based on two intersecting axes – formal/informal and public/private. The axis of public/private is about the extent to which a transport mode is publicly used. The axis of formal/informal indicates the extent to which modes of transport are formally endorsed.

The metro system in Tehran (Figure 4.10), started to operate in 1999, is largely underground and incorporates four operational lines⁵. In 2005, the metro network had 95km of track and 42 stations, with plans to grow to a 170km long track by 2020 (Hashemi, 2006). Local buses and minibuses travel in mixed traffic with cars, with often no dedicated lanes and fixed time schedules. The bus rapid transit (BRT) network, inaugurated in 2008, plays an increasingly significant role in providing access to different areas across the city (Figure 4.10). In some areas, BRT lines run through mixed traffic with cars, which make them often infrequent compared to the other lines with dedicated lanes. Car-taxis operate both formally and informally across the city, offering public transport services. While formal car-taxis generally stop at designated areas to board passengers, informal ones may stop at any point along the streets, causing road congestion. Van-taxis are formally registered and compete with car-taxis and motorcycle-taxis, providing public transport service (Figure 4.9). Motorcycles in Tehran might be formally registered, but they are not approved to offer public transport services nor formally managed or identified. Yet, they have become a burgeoning mode of transport throughout Tehran, which is linked in part to their capacity to respond to the inefficiencies of formal modes of transport and provide access to the areas with a low level of accessibility. Bicycle is the least common transport mode, which links to the fact that there are only a few areas available with dedicated bicycle lanes across the city.

⁵ The information about metro lines is based on the data collected in September 2014.

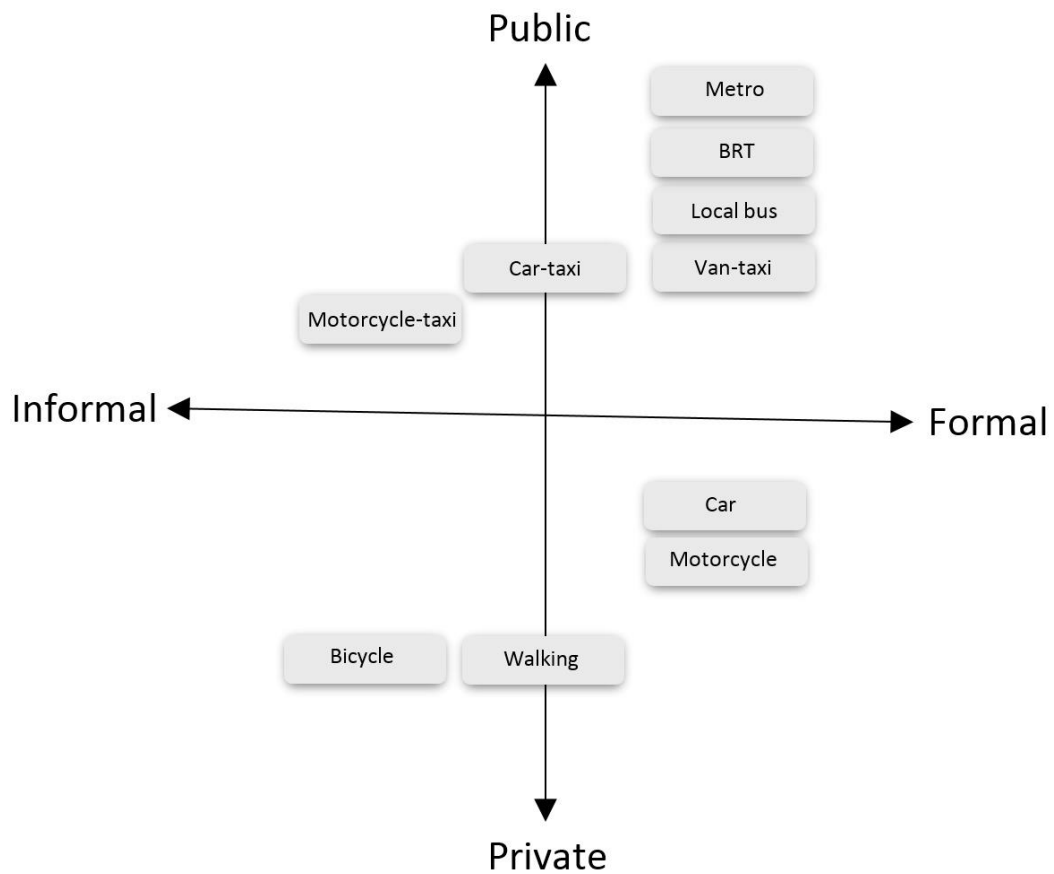


Figure 4.8. Key transport modes in Tehran



Figure 4.9. Competition between van-taxi, car-taxi and motorcycle-taxi to collect passengers

Public transport services in Tehran are gendered in various ways. There are women-only sections for female passengers travelling by metros and buses. This gender division in the metro has enabled many women informal traders to appropriate space because security staff are often men and cannot enter women-only carriages. Men are also not allowed to use car-taxis driven by women that only provide service for female patrons. Like many cities with large Muslim populations (Peters, 2013), motorcycles in Tehran are also considered as a gendered form of mobility. Drivers are exclusively male and there are often sanctions and cultural norms against female use of motorcycle-taxis.

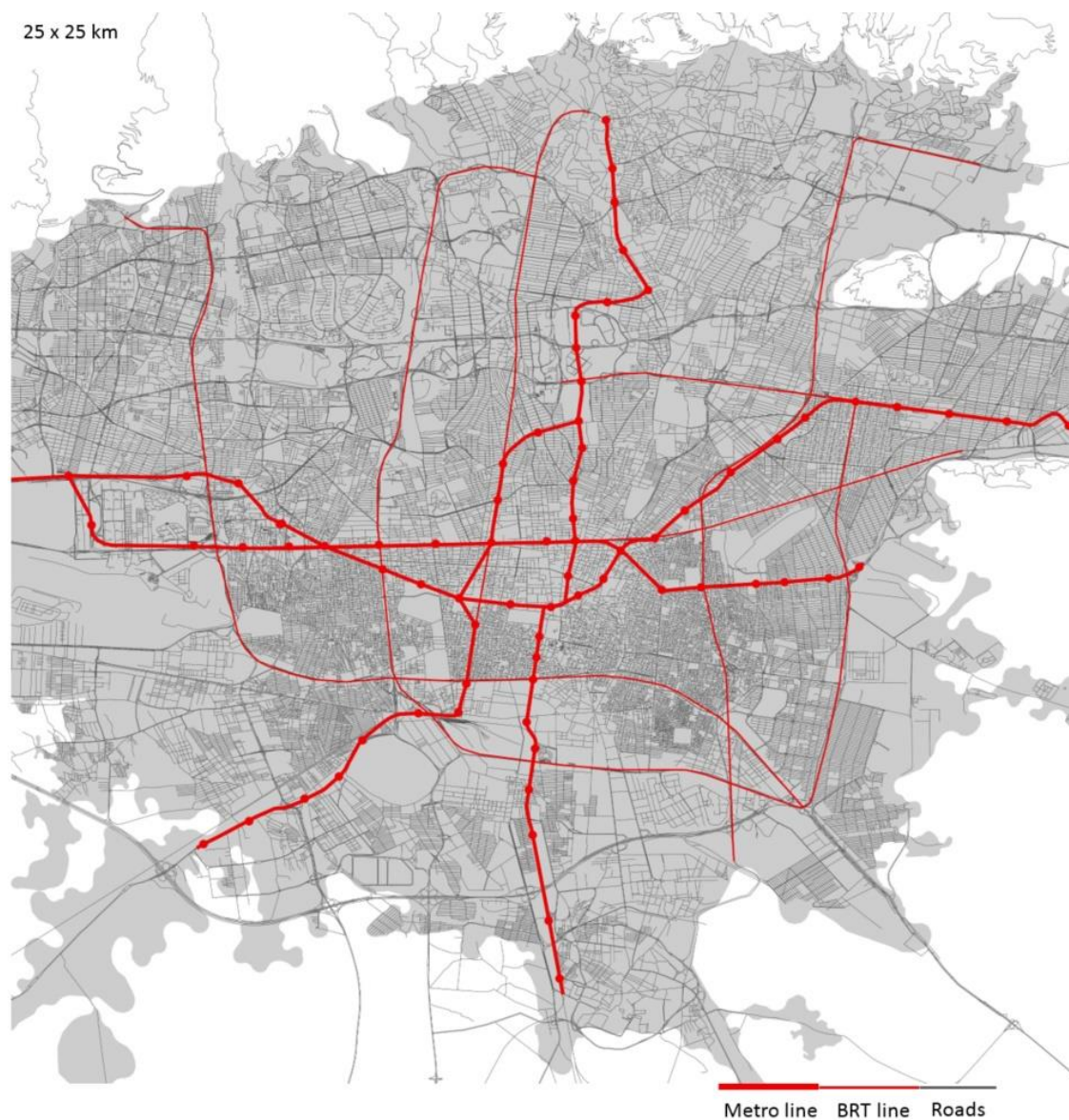


Figure 4.10. Metro network in Tehran

Tehran has been identified among the most polluted cities on earth, suffering from high levels of car dependency and traffic congestion (Allen, 2013; Atash, 2007; Bayat, 2010; Bertaud, 2003; Madanipour, 2011). The formal public transport networks have often proven inadequate and informal services have largely emerged in response to the inefficiencies of formal public transport services. To relieve traffic congestion and reduce air pollution, a number of proposals have been suggested. A radical plan was introduced in the mid-1980s, which restricts private car access within the central city. Private cars were not allowed to enter the area of about 23km² during working hours (Atash, 2007). While this plan had a strong impact on relaxing traffic congestion in the city centre, it was considered as one of the major reasons for decentralisation of functions and streetlife intensity and thereby decay of central Tehran⁶ (Madanipour, 2011). Another traffic restriction scheme was the enforcement of odd/even plate program in the 2000s within a larger area of about 90km² to ease traffic flows. Since the 1990s, there have been some attempts at improving the quality of urban environments in Tehran often through increasing the green space density across the city and developing pocket parks on vacant or abandoned lots especially in the less privileged south (Madanipour, 1999, 2011). This plan was identified as one of the 'best practices' by the UN Habitat that could be used as a model for future programs in cities worldwide (United Nations, 1996). Yet, environmental concerns remain the major challenge in Tehran.

To fill the gap of the more formal modes of public transport across Tehran, motorcycles especially motorcycle-taxis emerge informally in large numbers. They contribute problems such as noise and air pollution, road accidents and traffic congestion (Allen, 2013; Atash, 2007). Their transgressive behaviour is often unsafe and potentially destructive to the economic and everyday life of the city. Attempts at formalisation have been under way in Tehran as the municipality has recently provided some designated areas for motorcycle parking to ease pedestrian movements (Peimani & Dovey, 2017). However, these spots generally remain underused.

Urban precincts around metro stations across the city are not often well integrated with transit – whether in terms of functional mix, density and access networks. Despite decades of planning

⁶ Tehran's municipality's decentralisation policy struck a further blow to the central areas, dispossessing it of its economic potential (Madanipour, 2011, p. 84). Less than a decade ago, another policy has assigned massive parts of the decaying centre and poorer urban areas as 'worn out', aiming at radical redevelopment of these areas (p. 85).

regulations to address the major problems of car-dependency, air pollution and socio-spatial polarisation, the urban environments within walkable proximity to the existing and planned metro stations have rarely been the focus of research. There has not been any integrated transit-oriented development planning identified in Tehran. As argued by Bertaud (2003), there is a need for transit-oriented policies, which favour large increases in floor area ratios for retail, office and residential uses to encourage urban developments around major transit stations. He suggests that vacant and abandoned construction lots within station areas should be heavily taxed if they constrain opportunities for an intensive station area. Hence, any attempts at improving the quality of urban environments throughout the city will benefit from transformational change around existing and planned transit nodes to reduce car-dependency and traffic congestion. Such intensification opportunities will concentrate on improved public transport networks and urban design capacities that are embodied within station precincts.

5. RESEARCH DESIGN

It has been argued in the previous chapters that while the significance of transit-oriented developments is well established at the scales of policy and planning, there are fewer empirical studies that address the synergies between urban design dimensions of urban morphology, functional mix and urbanity within station areas, particularly in the less formal and more congested cities. Furthermore, the number of comparative studies that have focused on fine-grained analysis of urban design issues in transit-oriented developments are limited. Therefore, this study explores transit-related synergies and capacities for change by drawing on a comparative analysis of urban areas centred on metro stations. Five study areas have been selected from Tehran, offering a broad range of urban morphologies, functional mix, streetlife, everyday mobility patterns and location within the major formal public transit network.

5.1. Case study selection

Case study approach is selected as an 'empirical inquiry', which investigates a complex phenomenon within the context of a real-life situation (Yin, 1994). It seeks to describe, map and draw relationships between different variables (Stuart et al., 2002). Yin (1994) argues that a case study does not aim for representing a 'sample' of larger universes and populations (statistical generalisation), but instead aims for expanding the theoretical propositions through analytic generalisation. The research is a case study with multiple study areas.

Two main approaches to case-study selection have been identified as 'information-oriented' and 'random' (Flyvbjerg, 2004). While random cases may not include data richness, information-based cases incorporate data richness on particular phenomena. This research adopts an information-oriented approach for selecting the case study of Tehran to investigate the synergies between transit and urbanity within different urban environments for potentials and capacities for change. The information-oriented type encompasses the choices of extreme, critical, maximum-variation, or paradigmatic cases (Flyvbjerg, 2004). Tehran has been considered as a critical case in the context of more congested and less formal cities that face significant challenges of rapid urban growth, car-dependency, traffic congestion, air pollution, urban informality and gendered public spaces (Amir-Ebrahimi, 2006; Atash, 2007; Bayat, 2010; Madanipour, 1998, 1999; Navai, 2014).

The embedded five study areas are centred on metro stations as the major public transit nodes. The selection of the study areas aimed at building a framework, based on the maximum variation rationale (Flyvbjerg, 2004), incorporating a broad range of transport modes and networks, urban morphologies, functional mixes, public activities and gender differences in the use of public space. To ensure such a variation, the study areas are selected from different parts of the city to understand how different conditions of urban morphologies, demographic profile and context might make a difference. This is also linked to the fact that a north-south divide in Tehran has been manifest in both its social and physical structure (Bayat, 2010; Madanipour, 1998; Navai, 2014). A further consideration is to select study areas with different conditions of high-volume public transport modes. There are primarily four different kinds of high-volume transport nodes in Tehran; those that are the intersection of different metro lines, those that are the intersection of metro and BRT lines, those that are where there is no major public transport intersection and those that are at the end of major public transport lines. Therefore, the study has chosen two nodes where metro and BRT lines intersect. The other three nodes are where metro meets non-BRT bus lines. In order to capture everyday life in Tehran, exceptional high-peaks (intersecting metro lines) and low peaks (end lines) have been excluded. Thus, the focus is on standard stations along various lines. Figure 5.1 shows Tehran, the major formal transit network and the five study areas – Shariati (north), Shoosh (south), Saadi (centre), Sarsabz (east) and Navab (west).

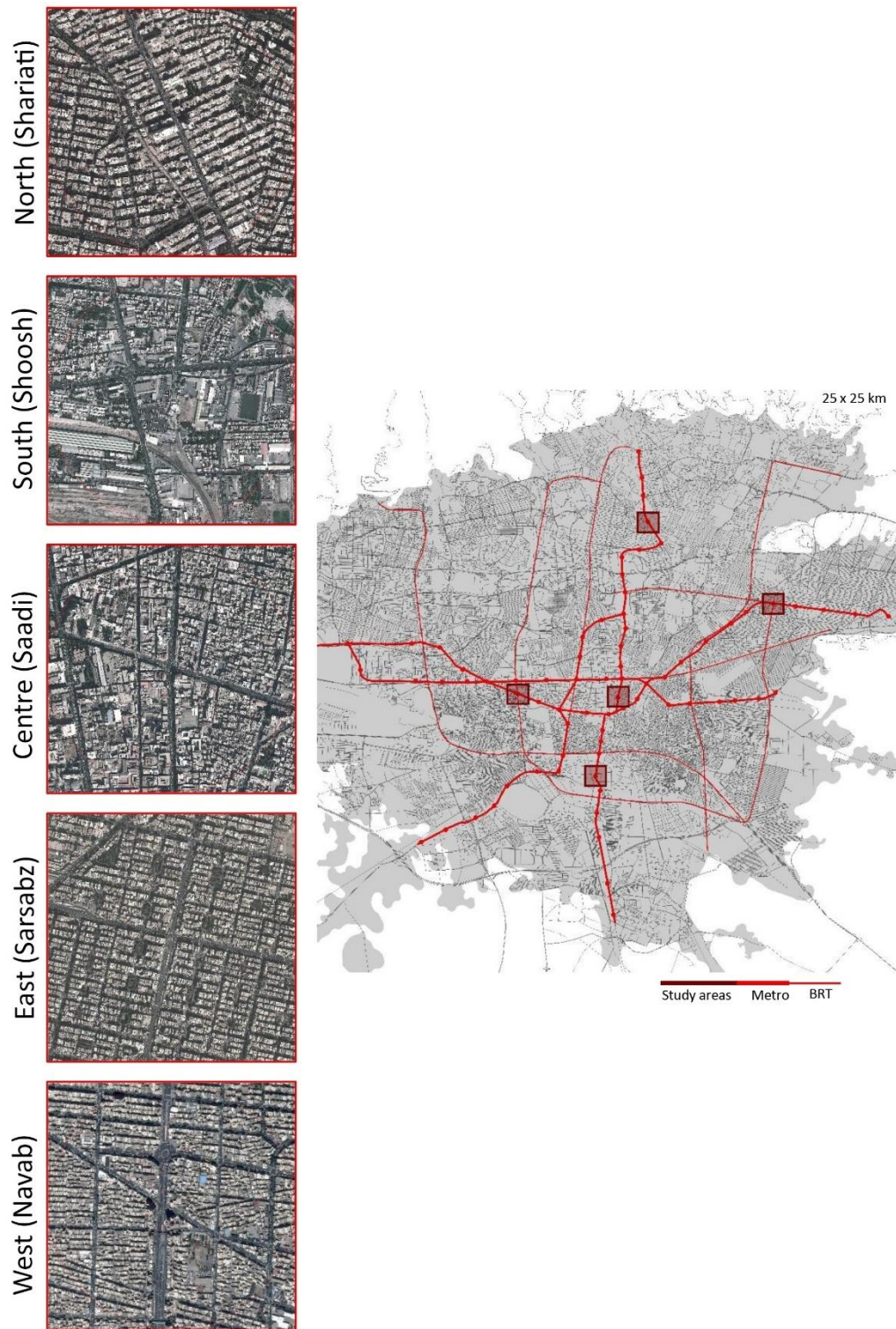


Figure 5.1. Study areas within Tehran

5.2. Research methods

The study uses multiple methods for data collection and analysis to address research questions. Triangulation is used as a key rationale (Janesick, 1994; Yin, 1994) by converging multiple methods, data sources, theories and empirical materials. Such a methodological approach provides a more robust basis for understanding of the research phenomena (Denzin & Lincoln, 1994; Dowling, 2000; Jick, 1979) since any singular method has limitations and potential biases. These methods are detailed below.

To address the main research question and provide insight into what the existing synergies are within the mix of mixes – morphological, functional, transport mode and streetlife – require the detailed investigation of morphologies, access networks, density, functional mix, everyday mobilities, gender differences and public activities in the five selected study areas. The methods of data collection and analysis incorporate non-participant observation, fieldwork notes, photographing, filming, archival records, multi-scalar analysis and urban mapping (morphological, behavioural and isochrone).

Fieldwork for this study was conducted in Tehran from September to October 2014. Since a part of the fieldwork includes studying the intensity of streetlife, the first months of autumn were selected to avoid the periods of unfavourable climatic conditions. Hence, the selected timeframe for studying all the five case study areas incorporate mild climatic conditions (i.e. without rain and strong wind) to minimise the short-term distortions of pedestrian activities.

5.2.1. Multi-scalar analysis

The study uses a multi-scalar approach to explore the ways in which transit-related synergies and capacities for change at urban design scale interconnect with larger scales of the city. The case study areas are analysed within urban scales of an easy walking distance of about 500 metres from the transit station (1 x 1km), the broader district (4 x 4km) and the whole city (25 x 25km) (Figures 5.2 and 5.3).

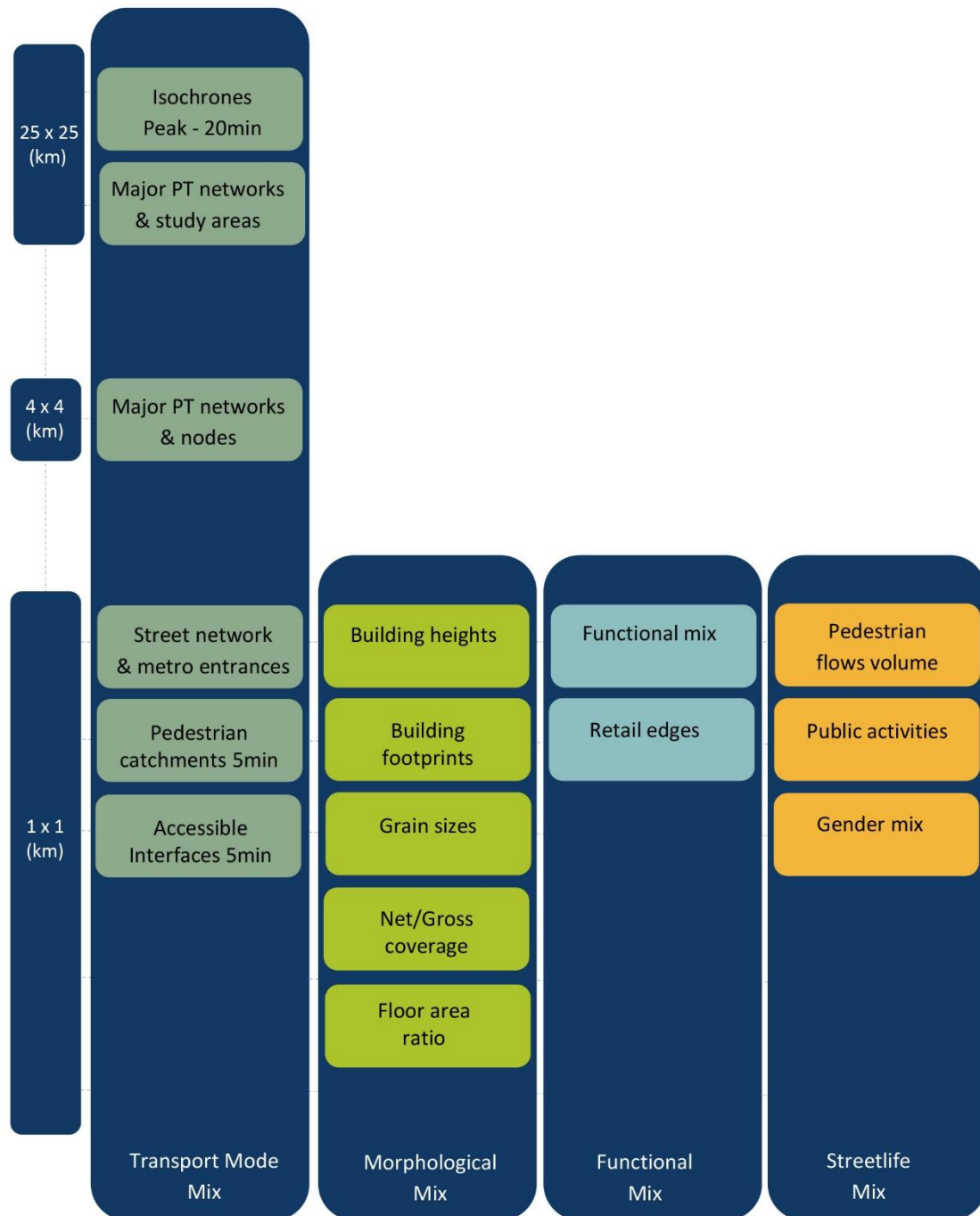


Figure 5.2. Diagram of scales

Figure 5.2 is a diagram of scales within a mix of mixes, indicating the ways urban design dimensions associated with morphological, functional, streetlife and transport mode mixes are analysed at different scales. The average radius of 400-800m is recommended as an easy walkable scale for transit-oriented urban design (Calthorpe, 1993; Dittmar & Potichia, 2004), thus well framed by a square of 1 x 1km. This measure is highly reliant on the quality of pedestrian space (Gruen, 1965) and its users (Gehl, 1987). At this scale, the questions of density,

functional mix, catchment of accessible public spaces, accessible interfaces and intensities of streetlife are explored. The 4 x 4km scale has been selected to document large-capacity transport networks and stations that are key nodes for everyday travels beyond the walkable scale. The average city commuting scale in this study incorporates a frame of 25 x 25km, which makes it possible to analyse the location of each key metro station relative to the city of Tehran and the ways in which each metro station connects to the metro network. Another critical analysis at this scale incorporates catchments by different modes of transport from the selected metro stations including public transit (BRT and Metro) and walking, car-taxis and motorcycle-taxis.

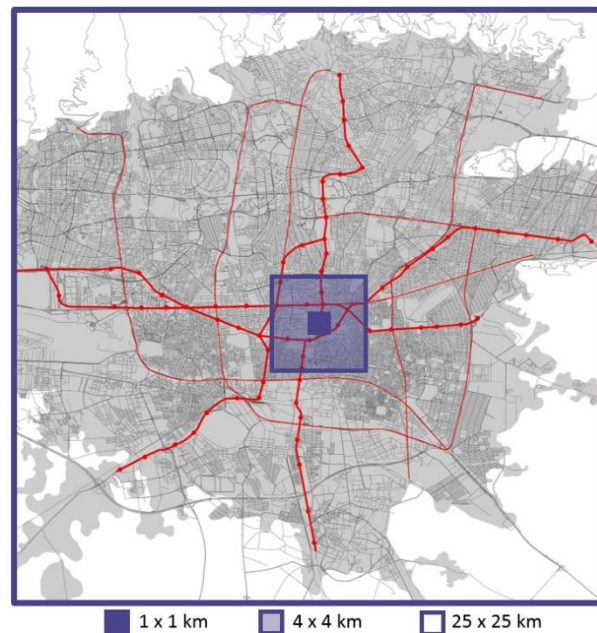


Figure 5.3. Three key scales of analysis on the map of Tehran

5.2.2. Non-participant observation

Non-participant observation is a primary method in the studies of streetlife (Gehl & Svarre, 2013; Jacobs, 1985). This method predominantly relies on visual experiences and gathered knowledge to interpret urban phenomena. The lack of publicly available data on each study area increased the importance of non-participant observation as a primary diagnostic tool. To collect data on functional mix and morphological properties such as building height, lot size, street networks and building types, the preliminary maps with different layers were created prior to fieldwork using an online database (<http://map.tehran.ir>). The maps were then completed and modified

on the spot. While the online database was a useful tool in enabling a more effective data collection, it was not complete in some areas (i.e. street views of narrow laneways and dead ends were not captured).

Urban transport isochrones have been identified as a useful way to document the ways in which one makes choices between different travel modes in everyday life (Bertolini et al., 2005; Bonotti et al., 2015; Dovey et al., 2017; Lei & Church, 2010; O'Sullivan et al., 2000) (see the section on isochrone mapping for further detail). This study uses observation together with Google Maps and public transport timetables (Metro and Bus Rapid Transit) to investigate the ways in which high volume public transport competes with car-taxis and motorcycle-taxis. All data was collected during the morning rush hour (6:30 - 8:30 am) on weekdays. Non-BRT bus networks have been excluded because they are generally infrequent and run through mixed traffic with cars. Private cars also have been excluded because of the restrictions on their use in different parts of the city during working hours and parking delay time, which diminish their capacity to compete with other forms of public transport. Observations indicated that the general practice for car-taxis is to wait for about four customers travelling to similar destinations before departing. This often incorporates an average delay of 5 minutes at the beginning of each journey. It has been pointed out that the data collection of different travel patterns is challenging in the less formal cities because there is no available data on informal mobilities (Kibambe Lubamba et al., 2013). To overcome such challenges, the data for motorcycle-taxis has been collected through direct observation. For each study area, a motorcycle-taxi was hired to test the 20-minute range in different directions. These journeys were undertaken at least 24 times for each case study starting from the station. The total journey time did not involve any waiting times because motorcycle-taxis can depart promptly from the metro entrances. In the case of accessible interfaces and catchment of accessible public spaces, observation was used in addition to Google Maps, to register the access points within 5 minutes. This is because Google Maps is not accurate enough at the micro-scale as it does not account for the micro-scale barriers to pedestrian movement such as BRT fences. The applied methods are intended to reveal general patterns of formal and informal mobilities; while these measures are consistent across the five study areas there might be a degree of inconsistency between different modes due to the use of multiple data sources.

The study also uses non-participant observation to gather data on the volume of pedestrian flows within public spaces. Observations with the main purpose of counting have been traditionally used in the studies of time-geography in order to represent the ebb and flow of the spatiotemporal patterns of everyday activities (Kearns, 2000; Shapcott & Steadman, 1978; Walmsley & Lewis, 1984). The study accumulates observation and counting of pedestrians passing the specified street sections (approximately 50 metres from each intersection, marked on a map before the fieldtrip) during midday peaks on weekdays. The midday rush hour (12-2pm) represents Tehran's peak of streetlife when there is a broad range of stationary activities. For the aim of this study, total pedestrian flows in both directions are recorded without taking into account stationary activities. A 10-minute period is selected as a random sample (Gehl & Svarre, 2013) to compare the peak time pedestrian flow using a smart phone app. The observation indicates that the manual counts in the areas with a markedly higher volume of flows can face challenges in delivering the counts of more than 600 pedestrians over a 10-minute period. To overcome such challenges, the pedestrian flows are counted separately in each direction. It is important to note that the capacity of a single researcher posed some limits on better capturing pedestrian flows in each 100-hectare study area; there are many station areas in which a longer timeframe could result in a better understanding of the patterns of pedestrian flows.

A number of studies have introduced systematic observation as a key tool for capturing everyday actions and groups of users in public domains (Gehl & Svarre, 2013; Sommer & Sommer, 2002; Varna, 2014; Whyte, 1980; Whyte & Bemiss, 1978; Zeisel, 1984). Addressing the questions of "who does what, where, when, including or excluding whom (and why)" while doing observations can be crucial in exposing the ways in which public spaces work (Rapoport, 1993, p. 9). In this way, behavioural observations not only enable the researcher to get a dynamic sense of more complex chains of events but also unravel the ways in which different people bring places to life (Zeisel, 1984). One of the concerns of this research has been to understand the ways in which patterns of everyday streetlife play out in public realm across the study areas: where and to what extent urban public spaces are used or appropriated by different individuals for various stationary activities? Therefore, the study draws on behavioural observation as a key method to capture a mix of stationary activities including standing, sitting, informal trading, street performance and playing as well as gender differences and their spatial manifestations. Walking on site for a long cohesive period during the midday peak periods was

key to exploring the spatiality of gender differences in the use of public spaces, informal trading and mobility patterns.

Another key issue that assists with understanding the complexities of urbanity is the ways in which 'clues' can be read within different urban environments (Jacobs, 1985). To document these clues and indicators during the fieldwork, capturing the 'non-event' (Sommer & Sommer, 2002) was considered as important as what existed in the study areas. This means to capture what is not happening that is expected to take place during observations.

The study applied the fixed-unfixed continuum theorised by Hall (1966) in relation to the environment-behaviour interactions. Fixed-feature elements in urban assemblages incorporate buildings and street layouts that cannot be easily changed while the unfixed elements include people, motorcycles, cars and so on. There are also semi-fixed elements, what Nicholson (1971) calls 'loose parts', which can be easily manipulated and changed; such as tables, seats, food stalls, signage and so on. This research addresses the key questions of how different users' actions are organised by observing fixed, semi-fixed, unfixed elements in urban public space and the ways in which they are linked. Loose elements have the capacity to allow 'non-verbal communication' in urban public spaces (Rapoport, 1982); they contribute to the flexibility of use in a space (Franck & Stevens, 2007) and offer possibilities for people to temporarily appropriate them and signify territories. The study draws on the nonverbal communication theory of Rapoport (1982) and directly observes different settings to make sense of the cues present in them. This unravels the relationships between the cues and different users' activities. Such a method becomes more important when it comes to understanding informal codes within public spaces. A record of details and nuances in relation to the observed links between nonverbal cues and ongoing activities were noted in a diary and translated into a visual notation on a base map using symbols for different activities and gender groups during the fieldwork.

5.2.3. Photographing and filming

Visual recording including photographing and filming is a commonly applied method in the studies of everyday public life. It has been identified as a useful research tool for capturing fleeting or complex situations for later detailed analysis (Gehl & Svarre, 2013). Whyte (1980) often used time-lapse recording in addition to his observations in the past to study people's

behaviour and public life in different urban spaces such as squares and street corners in New York. He argues that while this method seems an easy tool to capture pedestrians' social activities, it can be difficult in the evaluation process. This is the similar difficulty as it is with the direct observation due to the overwhelming level of information, which can be addressed by running the recordings for multiple times at different speeds (Whyte, 1980).

The study uses photographing and filming as a supplementary method to fill the possible gaps of direct observation during the field survey. While photographs and film make it easier to sit at the desk and accurately analyse the recorded situations as well as explore new patterns, they may pose limitations. Using a video camera to document everyday life in the reference station areas can be particularly challenging even though it is conducted in the public domain. A preliminary pilot study showed how some groups of people such as informal traders and women might change their behaviours or react defensively. In such conditions, 'unobtrusive observation' (Sanoff, 1991) is employed as a better alternative to photographing to understand the ways in which different people perform various activities in public spaces with the least influence or obstruction from the researcher.

5.2.4. Urban mapping

The map is open and connectable in all of its dimensions; it is detachable, reversible, susceptible to constant modification. It can be torn, reversed, adapted to any kind of mounting, reworked by an individual, group, or social formation. It can be drawn on a wall, conceived of as a work of art, constructed as a political action or as a mediation.

(Deleuze & Guattari, 1987, p. 12)

Mapping has an agency in the production of spatial knowledge, which can be interrogated to develop a better understanding of how the city works (Kitchin et al., 2011). Corner (1999) develops an understanding of mapping as unfolding potentials; they uncover "the various hidden forces that underlie the workings of a given place" (p. 214). He argues that maps act as rhizomes as they are infinitely open and engender milieus to new possibilities of action. Drawing on ideas of Deleuze and Guattari (1987), it has been argued that maps are in constant process of becoming; they are not simply "representations of particular contexts, places and times", but

nonetheless are “mobile subjects, infused with meaning through contested, complex, intertextual, and interrelated sets of socio-spatial practices” (Del Casino & Hanna, 2005, p. 36).

The research used urban mapping as a lens to develop a better understanding of different socio-spatial assemblages across the five study areas. Three forms of urban mapping are employed in this study, which are further detailed below.

Morphological mapping

The morphological elements mapped in this study are building footprint, building height, grain size and street network. Grain size is mapped according to the scale of 0–300m², 301–400m², 401–500m², 501–1000m², 1001–5000m² and >5000m². To measure the built density of station areas and the degree to which it is correlated to urban form, the study explores the links between building heights, footprints, gross floor area ratio (FAR) and net/gross coverage for each case study. The heights of the buildings are coded according to the number of storeys on each property using four categories (1-2 storeys, 3-5 storeys, 6-9 storeys and >9 storeys). The building footprints of each study area are mapped with present buildings, lots and street network in detail. This mapping illustrates the figure-ground relationships, which can be a useful tool for identifying different patterns of urban fabric in a static and two-dimensional representation (Trancik, 1986). The analysis of residential, job, population densities was constrained by the availability of data in the reference study areas.

In this study besides the common mapping of morphological properties, a key focus is on mapping functional mix as generator of synergies between different uses within the walkable proximity of reference metro stations. Chapter 2 investigated the commonly-used metrics for measuring functional mix and the potential limitations associated with them. For the aim of this study, the live/work/visit triangle is used (Dovey, 2016), which is adapted from the works of Hoek (2008) and Mashhoodi and Berghauser Pont (2011). In this approach, the functional mix is mapped based on observations. The coverage percentage of each category per 100 hectares of study area is also combined with the maps, which made comparison between mixed and monofunctional urban areas easier across the five case studies. The possibility of detailed functional mix mapping and quantification in the studied station areas was constrained because there was not a publicly accessible database that could quantify floor areas for different

functions at cadastral scale. For mapping formal retail edges within the public spaces, storefronts are mapped in each reference study area.

Isochrone mapping

An isochrone indicates a line joining equal travel time points from a particular location. Isochrone mapping has been used in the studies of science and transport planning since the 1880s to represent the connections between time and space. Early isochrone mapping examples incorporate Galton's (1881) 'isochronic passage-charts', which aimed at representing the distances that could be traversed from London to various parts over the globe using different sea- and land-based means of mobility. The isochrones that could show the journey time by public modes of transport from the inner-city areas were developed in the 1950s, playing a primary role in urban transport planning (O'Sullivan et al., 2000). Since then, urban transport isochrones have been broadly used to understand how far one can get using different transport modes. Isochrone maps differ for each given location according to the factors including travel mode and direction, time period (over a day or a week) and the user's ability (Lei & Church, 2010). While there are always other issues involved, travel time is considered as a key criterion. There has been an increasing interest among urban and transport planners in using GIS to automatically produce isochrones for journeys by various modes of transport (Bertolini et al., 2005; Bonotti et al., 2015; Dovey et al., 2017; Lei & Church, 2010; O'Sullivan et al., 2000). Travel time websites (e.g. Mapnificent and Mapumental) have also become more extensive, allowing users to measure how far one can get from a specific location in a given time using public transport services. However, one of the limitations of these interactive websites is that they are generally limited to Western cities, which incorporate more accurate public transport timetables. Google Maps allow for an instant reading of travel times and route choices between any two given locations using various modes of transport. However, this method is not applicable for public transport accessibility in the less formal cities where the provision of reliable public transport timetables is often problematic.

The response to the challenge of using isochrone mapping as a tool to compare accessibility of various modes of transport is relatively recent. Bertolini et al. (2005) have developed an isochrone mapping method to measure the areas from 'urban nodes' (where the jobs and non-daily activities are concentrated) that can be accessed by various transport modes relative to residential areas. With the use of isochrones, the study proposes the intensification of functional

mix patterns within the public transport catchment areas. It also draws attention to the implications of transformational change in transport provisions and functional mix patterns for both walk and bicycle isochrones across the city. For instance, it addresses the question of how the proposed transport link contributes to the shrinkage or expansion of walk or cycling isochrones. However, the isochrone maps for various modes were not superimposed, which made comparisons harder to interpret. Bonotti et al. (2015) developed isochrone mapping to investigate space-time accessibility of public amenities before and after the implementation of a new light railway network in Brescia. The study argues that the multiscale and diachronic assessment of public transport accessibility not only exposes the differences between various transport modes and time-based zones but also opens up the potentials for the future changes in planning choices; i.e. transit infrastructure and location of transport services. The applied space-time mapping methods are useful in unravelling the sites with the greatest potential for transformational change such as major transit nodes and corridors and activity centres.

Walkable catchment areas or 'pedsheds' and interface catchments are discussed in Chapter 2. This study measures both catchment of accessible public spaces ($CAPS_{5min}$) and accessible interfaces (AI_{5min}) from the metro stations within a 5-minute walking distance. The accessible interfaces (AI_{5min}) measure used here is similar to what is called 'interface catchment' (IC) (Pafka & Dovey, 2017), with a difference that it considers travel time instead of travel distance. Hence, it accounts for the micro-scale barriers in the total time period travelled. The $CAPS_{5min}$ measure used in this study indicates the total accessible public spaces for pedestrians excluding the blocks, high-speed and high-volume road networks and impermeable open spaces. This measure is adapted from the previously developed metric of IPCAs (impedance pedestrian catchment areas) (Schlossberg & Brown, 2004) (see Chapter 2). The advantage of the $CAPS_{5min}$ is that it includes parks and other publicly accessible open spaces while excluding the impermeable open spaces. The exclusion of high-speed arteries would minimise the impact of large impermeable areas. It is common practice for many pedestrians in the less formal and more congested cities to transgress formal traffic rules and walk through the vehicular traffic especially in the cases with narrow sidewalks or deterrents to pedestrian movements. The proposed measure also accounts for the narrow dead-ends in the studied areas. Another key issue about this measure indicates that it considers micro-scale barriers such as BRT fences that may impede pedestrian access to/from major transit nodes. The delay time for such barriers is deducted from the total journey time. While the measures of $CAPS_{5min}$ and AI_{5min} can be valuable tools in understanding

how flows of pedestrians are enabled or constrained at the neighbourhood scale, they share some limitations with the previously discussed accessibility measures (see Chapter 2). For instance, the measure of CAPS_{5min} does not differentiate between various block shapes and block sizes.

This study also uses isochrone mapping as a means to compare the accessible areas for different transport modes within 20 minutes from the reference metro stations. The study analyses the collected data from Google Maps and public transport timetables as well as observational fieldwork (see observation section) to produce isochrone maps.

Behavioural mapping

Since the links between built form and people's behaviours have long been an issue of concern in the fields of environmental psychology, urban design and planning, a number of studies have used behavioural mapping methods to illustrate the ways in which everyday activities play out in urban public spaces. Behavioural mapping has been identified as a key method to represent a detailed 'snapshot' (Francis, 1984, p. 25) of where and what activities take place in the public realm (Sommer & Sommer, 2002). In the 1960s, Gehl introduced a behavioural mapping method to study where pedestrians stand in public spaces (Gehl & Svarre, 2013). They showed that the edge of public spaces are popular areas for individuals to situate themselves – what De Jonge (1967) calls the 'edge effect'. Gehl et al. (1977) later deployed another mapping method, showing the spatiality of different activities as well as different age groups (adult sitting, adult standing, adult standing and talking, adult doing something, child playing, child standing or sitting) within residential streets of Melbourne (Figure 5.4). While the method is useful in demonstrating the interactions between some limited age groups, it faces some limitations in terms of the consistency of categorisation. The differentiation between different age groups could also benefit from a wider range of young and elderly groups.

Figure 5.4. Mapping activities and user groups on residential streets (Gehl et al., 1977).

Whyte and Bemiss (1978) developed a mapping tool to record the social behaviour of pedestrians in the department store doorways within New York and Tokyo (Figure 5.5). The study focused on two main activity types, which involve standing pedestrians in New York and pedestrians having conversations in Tokyo. One of the findings of this study is about the ways in which static activities tend to cluster in the areas with a high level of pedestrian flows.

Figure 5.5. Mapping activities of department store doorways (Whyte & Bemiss, 1978, p. 4).

Mehta (2009) captured stationary, lingering and social activities through walk-by and timed observations as well as participant observations to understand the relationships between spatial form of the physical settings and social behaviour on different commercial streets in Boston. A combined plan and elevation of studied areas are used as a base map on which 14 activity types are plotted. As Figure 5.6 shows, the produced maps illustrate urban environments with detailed physical design features, which can be useful in understanding where stationary activities are clustered. However, the relationships between the physical environment and different forms of activities are not clearly represented. Furthermore, the produced maps are not legible since the

boundaries of many of the activity categories overlap and one can become easily the subset of another.

Figure 5.6. Behavioural mapping of people engaged in stationary activities on different commercial streets in Massachusetts (Mehta, 2009).

This study focuses on the activities that often encourage people to stay in public open spaces around reference stations and considers these public spheres as places to be rather than places to get to a destination. Such activities are often stationary in a way that can be considered as a kind of temporal appropriation of public space for possible face-to-face interactions between different humans and for stepping out from daily routines, possibly just for a short time (Carr et al., 1992; Gehl, 2010; Stevens, 2007; Whyte, 1980). This study introduces a fine-grained mapping method to illustrate the spatiality of stationary activities as well as gender differences. Thus, while the study is concerned with an interpretive act, what is called 'thick description' (Geertz, 1973), to obtain a deep and multifaceted understanding of the human behaviour and streetlife intensity within public space, it seeks to translate the collected data into a visual format. To analyse the collected data from observational fieldwork and visual recordings, the study uses different dots with different colour codes based on different forms of stationary activities including standing, sitting, informal trading, street performance and playing and the number of users engaged in public open space. The registered categories are consistent with Miller's (1956) argument that more than seven categories would be beyond the span of legibility. The proposed mapping method unravels the ways in which different people are engaged in public activities: where they are located in the public space and how intense their level of use is (individual, in pairs or in groups of more than three people). The diameter of the mapped dots varies from low (smallest ones) to high (largest ones) with a medium condition in-between. The smallest dot in this method indicate individuals engaging in actions. The mid-sized dot shows the users who are more likely to perform activities in small groups of two or three people. The largest dot refers to the people who have appropriated public spaces for their uses in larger groups (more than three people). A similar method is used for mapping the spatiality of gender differences to unravel the ways public spaces are shared between men and women and the ways acute forms of social exclusion are spatially manifested within cities. The number of categories in this method

is limited to two main groups of men and women. The proposed method has the potential to expose the ways public spaces within walking distance of the stations can either enable or constrain a diverse range of activities as well as gender groups.

This chapter discussed the research design, providing an explanation and justification for the selected case study areas and key research methods (direct observation, fieldwork notes, visual recording and urban mapping). The findings of the empirical research are presented in the next five chapters (6-10). Each of these accounts is based on the findings from a single case study – each telling the story of a particular urban socio-spatial assemblage.

6. THE NORTH: SHARIATI



6. THE NORTH: SHARIATI

Introduction

Shariati station is located in a residential neighbourhood, 9.5km north from the city centre, at the highest elevation of Tehran's sloping landscape. This study area has a better climate and a visual dominance. The well-off denizens of this part of the city are often associated with higher social classes, more liberal ideologies and religious openness. The access network is relatively recent, evolved in the mid-20th century and adapted to the north-south sloping topography. One of the city's north-south running creeks (Zargandeh) crosses the reference area and is lined with high-rise residential developments. These luxury apartment buildings clustered along the grid network form modern and westernised streetscapes. Unlike the old city centre (with the primary functions of exchange, production, consumption) and poor south (with a mix of production, storage, residential and cheap labour), this part of the city is where the relations between practices of dwelling and consumption take on a more key role. Shariati is a highly car-dependent area, only connected with the north-south axis of the city via the underground metro line as the only high-volume and frequent public transport. The street network at the scale of 1 x 1km are jammed with car traffic where speeds are low and informal pedestrian crossing is predominant. This is closely related to the proximity of the study area to major highways in almost every direction at the scale of about 4 x 4km. This chapter first provides a brief summary of the case study location by focusing on the ways it connects to the high-volume public transport network across the three main scales of analysis. Through a series of urban mappings, it then explores the morphological, functional, transport mode and streetlife mixes associated with the Shariati transit node. The final section of the chapter summarises the key themes by addressing the ways this particular urban assemblage works, the transit-related synergies and capacities for change that emerge from interconnections between urban morphology, transport modes and streetlife.

6.1. The study area

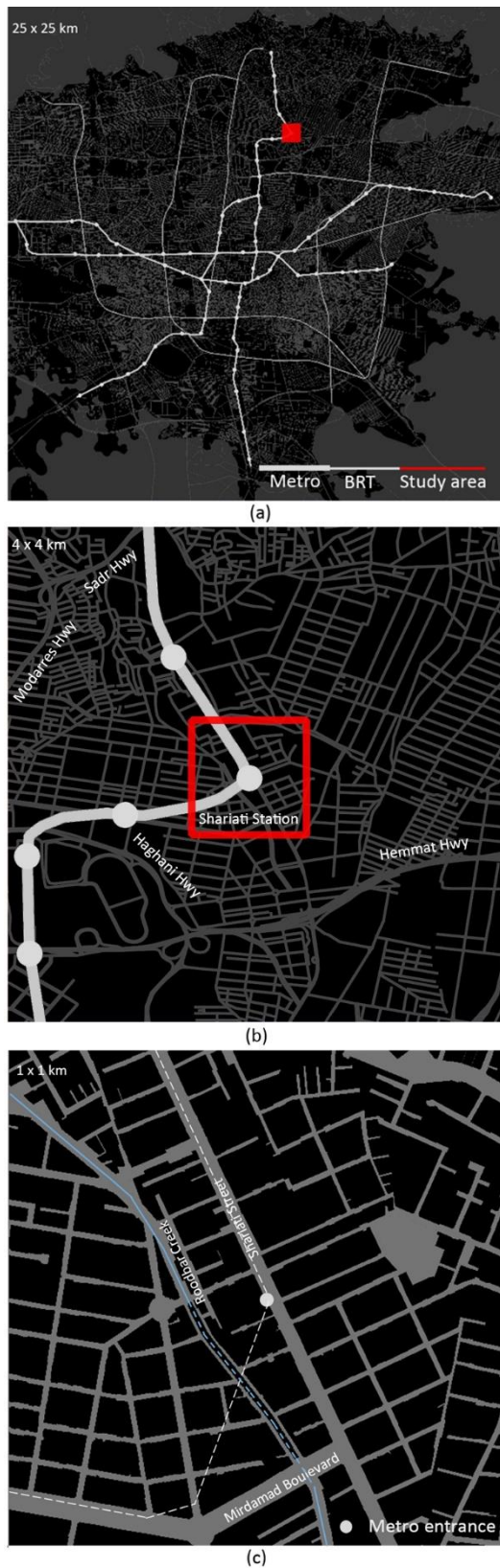


Figure 6.1: Shariati study area

The study area comprises a 100-hectare area within walkable distance of the Shariati metro station. The metro network was extended through the study area in 2009. The reference station area is roughly divided in half from northwest to southeast by Shariati Street, which connects the key east-west axis of the city (Enghelab Street) (see Chapter 4) to its northern end. Parallel to the Shariati Street, runs one of the city's creeks (Figure 6.1c), lined with modern apartment buildings as well as construction sites. The entry to the metro station is through an office building, from the Shariati Street (Figure 6.2).

At the scale of 4 x 4km, the station area is surrounded by major arteries in every direction, while there is just a single metro line providing high-volume public transport connection. To the south, about 1km from the metro station is one of the city's key east-west arteries – Hemmat Highway. To the north lies Sadr Highway, about 2km away from the reference area. Two other arteries in the city, Modarres Highway and Haghani Highway, intersect at about 2km distance to the west of the metro station (Figure 6.1b). At less than 2km to the east, the reference area connects with Sayyad Highway.



Figure 6.2. Metro entrance in the Shariati Street

6.2. Transport mode mix

The Metro is the only high-volume and frequent formal mode of public transport in the study area. Other formal public transport services include non-BRT buses and car-taxis. The metro line is north-south running along Shariati Street, which turns towards west near the metro station and thereafter extends towards Central and South Tehran (Figure 6.1b). The non-BRT buses are often infrequent and low-quality services, running through traffic mixed with cars along the north-south main street (Shariati Street). Observation suggests that motorcycle-taxi is the most common informal mode of transport.

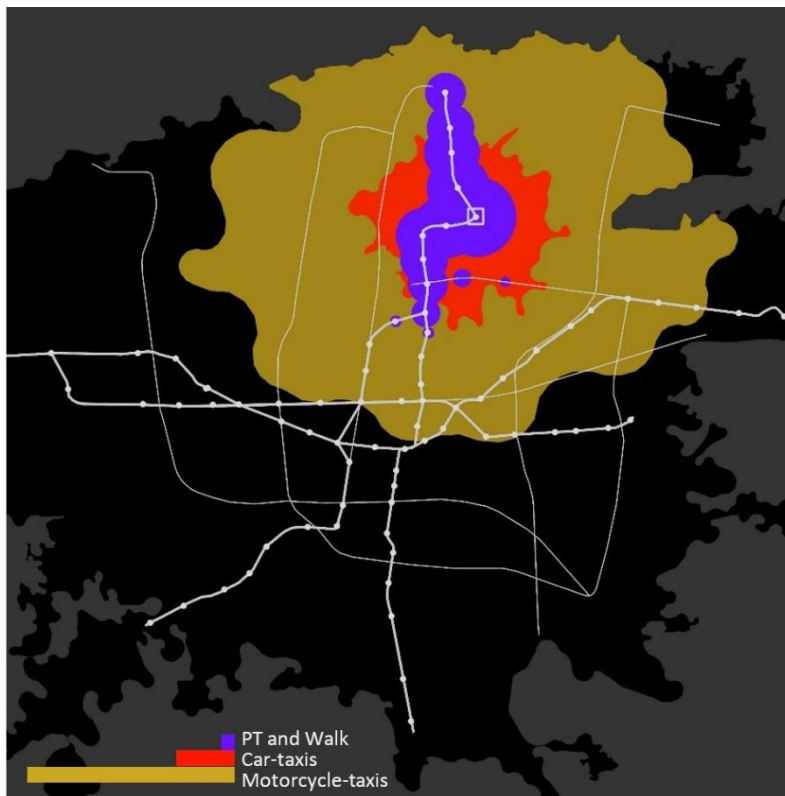


Figure 6.3: 20-minute isochrones: Car-taxi, motorcycle-taxi and public transport
25km scale

Figure 6.3 illustrates multi-modal isochrones for the Shariati station over 20 minutes with the three main modes of transport: motorcycle-taxi, car-taxi and public transport (metro and BRT). Motorcycle-taxi access is much greater than public transport and car-taxi in all directions. The average area accessible by motorcycle-taxi from the Shariati metro station is about 165km^2 compared to 27km^2 by car-taxi and 16km^2 by high-volume public transport. The Metro enables public transport to compete with the car-taxi in the north-south direction, but is non-competitive in most other directions. While it is often faster to use public transport than the car-taxi in the direction of key transit lines, this is not so for the motorcycle-taxi, which cover about six times the area of the car-taxi and have about three times the range of the car-taxi. The accessibility of the motorcycle-taxi has been inhibited by chain of mountains at the northern end and by the forest park at the eastern end.

6.3. Morphological mix

6.3.1. Access networks

The street network around Shariati metro station is relatively recent, evolved around several rural settlements with large farming lands since the mid-20th century. The existing access network often follows an overarching irregular pattern with several straight dead-end lanes distributed across the station area. The irregularity of street networks has featured a variety of block shapes and sizes allowing different degrees of accessibility around the major transit node. Block perimeters range from about 100 to 1200m and block lengths varying between about 20 and 290m. Therefore, the accessibility within a walkable distance from the station is mixed, with the catchment of accessible public space (CAPS_{5min}) of about 8.5ha where elongated rectangular blocks of about 30 x 290m mix with smaller blocks of 70 x 80m. The analysis shows that the elongated blocks are barriers to pedestrian movement and streetlife vitality. The total length of accessible public/private interfaces (AI_{5min}) from the metro station is about 12km (Figure 6.4).



Figure 6.4. Accessible interfaces within a 5-min timeframe
1km scale



(a)



(b)



(c)

Figure 6.5. Street widths from narrow to wide

Streets in the reference area vary broadly from cul-de-sacs and minor streets to a wide boulevard and main streets. Figure 6.5 illustrates street widths from the narrowest (a), medium level (b) to the widest (c) ranging between about 6 and 46m. Dead-ends and narrow lanes have widths of about 6-10m. A few exceptions to this pattern exist, with street widths of less than 3m. The average width of minor streets is about 10-20m and for main streets is about 20-30m. Many minor and main streets are protected from through vehicular traffic with a network of one-way streets and some barriers such as bollards to prevent 'rat-running', especially through the residential blocks. However, streets are often jammed with traffic during peak periods (Figure 6.5b), which is partly linked to the fact that the study area connects to highways and major vehicular arteries in several directions. At the scale of 1 x 1km, such a condition has resulted in lower car speeds, easier informal pedestrian crossing and motorcycles driving the wrong way up one-way streets.

6.3.2. Building densities

The map of building heights (Figure 6.6) shows that the vast majority of the study area has buildings of less than 9 storeys, and most of those fall in the 1-6 storey range. Exceptions to this pattern are mainly new developments that rise up to 10-16 storeys (Figure 6.11a). The map shows a 10-storey commercial-office building along Shariati Street where the underground metro station is located. There are several construction sites as well as recently constructed buildings throughout the reference area showing a tendency for developing greater building heights (more than 6 storeys) around the major transit node. This is also linked to the rash of high-rise developments in the affluent North especially since the 1990s, which has led to high profit rate on real estate (Bayat, 2010). Therefore, the older dwellings with lush gardens are now being extensively replaced by luxury apartment complexes and their parking lots in this privileged area. With a few exceptions of new high-rise developments, the main street close to the station (Shariati Street) is lined with low-rise buildings, rarely exceeding 3 storeys (Figure 6.11b). Distributed along this street, are also a few large vacant lots. The resulting gross FAR is about 1.9.

Since the reference area is largely characterised by relatively new developments, the urban morphology follows a modern and planned pattern where attached row houses are predominant (Figure 6.7). Exceptions to this pattern are some pavilion type buildings, which can be traced to the first layers of development. As is evident in Figure 6.7, building footprints cover up to 100% of the non-residential plots, and about 60% of residential plots. The residential lot coverage generally follows the urban code in Tehran's master plan of 1970, which requires buildings to be located on the north of plots and limits the ground coverage to a maximum of 60%. The gross coverage represents approximately 40% of the 100ha subject area.



Figure 6.6. Building heights (storeys)
1km scale



Figure 6.7. Building footprints, lots
and street network
1km scale



6.3.3. Grain sizes

The map of grain size (Figure 6.8) shows that the urban morphology of the study area embodies a mix of small, middle and large lots. The grain-size ranges from about 150m² to more than 5000m². Exceptions to this pattern are a few lots of about 9000m² distributed throughout the reference area. Residential sites are often characterised by a mixed-grain urban morphology, with older buildings on small plots (less than 300m²) and new developments occupying amalgamated lots, many of which fall in the 400-500m² and 500-1000m² ranges (photo 6.11c). The grain size along the main streets (Shariati Street and Mirdamad Boulevard) is mixed, with many work/visit buildings and sites under-construction occupying lots from 50m² up to 4000m². Observations indicate the practice of demolition and replacement of 1-2 storey small-lot houses or stores with large-lot high-rise developments.



6.4. Functional mix

The map of functions (Figure 6.9) shows a high level of work/visit mix along the main streets with vast residential hinterlands. Zoning ordinances have constrained functional mix throughout the station area producing singular uses of residential, with a low volume of streetlife. Most of the area is occupied by mono-functional residential blocks (red), accounting for approximately 55% of the 100ha study area (Figure 6.9 and 6.11d). The concentration of areas with mixed functions of live/work and live/visit is generally low; they are often occupied by either educational (green) or retail/residential (orange) buildings. By contrast, main streets around the transit node (e.g. Shariati Street and Mirdamad Boulevard) often exhibit a rich mix of functions, including vertical visit/work mixes. The lots along these public spaces are often occupied by both shopping centres and retail/office buildings. Buildings with singular work or visit uses often include offices, vacant construction lots, retail stores and a petrol station. The petrol station is on the opposite side of the metro building, attracting a large number of cars to the study area throughout the day. The primary uses along the main streets (e.g. offices, banks, shopping centres, educational buildings, hospital, etc) attract people from outside or inside the area varying from affluent customers and business owners to those engaged in working in private enterprises and offices as mostly middle-class and upper-middle-class individuals.

Figure 6.10 shows a linear pattern of retail distribution along the main streets. Such retail edges feature various kinds of foreign-brand clothing, home appliances and luxury products, which often attract wealthier patrons to the area. To the west of the station, an elongated rectangular block of 12 x 380m is located above the creek, which is a significant barrier to station accessibility (Fig 6.9). This block is a shopping centre, which attracts a large number of day-visitors. Except for a few small grocery shops and food stalls, formal markets along the retail edges do not often extend their goods and services beyond their thresholds. Observation indicates a competition among many retailers to maximise the pedestrian gaze onto product displays where they have often renovated their storefronts to differentiate their business from others. Figure 6.11e shows that shopfronts are not fixed in design or in the ways they are intended to be used.



Figure 6.9. Functional mix
1km scale

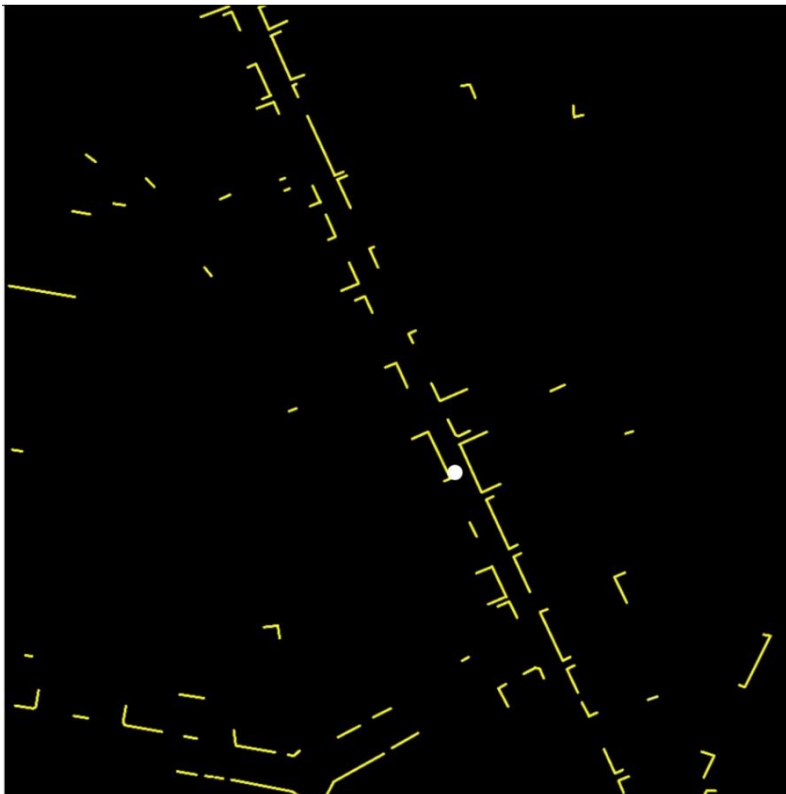
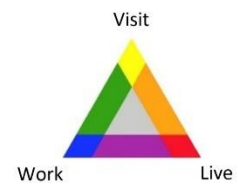


Figure 6.10. Retail edges
1km scale





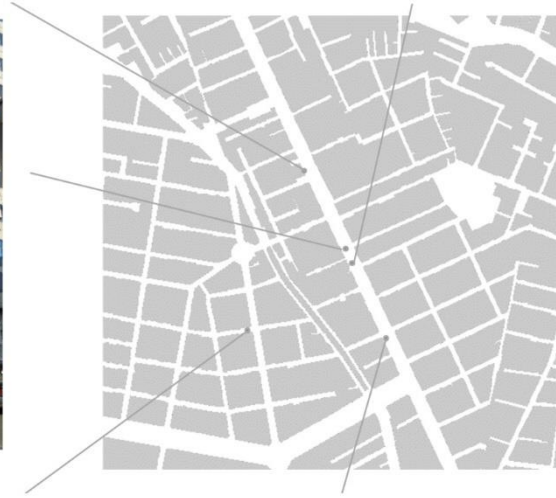
(a)



(b)



(c)



(d)



(e)

Figure 6.11. Formal and functional mixes

6.5. Streetlife

Figures 6.12 and 6.13 show that the vibrant streetlife in the station area is limited to some main streets (e.g. Shariati Street and Mirdamad Boulevard). Closer to the station, the concentration of public activities increases, as different types of users including passengers, storekeepers, consumers and informal traders recognise the possibilities inherent in public spaces and make use of those possibilities for their needs (Figures 6.16a,b,e). Observation suggests people sitting on loose chairs against food stalls; motorcyclists waiting for passengers in proximity to metro entrance, shopping centres and intersections of main streets; informal traders sitting at a few spots close to the station entry and setting up their small businesses. The rest of the areas accommodate a low volume of streetlife even during peak activity periods (Figures 6.16c,d). The mono-functional and large-grain developments often produce less attractive public spaces which are almost empty of people and their appropriations. Lack of such diversity is further amplified within some areas with wider footpaths and parks. The use of public space for play and street performance throughout the reference station area is rare. The few exceptions to this pattern were children playing in a park adjacent to their school and advertising performers drawing the attention of passers-by (especially females and children) to the retail edges along the main streets. One can also observe a low use of space for public sitting, socialising and people-watching. This condition is linked to the low concentration of public furniture and moveable elements along most sidewalks.

As shown in Figure 6.12, there is a limited use of space for self-organised musicians and informal traders across the study area. Observation suggests a low level of competition between the formal market and informal traders within the highly controlled urban public spaces of Shariati. The limited presence of informal traders is often geared to those parts of the access network with a high volume of pedestrian flows and a low possibility of strict control. An example of this pattern is the limited presence of informal activities along the Mirdamad Boulevard where a police kiosk is located in proximity to a major intersection. Hence, along this axis traders follow more mobile and less durable patterns for their informal businesses. Their use of less mobile elements along the footpaths is often limited to the newspaper kiosks with a prefabricated fixed structure whose permission to trade is often negotiated with authorities.

Shopping centres in the study area provide opportunities for male performers to appropriate space, stimulating pedestrians' interests in escaping from the everyday life routines. Such performances are often tolerated within the quasi-public spaces as there is often a lower degree of moral policing over space and its users than that in public spaces. In addition, the presence of performers in shopping centres is geared to the pedestrian flows as they appropriate spots in proximity to busy entries. Such a use and appropriation of space generally distract pedestrians in the flow and extend their (especially women's) necessary activities of shopping into optional ones.

The map of gender mix (Figure 6.14) shows an even presence of men and women in public spaces. The level of use and appropriation by both men and women decreases as one gets further from the main streets. According to the 2006 census, the ratio of male to female residents (94:100) is lower than the city average (104:100) with a large proportion of single women residing in the subject area (Tehran Municipality and Tehran University, 2011). It is notable that unlike South Tehran, women in this part of the city are not confined to the private space of the dwelling but relatively more engaged in public space activities (Figures 6.15b,c). Figure 6.15a illustrates female college students passing through, window-shopping and wandering individually or in groups. The concentrations of shopping centres and modern cafés in North Tehran provide opportunities for young females and opposite gender users to gather and socialise. As Bagheri (2014) has noted, within such areas in North Tehran, many female teenagers wander around, display or show off themselves to attract attention of strangers and make eye contact with them – without necessarily making any purchases. While there are social norms and sanctions against women performing activities such as smoking and meeting with people of opposite gender in public space, quasi-public spaces such as shopping centres become places where codes are transgressed and women can temporarily escape from such restrictions.

Although women need to observe Islamic dress codes in urban public spaces, the broadening of the modern public domain and the growing autonomy of females in the affluent North have had significant impacts on the ways women behave in public space. Many females respond to such dress codes by turning them into symbols of fashion. These practices show the ways modernity competes while co-existing with Islamic codes and social sanctions (Amir-Ebrahimi, 2006). The police are installed in proximity to the metro station and shopping centre entries to control the ways dress codes are observed and activities are performed by different gender groups within

public spaces. Amir-Ebrahimi (2006) has argued that the morality police are concentrated in the Westernised, modern and wealthy parts of North Tehran where anonymity is most common and individuals do not accost each other for how they behave in public sphere and the ways they are dressed. This contrasts with the old traditional areas of the centre or the south of Tehran where self-policing is more common. To not attract the attention of the morality police, individuals, especially women, often change their behaviour such as trying to fix their hijab and young girls and boys distancing themselves and so on (Amir-Ebrahimi, 2006).

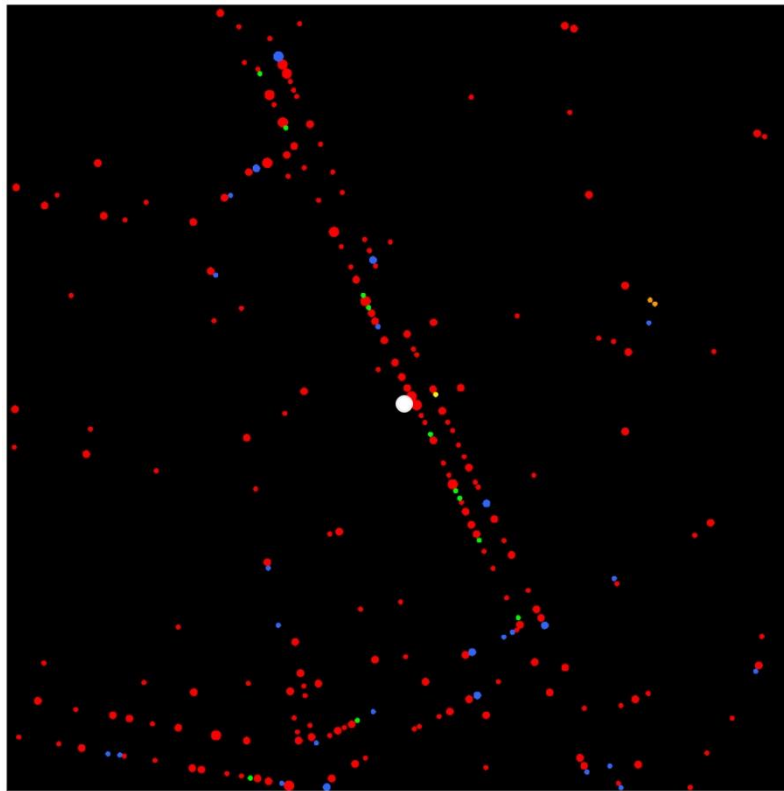


Figure 6.12. Mix of activities
1 km scale

● Standing ● Sitting ● Street trading ● Performance ● Playing

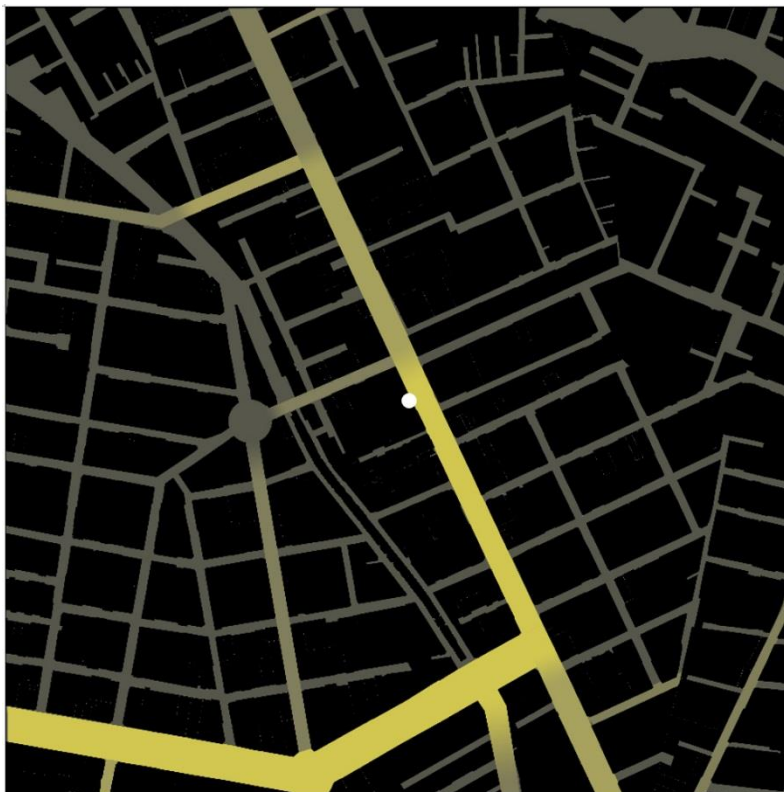


Figure 6.13. The midday-peak
volume of pedestrian flows
1 km scale

High Low

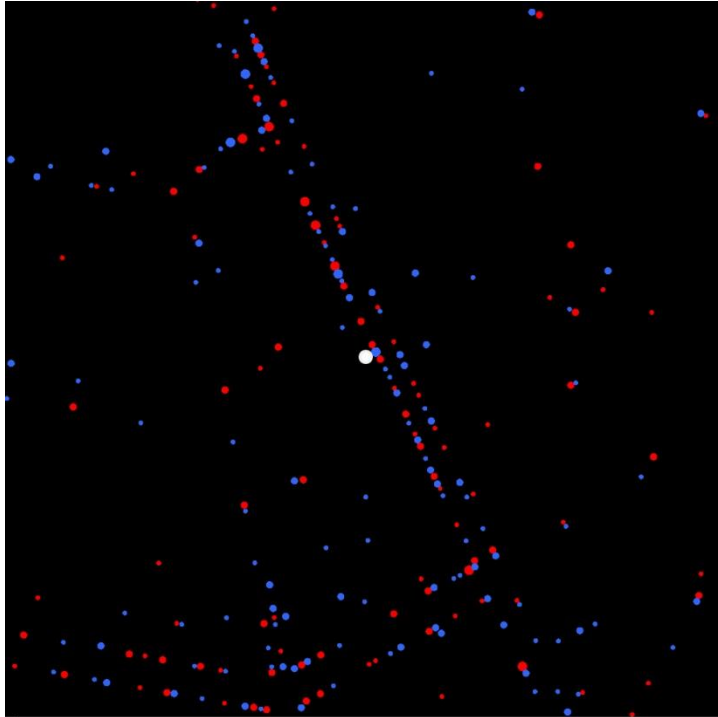


Figure 6.14. Gender mix
1 km scale

●● Female ●● Male



(a)



(b)



(c)



Figure 6.15. Gender differences in the use of public space



(a)



(b)



(c)



(d)



(e)

Figure 6.16. Mix of activities

6.6. Potential for change

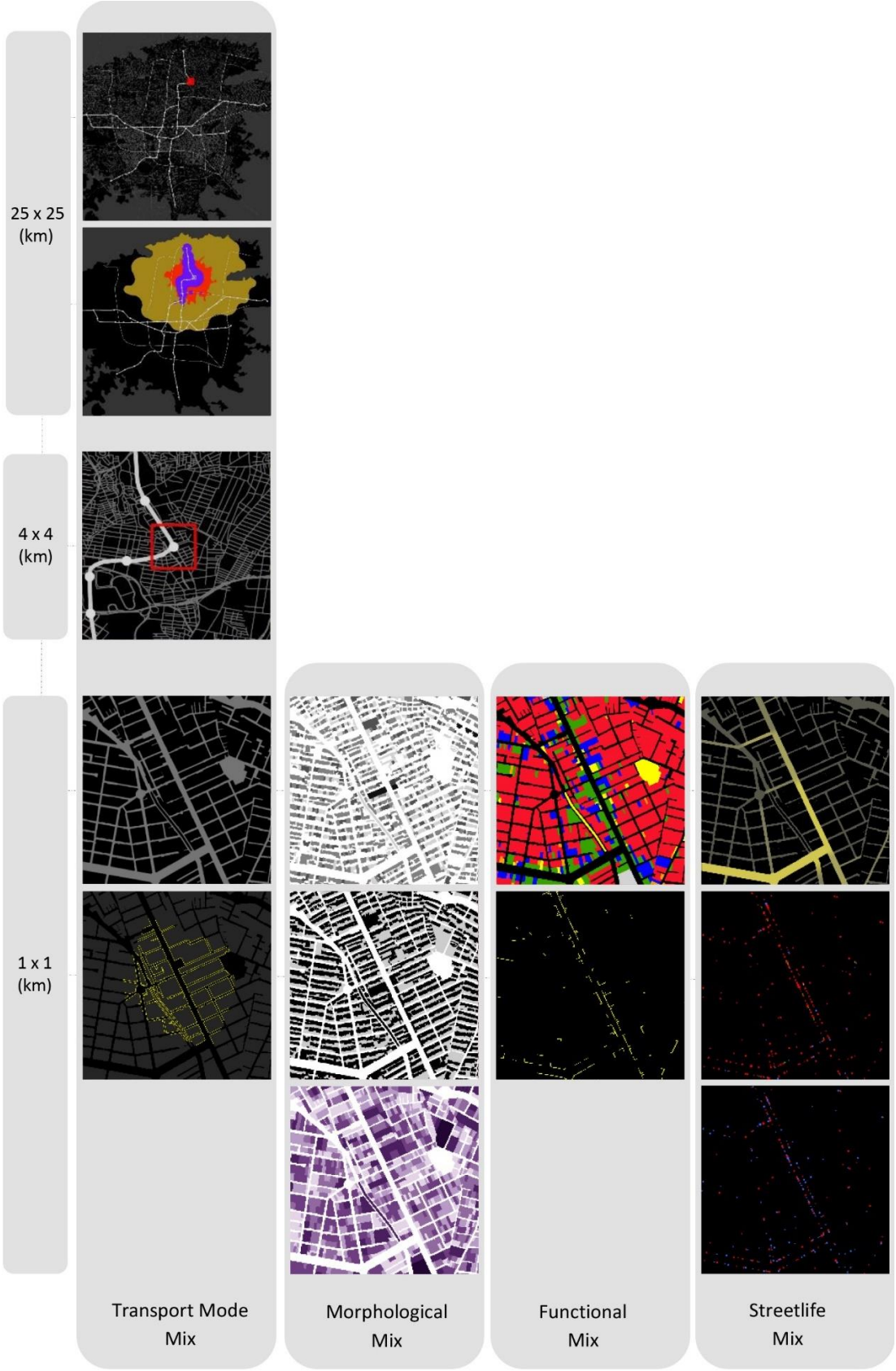


Figure 6.17. A map of maps

Mix of transport modes

Motorcycle-taxis are one of the most efficient patterns of mobility within the studied area, which is linked to their advantages of fast speed, almost no delays to departure and park a few steps away from the metro entry on the sidewalks. While the busy metro entry and shopping centres are controlled by numerous police and CCTV cameras, motorcycle-taxis still park temporarily in some areas to board passengers. A large number of people use motorcycle-taxis to travel from the station especially during the peak travel periods when the other modes of transport such as car-taxis and non-BRT buses fall short of providing efficient public transport service along the trafficked roads. The multi-modal isochrones indicate that the capacity for change here is to invest in high-volume, frequent public transit particularly in the east-west direction. This provides the leverage to enable this urban assemblage to connect effectively with its surrounding urban environments as well as to achieve modal shift for its more extensive catchment areas.

Morphological and functional mixes

Mixed-grain morphology around the studied station is often linked to less varied streetscapes and urban landscape devoid of life except along the limited main streets. While several attempts of site amalgamation and incremental change are evidenced in the small to medium grained residential hinterlands and (less frequently) in retail edges, the potential for redevelopment around the station is constrained by functional zoning, building codes and small grain holdings.

The analysis shows that the high intensity of streetlife in Shariati is often limited to main streets where the productive encounters are produced between different commercial and office uses. The diversity of grain sizes in these areas often enable synergies between work, exchange and consumption reciprocally drawing upon one another. Some changes have been under way along a main street where mono-functional work and retail developments have been replaced by new mixed urban developments. The fact that the petrol station has produced public spaces with a heavy vehicular traffic close to the high-volume transit station is not congruent with the concept of transit-oriented development. Therefore, such an area as well as the vacant lands adjacent to the station hold potential for infill development and higher-density transformation.

The station site is relatively mixed in main streets and mono-functional within the residential hinterland. The enforcement of zoning ordinances here inhibits the functional mix, the capacity for active transportation and adaptation around the major transit node because housing, retail

stores, schools and work are not within walkable proximity of each other. A more effective functional mix could be accommodated, shortening the distances between the station and various functions as well as enhancing transport flows. The capacity for change here relies on how and what forms of regulations best enable the emergence of functional mix – hence, increased retail edges on the ground-level of live or work buildings along the minor streets can lead to a more productive urban landscape and encourage walking from the station.

This case study showed that in some parts there is a limited capacity of walkable access to the station. This condition is linked to the predominance of elongated barriers to pedestrian movements and streetlife vitality, which opens up potentials for redevelopment. For instance, the areas with small-grained morphologies and vacant lots provide potentials for increasing permeability around the station.

Density and streetlife intensity

While the gross coverage is about 40% of the land area, the relatively high FAR corresponds to the great building heights. However, the metro station area is not much denser than the surrounding residential hinterland. This shows that a combination of FAR and other controls such as coverage and height is insufficient to estimate potentials for transit-oriented intensification.

The studied transit node has a much lower internal density than the city average. This is linked to the relatively larger dwelling sizes in the northern affluent urban areas. This condition is congruent with Berghauser Pont and Haupt's (2010) argument that consumption of space increases as internal density declines with increasing affluence.

While the studied metro station becomes a busy node especially during peak activity periods, the public spaces within its walkable catchment are not utilised at their full potential. The fine-grained analysis of public activities suggests that footpaths are often orderly and controlled where the enforcement of codes exerts a significant constraint on what can happen. Thus, the ways in which behaviour is controlled, is closely linked to how boundaries between different practices, functions and gender groups are established. In effect, possibilities are often curtailed through sanctions on some specific activity types or gender groups, as in restricting informal trading or controlling women's behaviours and forbidding face-to-face interactions between

opposite gender groups in public spaces. Therefore, there is a capacity within most public spaces to encourage possibilities for generating a loose domain outside the control of regulations and surveillance where socio-spatial boundaries can be softened or become porous for different forms of activities. Indeed, when kept open to a variety of uses and appropriations, public spaces around transit nodes thrive in diversity, producing intensive forms of urbanity.

7. THE SOUTH: SHOOSH



7. THE SOUTH: SHOOSH

“Shoosh, so near to Tehran’s beating heart, and yet on the edge of society itself. It may have been at the other end of Valiasr, but for most Tehranis Shoosh does not even exist” (Navai, 2014, p. 243).

Introduction

Shoosh station is located in the southern part of Tehran, about 1.5 kilometres east of the city’s main railway station and less than 1 kilometre away from the southern terminal of the city, which operates as a key bus hub for intercity travel. To the southwest, Tehran’s main intercity train line passes through the area, adjacent to a large area of train depot. While the reference area is close to Tehran’s beating heart, it is on the periphery of society. Its network of twisting lanes is generally filled with deprived and impoverished buildings, occupied by lower-middle-class and working-class people; the poorer residents of the area such as families of illegal immigrants and gypsies (locally called *Kolee*) often squat in abandoned and dilapidated houses (Navai, 2014, p. 244).

While historically the site’s development can be traced back to 19th century, urban transformation in this part of the city has been considerably slow. In other words, its physical and social structure has not been changed much over the hundred-year period, leading to a large gap with Tehran’s affluent North (Navai, 2014). The key east-west arterial road within the reference area, Shoosh Street (Figure 7.1c), runs along the southern section of the old city wall built in the 1880s (Qajar era). Following the rapid urban growth of the late 19th century, the construction works carried out in the city, attracted a large number of unskilled labourers from the rural areas to the south of the city (Gilbar, 1986, p. 86). Most of these new rural migrants remained in the lower stratum of the civil society, which was likely to have the greatest impact on the socio-spatial stratification of the capital. Due to the surge of migration in the 1920s and 1930s, many people especially tradesmen relocated to the northern and western suburban sections. Since then, the central and southern parts of the city have been subject to various degrees of deterioration.

7.1. The study area

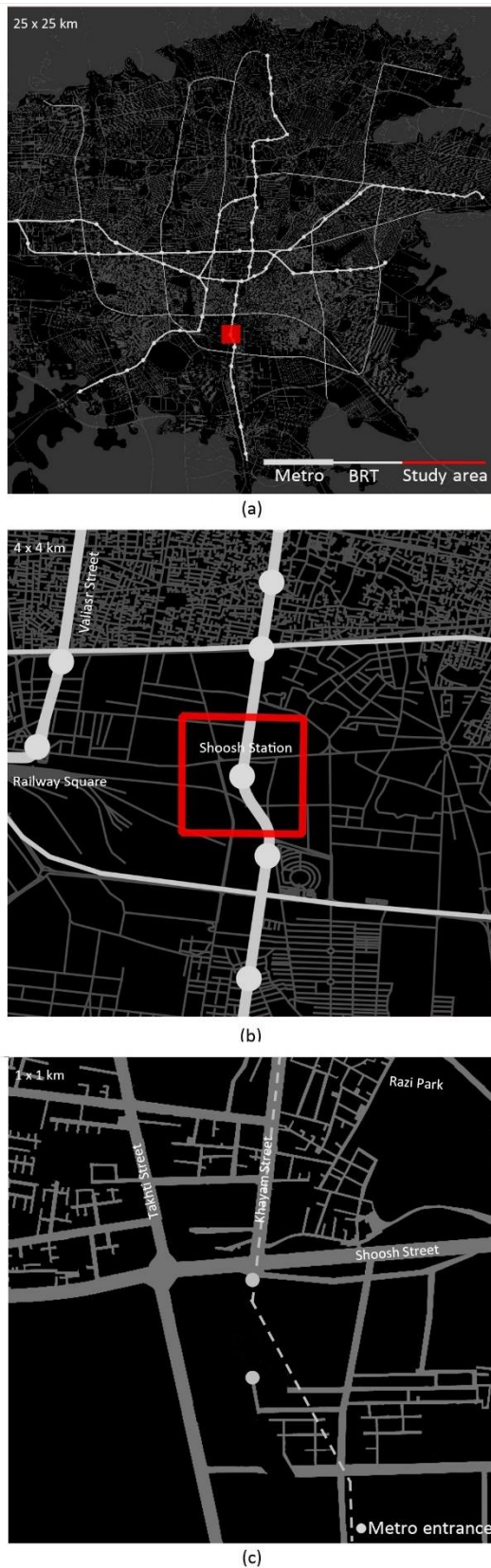


Figure 7.1. Shoosh study area

The study area includes a 100-hectare district surrounding the Shoosh metro station. Shoosh Street divides the reference area from north to south as shown in Figure 7.1c. The metro station lies at the centre of an area in the southern end of central Tehran (Figure 7.1a), with a mix of industrial, service and residential uses, most of which function at an interregional level. The urban fabric is largely characterised by old and low-density buildings. A few parts of the station site have been developed under heritage codes. The metro network was extended through this area in the early 2000s. The access to the station is provided through a gated area with two entrances (Figure 7.1c).

7.2. Transport mode mix

As observations suggest, the Shoosh metro station serves as a transfer point for many people to get access to the main railway station to the west (Figure 7.1b) using buses, car-taxis and motorcycle-taxis. This links to the fact that the metro lines are not yet extended to the main railway station, resulting in a high volume of traffic along the east-west corridor between the study area and the main metro station (Figure 7.2). The railway station opens out to Tehran's railway square (Rah Ahan Square) from where Shoosh Street crosses and Valiasr Street, Tehran's pulsing thoroughfare, extends northwards (Figure 7.1b). In addition to the metro, the subject area is serviced by non-BRT bus network. As illustrated in Figure 7.2, there is a dedicated bus lane located at one side of the Shoosh Street, which facilitates non-BRT bus movements from the metro to the railway station. However, motorcycle-taxis may often transgress formal codes and drive through this lane. The east-west running BRTs shown in the broader district (4 x 4km), do not extend to the study area (Figure 7.1b).



Figure 7.2. Shoosh Street

The overlapped isochrones in Figure 7.3 show patterns of mobility for different mode choices from the Shoosh station. It is notable that the area accessible with motorcycle-taxi indicates a clear advantage over any other transport mode in almost every direction. The average area accessed by the motorcycle-taxi is about 180km² compared to 65km² for the car-taxi and 20km² for the public transport. While public transport access is generally faster than the car-taxis in the

north-south direction of the key metro line, this is not so for the motorcycle-taxi, which cover about three times the area of the car-taxi and have up to twice the range of car-taxi. In the east-west axis, there is a gap between high-volume public transport and motorised transport modes of car-taxi and motorcycle-taxi, which is partially linked to the fact that the metro network does not extend in this direction. The only connected public transport network to the metro station in this axis is the non-BRT bus network that runs in mixed traffic with the car. The non-BRT buses generally do not include dedicated lanes, meaning that they are delayed as the car congestion increases. There is an exception to this on Shoosh Street where a dedicated lane is partially provided for the non-BRT buses running in an opposite direction to cars.

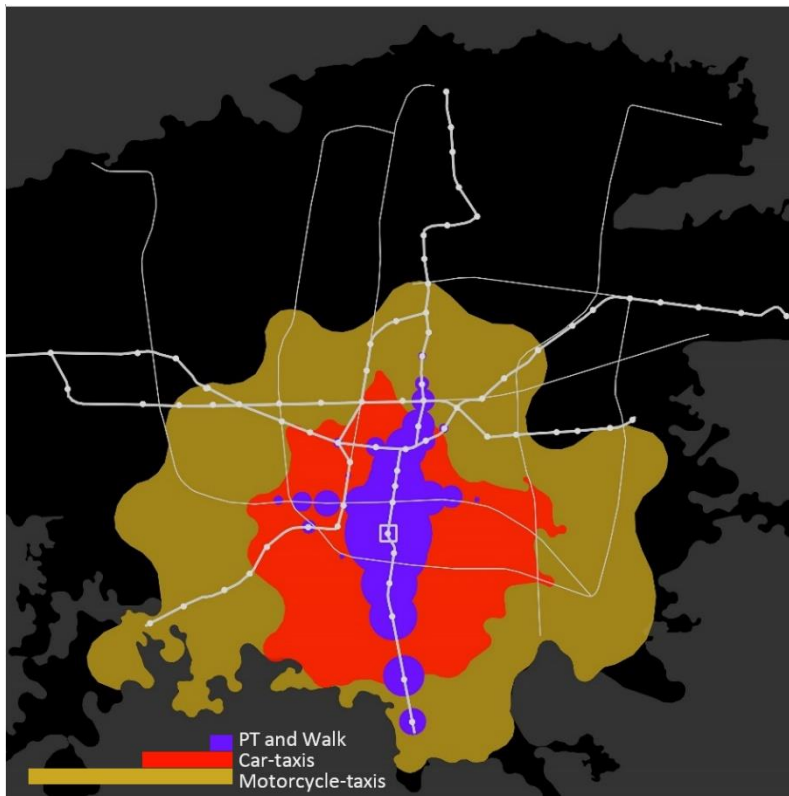


Figure 7.3: 20-minute isochrones: Car-taxi, motorcycle-taxi and public transport
25km scale

7.3. Morphological mix

7.3.1. Access networks

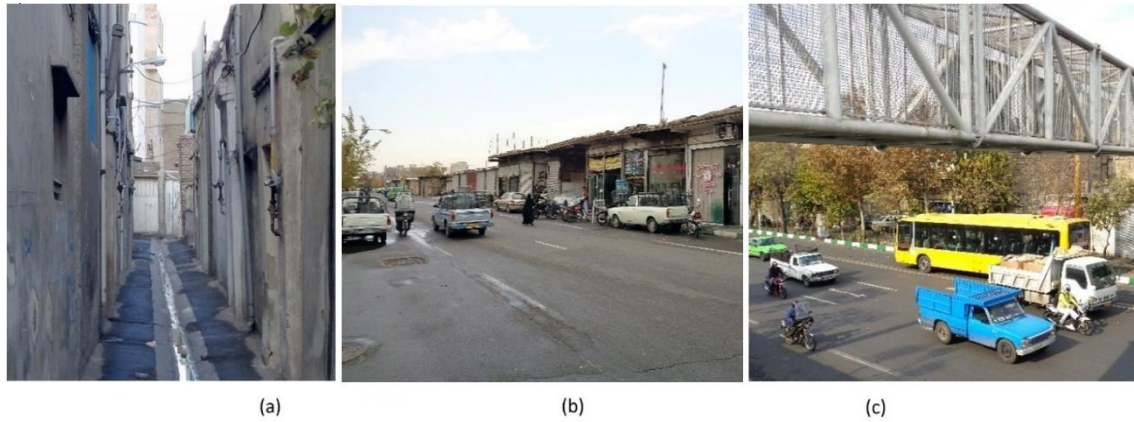


Figure 7.4: Street widths from narrow to wide

The accessibility from the Shoosh metro station to the surrounding areas is generally low, with a catchment of accessible public space ($CAPS_{5min}$) of about 6.5ha. The pedestrian network is disconnected between north and south of the study area. The connection is facilitated over Shoosh Street by a bridge. However, the pedestrian bridge is rarely used, thus resulting in a large number of informal crossings along this axis. To the north, different areas connect through an irregular street network including numerous dead-ends and narrow lanes. Figure 7.1c shows a large park to the east of the northern half to which access is provided by some narrow laneways. To the south-west of the reference area, the impermeable network constrains pedestrian access from the metro station as a result of large gated compounds and a train depot. Urban blocks of greater than 200m in length mostly characterise the southern half of the station area where the urban morphology is not permeated by publicly accessible space. The large gated compounds generally accommodate residential apartment buildings, which are poorly connected to the surrounding street networks. Thus, such areas together with walled and impermeable blocks of industrial sites act as cul-de-sacs in Shoosh's urban fabric; they are obstructions to pedestrian traffic and accessibility to the major transit node. The total length of public/private interfaces that can be reached over a 5-minute time range (AI_{5min}) from the station is about 7,320 metres (Figure 7.5).

The street layout in the station area includes street widths varying between 2.5 and 30 metres, with some exceptions of less than 2 metres wide. Figure 7.4 illustrates street widths from the narrowest (a) medium level (b) to the widest (c). The connections with the most common

patterns of dead-ends and narrow laneways predominate the northern half of the study area. The dead-ends are not often accessible for cars. Traffic on many streets is one-way, few of which also partially incorporate dedicated lanes for local buses passing in opposite directions such as Shoosh St and Takhti St. However, other buses run in mixed traffic with cars on the main streets.



Figure 7.5. Accessible interfaces within a 5-min timeframe
1km scale

7.3.2. Building densities

The analysis of building heights indicates that nearly all the dense areas are well away from the metro station, concentrated in the north, with small patches distributed across the southern part of the study area (Figure 7.6). Buildings often have 1 to 5 storeys, with a vast majority in the 1-2 storey range. Exceptions to this pattern are several new row apartment developments that incorporate greater building heights. Residential areas often have a higher built density than the rest of the areas as they have higher levels of coverage and building heights. The gross coverage represents only 28% of the 100-hectare station area. Closer to the metro station, the areas are dominated by low-density industry and storage lands, which often accommodate one- to two-storey developments with a large private open space. The resulting gross FAR is 0.54. Shoosh is also characterised by low levels of lot coverage, accommodating building footprints of about 40% of the lots (Figure 7.7). The low level of gross coverage is linked to the fact that the study area includes extensive private and public open spaces. In this sense, parks are publicly accessible open spaces, which predominate the north-western part of the site.

Industries, railway depot, loading and storage areas are among the privately-owned areas with a high open space ratio and lower building densities.

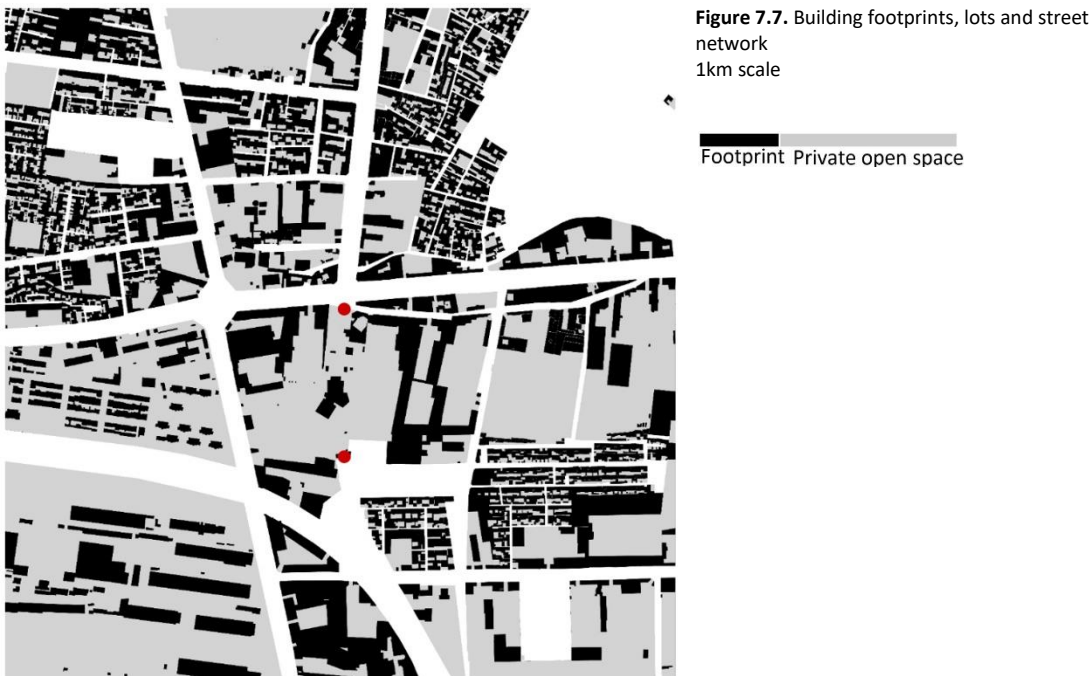


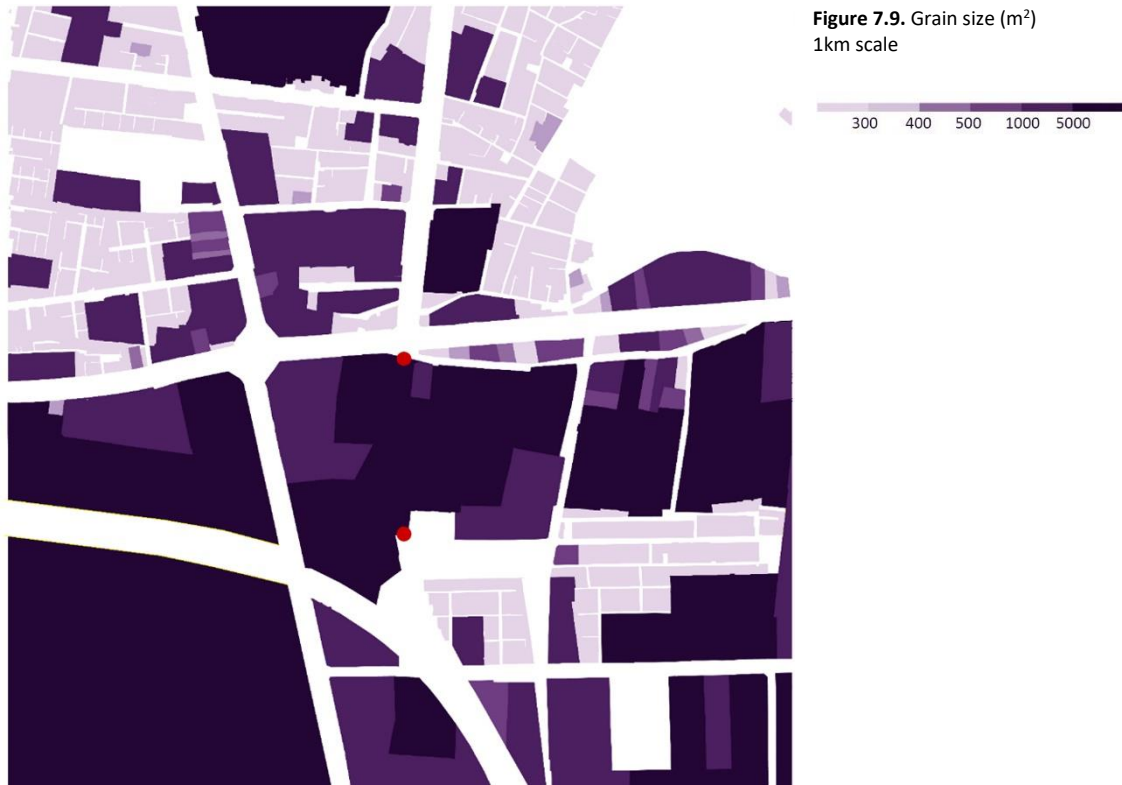
Figure 7.8. Housing types

7.3.3. Grain sizes

The map of grain size shows (Figure 7.9) the study area accommodates different patches of small, mid- and large-grain developments, although its main streets do not embody a mix of grain sizes. It is notable that the large lots of more than 1000m² predominate the station area. There is a tendency for the residential developments to occupy small lots (<150m²), specifically across the north (Figure 7.12c), and a small patch in the south. By contrast, industrial areas often occupy larger lots (>1000m²), concentrated in the southern half of the study area. For instance, the areas surrounding the metro station are generally characterised by large lots, sometimes occupying entire blocks. To the west, there are residential compounds for the railway employees within the gated areas, which accommodate a series of linear mid-rise slab blocks surrounded by a large gated open space (Figure 7.8c). These impermeable blocks are often occupied by apartment buildings of up to five levels, sitting in proximity to the main train depot.

Residential clusters in Shoosh generally accommodate a mix of old and new buildings ranging from 50 to 150m², which produces a mix of building types and lot sizes (Figure 7.12d). Differences in building ages are generally geared to differences in lot sizes in the reference area. Buildings with central courtyards (Figure 7.8b) with an average grain size of 120m² are the most common type among the old developments of Shoosh, while row-housing type predominates in the newly developed areas (Figure 7.8a). While row housing can be seen in many small-grain developments with an average lot size of less than 70m², it is also used in several modern residential buildings occupying amalgamated plots. The more mixed grain morphology in the

study area appears in the areas where deteriorated residential and industrial developments coexist with the recently built houses (Figure 7.12e).



7.4. Functional mix

While the station area accommodates a certain range of different uses at the scale of a 1 x 1km, functional mix is often low at the street level, either vertically or horizontally. Exceptions to this pattern, are some educational sites (green) as well as a hospital (light grey), which incorporate a higher level of vertical mix. Such areas are often occupied by substantial buildings, attracting users from inside the area and the neighbouring sites. Figure 7.10 shows limited vertical mix, with most sites mono-functional. Large patches of industrial sites appear along the main north-south and east-west axes (Takhti St, Khayam St and Shoosh St). Yet, some small-grain buildings appear along the minor streets and back lanes, which accommodate the vertical mixes of live/visit and live/work. Patches of residential developments appear in different sections of the study area, which connect to the metro station through a relatively irregular street layout. Along the twisting back alleys, are numerous courtyard houses, which sit together with the poorly

utilised car park areas that have replaced some former housing lots (Figure 7.12b). The station area also accommodates patches of visitation sites, which vary from small local shops to large parks and public facilities. Figure 7.10 shows a park adjacent to the station, which is mainly accessed from Shoosh Street. In addition to that, a large park (ca. 7.5 ha) has been recently opened to the northeast of the study area, which contains fixed elements of tables, chairs and sports furniture. Retail edges (Figure 7.11) are often confined to dining and small shops selling car products and repair services. Work-related functions include industrial, manufacturing, warehouse, office, loading dock, train depot, car workshop and transport companies. Some footpaths are almost entirely blocked by cars under repair from adjacent workshops. In general, while Shoosh accommodates blocks of production, maintenance and storage, it includes half-built wrecks and abandoned industrial ruins that are unused and marginal to urban life. Figure 7.12a illustrates a minor street along a former industrial site with small-grain car workshops and mechanics on the edge. To the west of the metro station, lies a wide expanse of train depot with a limited number of low-rise developments, which currently serves as a storage and service land. To the north, a vast area has been under-construction for about more than a decade (the large blue area on the map).

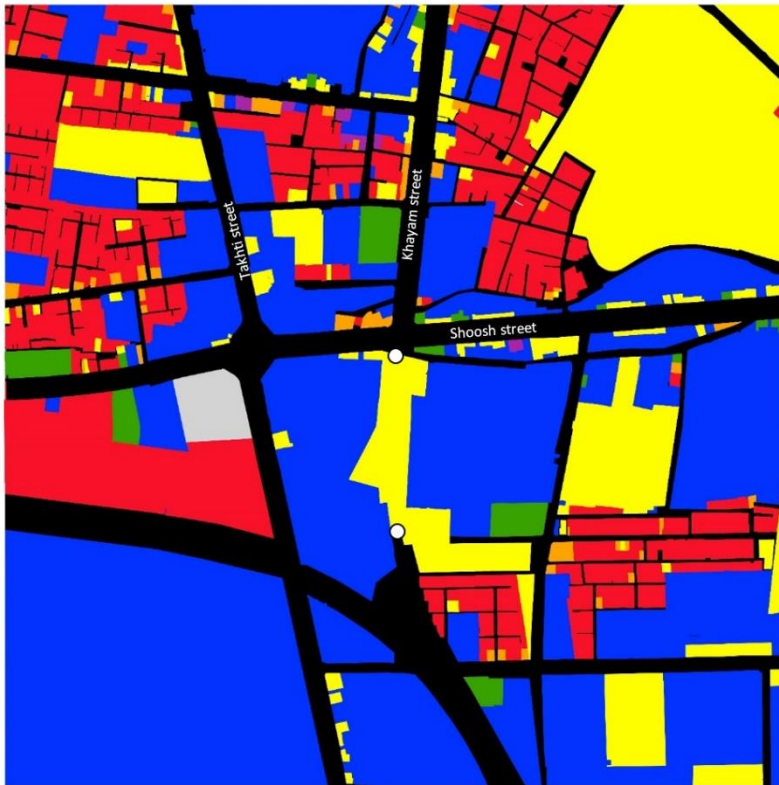


Figure 7.10. Functional mix
1km scale

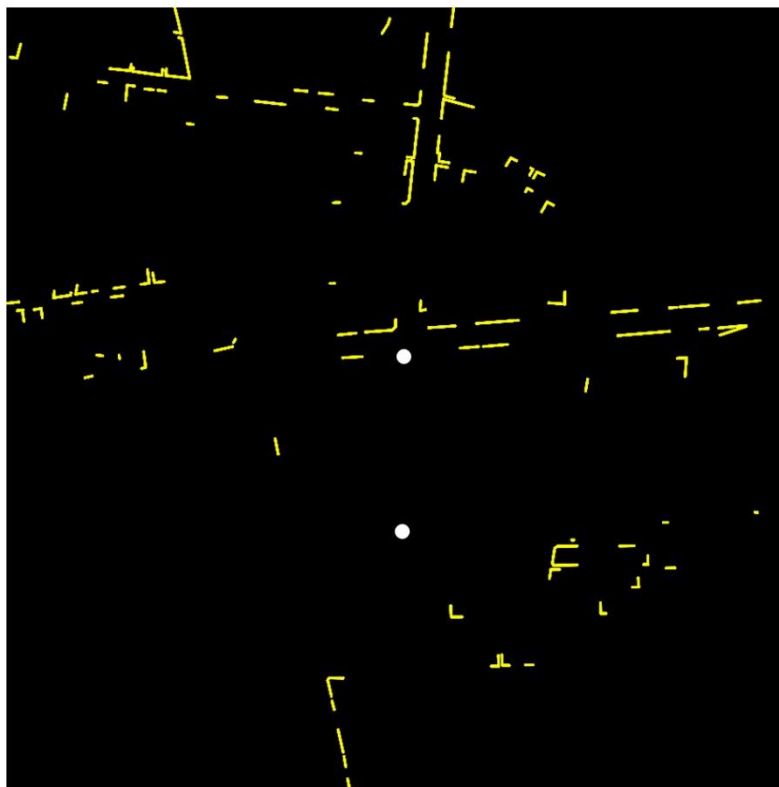
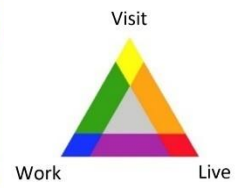


Figure 7.11. Retail edges
1km scale





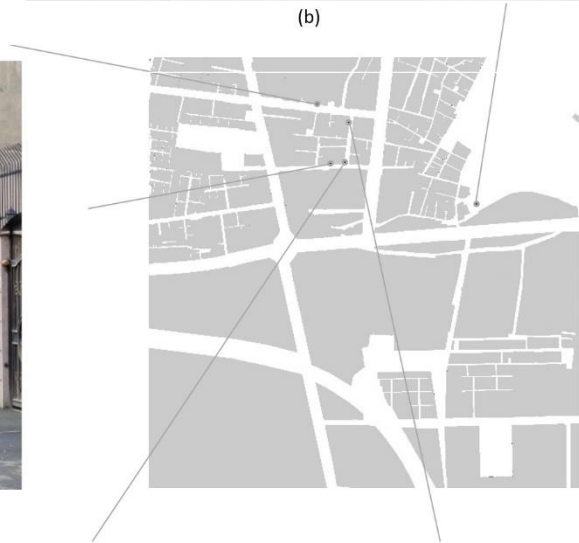
(a)



(b)



(c)



(d)



(e)

Figure 7.12. Mix of functions and grain-sizes

7.5. Streetlife mix

Figures 7.13 and 7.14 show that flows of people and their everyday activities are rather concentrated in the areas adjacent to metro station. The density of flows captured during the midday peak hours indicates a pattern with high fluctuation across different public spaces. Field observations suggest that people are not generally present in the public space unless they have to. Examples for this are the people getting to or from the metro station during rush hours, particularly when they are being dropped off and wait to catch motorcycle-taxis, car-taxis or buses (Figures 7.15b,d). While there is a limited range of stationary activities taking place around the metro station, the rest of the areas do not accommodate much everyday uses and activities. The observed stationary activities often vary between sitting, standing and street trading, which grow remarkably in the areas close to the metro entrance (Figure 7.13). Such activities are often performed by a different range of users such as vendors, storekeepers and everyday commuters. By contrast, within a few blocks from the metro, sidewalks become relatively empty of social activities and appropriations (Figures 7.15a,c,e). The use of space does not generally take place in the conventional public spaces designed to accommodate people such as parks even though fixed furniture and play equipment are placed to stimulate and make some playful social activities possible. The areas along the rail track and industrial developments are empty of pedestrian flows in most hours of the day. It became clear in observation of public spaces and their social life that individuals do not often take a break from their daily routines and fixed schedules for lingering and performing non-instrumental social interactions – either spontaneously or pre-planned.

As the map of activities shows, there is a low use of public space for informal trading throughout the reference area. The observations indicate that there is nearly no competition between the formal market and informal traders. The limited presence of informal traders is often geared to those parts of the access network with a high density of pedestrian flows such as the metro entrance (Figures 7.16a,c). Exceptions to this pattern are a few spots within residential clusters. The access of informal traders to the gated metro area is constrained by both the prevalence of CCTV cameras and the security guards patrolling. Observations suggest that such a gated space lacks informal activities that could give the space vitality. Informal traders often utilise a set of mobile and less durable elements to offer their wares such as a heap of clothes, bites of snacks, fruits and men's shoes. Their use of less mobile structures is often limited to the newspaper

kiosks, which are built after negotiating a deal with authorities. Figure 7.16d shows an informal kiosk occupying a part of the pathway adjacent to the metro entrance, which attracts a large number of male passers-by during the rush hours. Shop-fronts are rarely appropriated by informal traders. Exceptions to this pattern are a few traders closer to the metro entry who use a series of loose parts such as fold-up chairs and tables against the storefronts and appropriate the outer edge of the footpath to display their goods and services (Figure 7.16e).

Different forms of appropriation by parked cars and motorcycles in many sidewalks conflict with the economic and public life of the study area (Figures 7.17a,b,c). A few exceptions to this pattern are the retailers encroaching the sidewalks to put their goods and products on view for the passers-by (Figure 7.17d). Observation indicates that car repair workshops often invade pedestrian spaces to extend their service tools and under-repair vehicles. This poses barriers to pedestrian movement and limits public activities along the sidewalks. In the areas close to the northern metro entrance, motorcycle-taxis compete with car-taxis to pick up the passengers being dropped off to the metro (Figure 7.17e). In this case, appropriation is not an easy task since it requires negotiations to avoid or resolve conflicts.

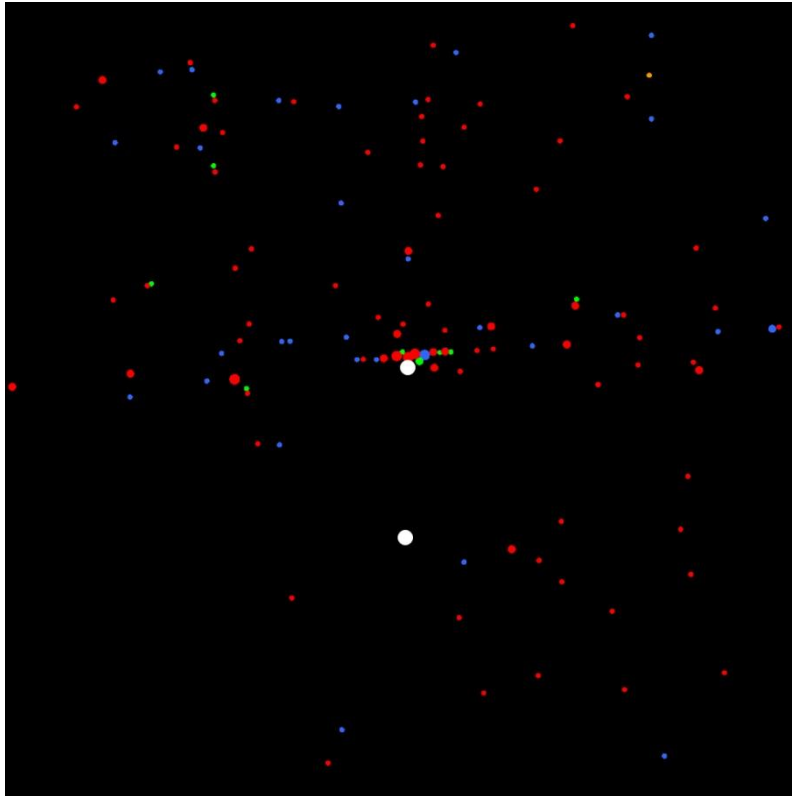


Figure 7.13. Mix of activities
1km scale

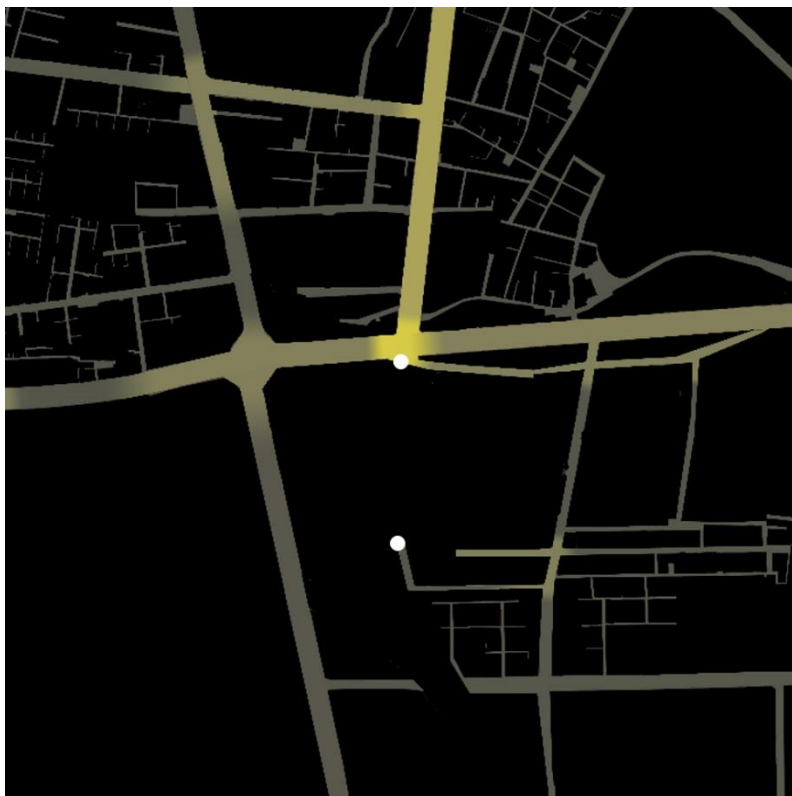


Figure 7.14. The midday-peak
volume of pedestrian flows
1km scale



(a)



(b)



(c)



(d)



(e)

Figure 7.15. Mix of activities



(a)



(b)



(c)



(d)



(e)

Figure 7.16. Informal trading



Figure 7.17. Appropriation and invasion of pedestrian space

Male dominance is a major characteristic within the urban public space of South Tehran (Figure 7.18). According to the census statistics, the ratio of male to females is estimated at 120:100 within the reference area, a higher ratio than the average in Tehran (104:100) (Tehran Municipality and Tehran University, 2011). Direct observation suggests that public spaces are

almost male-dominated so that it seems impossible to encounter women in many public spaces of Shoosh (Figures 7.16d and 7.19a,b). This may indicate that women residing in this station area do not generally engage in public activities as their needs are not catered, and thus more associated with the home and private space. Therefore, while the census statistics shows the overall male/female resident ratio in a given area, it does not indicate the ways this ratio is distributed in relation to public and private territories.

While most of the women living in the study area are not often visible within public spaces, those who occasionally use public sphere are generally attracted to the areas with a high volume of flows. Such areas are often among the key public nodes of activities where the possibility for spontaneous and informal interactions has been encouraged. Women often come into contact with strangers in the areas close to the metro entrance where they wait to catch different formal and informal transit services. Figure 7.16b shows the presence of female residents in the areas other than the transport nodes. Most of these women are attracted to informal trading in residential clusters where face-to-face interactions between neighbours have been enabled due to the presence of vendors. Informal traders pass through the residential clusters since it is more likely for them to find the possible customers in these areas rather than the main streets of the reference area. That is probably why everyday a number of mobile vendors appropriate specific spots to temporarily set up their informal business. They may use trolleys to bring their wares and extol them in a loud voice to attract residents' attention especially housewives'. Field observations indicate the ways female inhabitants question the strangers' right to get access to their territories within the residential clusters. Such areas often have a tendency to be hostile to outsiders. However, this is not an issue for vendors whose everyday appropriation of the same space is often tolerated because their actions are not seen by the inhabitants as lasting or dangerous. The control over space exercised by the residents in these areas have some drivers such as to maintain safety and to prevent outsiders from gaining awareness of the ways they, especially illegal immigrants and poor families, continue to squat in abandoned and dilapidated houses. Figure 7.19c shows how the use of space by the poor men and beggars constrain women's activities in public realm. This issue is partly linked to the high rate of unemployment and poverty among the residents of South Tehran (Tehran Municipality and Tehran University, 2011).

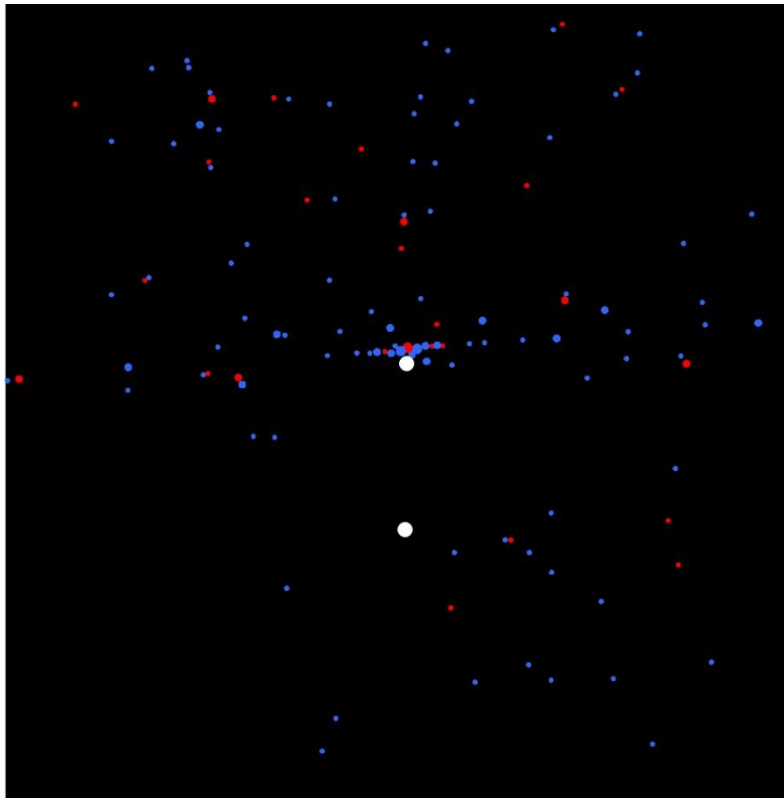


Figure 7.18. Gender mix
1km scale

●● Female ●● Male



(a)



(b)



(c)



Figure 7.19. Male dominated public spaces

7.6. Potential for change

To the south, lies the wide expanse of dysfunctional Shoosh station area where the city's lowest lands went to the marginal poor, working-class and new rural migrants. This is a piece of urban fabric, often characterised by a low mix of mixes – mono-functional areas, low building and residential densities, impermeable structure of urban spatial networks and low intensity of streetlife. The highly gendered public spaces around the station are often used and appropriated for a limited range of stationary activities. The fine-grained analysis of urban density, functional mix, streetlife and transport access catchments was key to explore the potentials for change in the existing spatial structure and improvements to the ways in which this particular urban assemblage connects to the surrounding networks and flows.

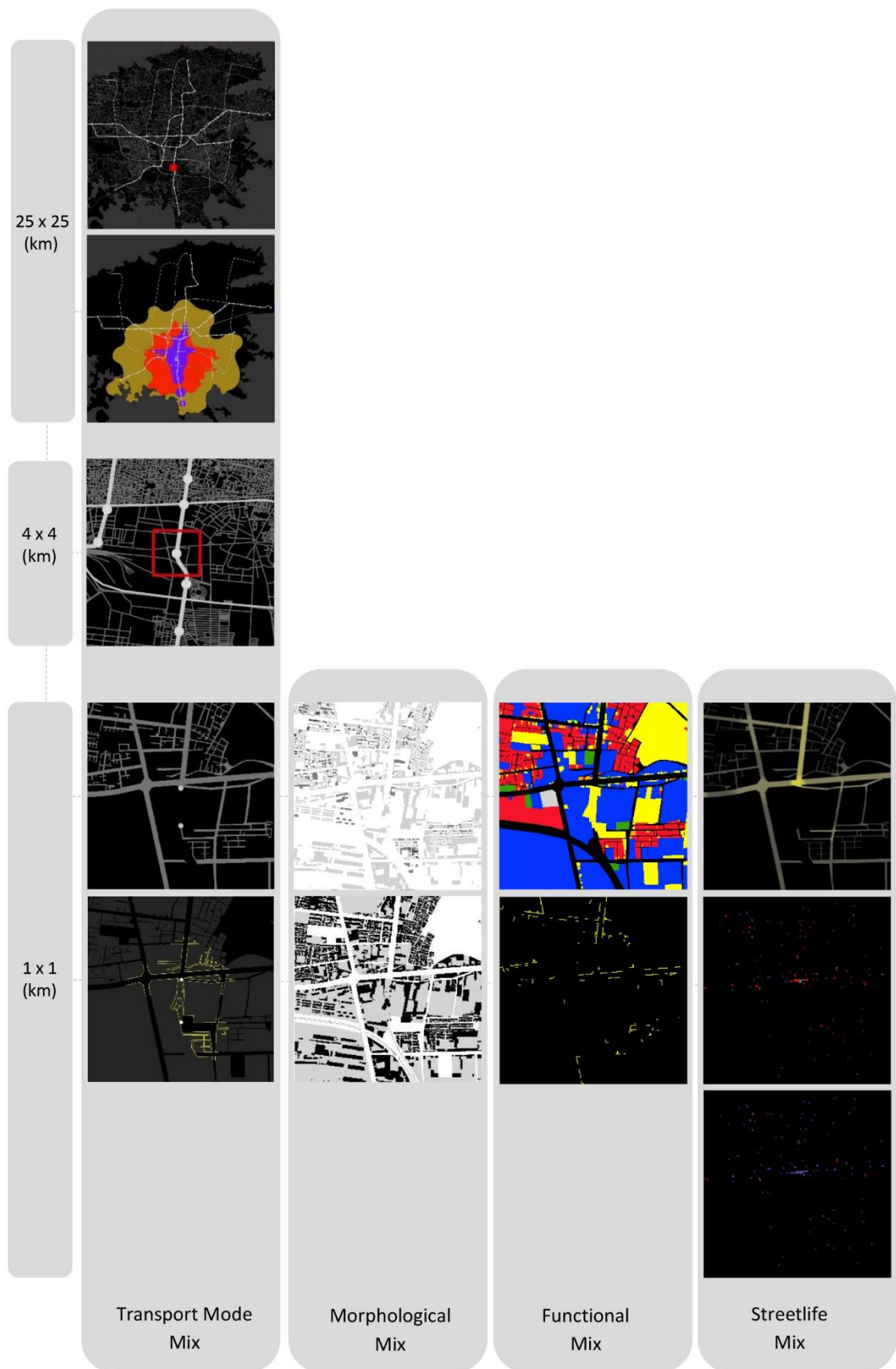


Figure 7.20. A map of maps

Mix of transport modes

The comparative isochrones showed that the capacity for change here is to envision the metro station as part of a larger intensified precinct where the provision of high-volume public transport services in the east-west axis can provide the leverage to enable the case study area to connect effectively with its surrounding context especially with the city's main railway station in the western end. In addition to that, the extension of high-volume public transport catchments in this direction would encourage modal shift during peak travel periods. The observations and catchment analysis of motorcycle-taxis suggest that they are the fastest mode of transport and often the most effective in terms of their capacity to park closer to the metro entrance and to start any journey with no delays. However, their transgressive practices including driving the wrong way up one-way roads, driving through pedestrian spaces and dedicated bus lanes and overcompetition with car-taxis for picking up passengers are often unsafe and damaging to the economic productivity and public life of this station area. Therefore, attempts at formalisation through the enforcement of regulation and surveillance particularly in the pedestrian spaces have the capacity to constrain their transgressive activities and ease pedestrian traffic flow along the footpaths.

Morphological mix

The spatial analysis of building heights, footprints and grain sizes suggests that a vast majority of areas around the metro station is characterised by low-density and large-grain industrial developments and substantial tracts of storage land, which have often produced blank/impermeable interfaces and public spaces devoid of life. The challenge and potential here lies in the ways large lots especially derelict industrial lots can be perceived increments of change as they can enable wholesale transformation. There have been also a few attempts at replacing the old and dilapidated buildings particularly courtyards by higher density row apartment houses or incrementally upgrading them. However, smaller grain morphologies (less than about 70m²) are seen as drawbacks by developers, which is partly because multiple owners are difficult to negotiate. Any understanding of the synergies and potentials for change here requires close attention to questions of pedestrian accessibility. The observations of pedestrian routes and street networks suggest a limited capacity to move through the public space network using multiple pathways. This is linked to the fact that this station area has evolved into a particular morphology that is somehow at its limit and cannot change without complete demolition in several parts. One of the potentials in the areas with the fine-grain developments

would be to take out some of the lots within the impermeable blocks to allow a greater pedestrian access from the station through a more interconnected urban network. Another capacity for change involves subdividing large lots, which has the potential to increase permeability and improve pedestrian movements and streetlife vitality throughout the station area.

Attempts at improving the quality of urban environments through developing parks on vacant or abandoned lots especially in the less privileged South Tehran (see chapter 4) (Madanipour, 2011) have resulted in the vast areas of public parks within the Shoosh station area. Despite the fact that such attempts were identified as a 'good practice' by the UN Habitat in 1996, the inserted parks are often empty public areas devoid of people and urban life. This is linked to the fact that although public parks contribute to an increase in the catchment of accessible public spaces, there is not much to catch in such spaces as shown in the small length of accessible public/private interfaces (AI_{5min}). This condition is not congruent with the concept of a TOD as the small accessible interfaces constrain capacity for a mix of functions; linked in turn to the limited potential for socioeconomic exchange.

Functional mix

The vitality of streetlife is impeded by the segregation of functions and poor connectivity among them. This condition indicates that Shoosh embodies great potentials for redevelopment especially in its extensive abandoned industrial sites and substantial tracts of empty land. Such derelict industrial sites are commonly identified as "blots on the landscape" (Edensor, 2007, p. 234) – areas of inactivity and full of possible danger. However, these marginal areas are also embodying potentials (capacities for connection and transformation) that extend beyond their actual forms. In other words, industrial ruins can be seen to create opportunities "for doing things differently outside the ordinary, regulated space of the city" (Edensor, 2007, p. 235). This condition may create blurred boundaries where formal and informal activities mingle with different people and built forms. The important issue here indicates that any adaptation or change in the patterns of functional mix to improve the quality of urban environments within this particular urban assemblage would require a close attention to the flows between that and built form, transport networks and the ways streetlife intensity emerges through this mix of mixes.

Streetlife mix

Public spaces in Shoosh are often characterised by the low density of everyday activities. Within its 'impoverished and deprived' urban fabric (Navai, 2014, p. 242), spaces are seen to be 'wasted' since they are not generating their 'best and highest' use. Despite the fact that such areas can be wasteful, at least in the short term, they have great capacities for urban diversity, inclusiveness and growth. This condition supports the argument that "an environment for growth . . . would not be the most efficient and safe environment. Nor would it offer maximum stability and security. It would certainly not be extremely comfortable, nor even very beautiful" (Lynch & Carr, 1968, p. 425).

Temporary uses can offer diverse possibilities for social activities and attract people to the gendered public spaces of Shoosh. When public space is open to multiple uses and appropriations, it can enable extensive formal and informal flows of exchange and interaction. In this way, temporary users, considered as 'pioneers', discover the spaces with the greatest capacity and make them publicly known through the pragmatic and low-cost appropriations (Oswalt et al., 2007). The presence of such temporary activities and appropriations can be a stimulus for the future permanent urban developments and can attract a pool of potential users, both women and men, from the middle class and north's affluent districts to use the marginal spaces in the south. An example for temporary appropriations of space is street trading. Under conditions of an intensive juxtaposition of informal trading and different social activities, the chance encounters between a wide range of users particularly the most marginalised ones will be encouraged. The findings of this chapter corroborate Brown's (2006) argument that urban poverty is a key determinant of exclusion from public spaces as young people, women and children are often excluded from the public life partly due to the increased unemployment, poverty and being marginal to the city. Hence, not only street trading can provide job opportunities for the urban poor in the most disadvantaged areas of the south, but also as argued by Bromley (2000) may add vitality to the streetscapes and stimulate economic activity that may otherwise not appear.

8. THE CENTRE: SAADI



8. THE CENTRE: SAADI

Introduction

Saadi station lies in the central part of the urban metro network, less than 2km away from the city's Grand Bazaar. Centred on the metro station, the reference area is located in the historic urban core, in an area of mainly commercial, retail (exchange), industrial (production), cultural, official and residential uses, most of which operate at the city scale. The staging of urban development and the overlap of different layers over time have resulted in a mix of functions, building densities, lot sizes and block shapes in proximity to the Saadi metro station. Such a mix in the old core cannot be only linked to the operation of metro, which is hardly more than 15 years. Several parts of the reference transit node are covered by heritage overlays, which can constrain intensification.

8.1. The study area

The study area for analysis incorporates a hundred hectares of land surrounding the Saadi metro station, which lies in the central part of the city's metro network (Figure 8.1a). The metro network was extended through the study area in 2001. As shown in Figure 8.1c, the area is roughly divided in half from north to south by Jomhuri Street and east to west by Saadi Street. At the intersection of Saadi Street and Jomhuri Street (Figure 8.2), is located the reference metro station with two entrances about 40m apart. Entrances are along the Jomhuri Street, divided by Saadi Street (Figure 8.1c). Both streets play a key role in conveying the traffic across the study area: to the north, the north-south running Saadi Street connects the site with the key east-west axis of the city – Enghelab Street (Figure 8.1b); to the east of the station, the east-west running Jomhuri Street connects with Baharestan Square, which is one of the key public spaces in the city. This public space has been served as an important node over many generations, accommodating major social, political and cultural functions. Lalehzar Street – once known as the city's cultural hub with its modern functions – was laid out in the late nineteenth century to the west of the current metro station and served as a place of contact between locals and foreigners until the 1950s (Costello, 1980). The construction of such modern boulevards as well as buildings was authorised by Naser al-Din Shah, the fourth king of Qajar dynasty, who drew inspiration from his first trip to Europe in 1873 (Scarce, 1991). In effect, the modern history of



Figure 8.1. Saadi study area

the city is tied to the birth and boom of Lalehzar Street, which acted as a place of meeting and exchange for artists, creative producers and intellectuals. Lalehzar Street is one of the oldest parts of the city where the overlap of different layers of urban development has often produced a diversity of grain and block sizes as well as a diversity of functions. Such mixed-grain urban developments are characterised by the rapid and radical change of many creative cultural activities to a particular type of retail activity. In the early 1960s, the street was characterised by cultural uses such as theatres, movie houses, nightclubs and cafes. These cultural uses, for the most part, were converted into a series of storage areas and retail shops selling electrical appliances after the 1979 Islamic Revolution. Observations indicate that a few blocks along this street accommodate abandoned lots of historic creative uses (e.g. theatres) and dilapidated buildings. Entered via Lalehzar Street, Berlin and Mehran Lanes (Figure 8.1c) are busy retail spaces filled with stores selling women clothing, accessories and services. The multiplicity of uses and loose parts here create visually complex yet vibrant streetscapes. Further to the west, is located Ferdowsi Street, which is a major thoroughfare connecting Toopkhaneh Square in the south with Ferdowsi Square in the north. This street is lined with embassies, official buildings and formal and informal currency exchange activities.



Figure 8.2. Intersection of Saadi Street and Jomhuri Street

8.2. Transport mode mix

The station area is connected to the city via different modes of transport including metro, non-BRT buses, car-taxis and motorcycle-taxis. While private car access has been restricted during working hours within the reference area (see Chapter 4), observations indicate congested car traffic within the public space network including narrow lanes and one-way streets. The increased level of car-dependency here is linked to a common trend in the city known as ‘selling traffic permit’ due to which private cars can enter the car-restricted areas within the central city by paying certain fees to the municipality. The primary high-volume mode of public transport that facilitates the connection between the study area and the city is the metro along the north-south axis as shown in Figure 8.1b. While non-BRT buses facilitate east-west connection in the reference area, they are often delayed by car-traffic. Within about 10 minutes walking distance from the station to the north, one can get access to the BRT system, which provides high volume mass transit along the main east-west axis of the city.

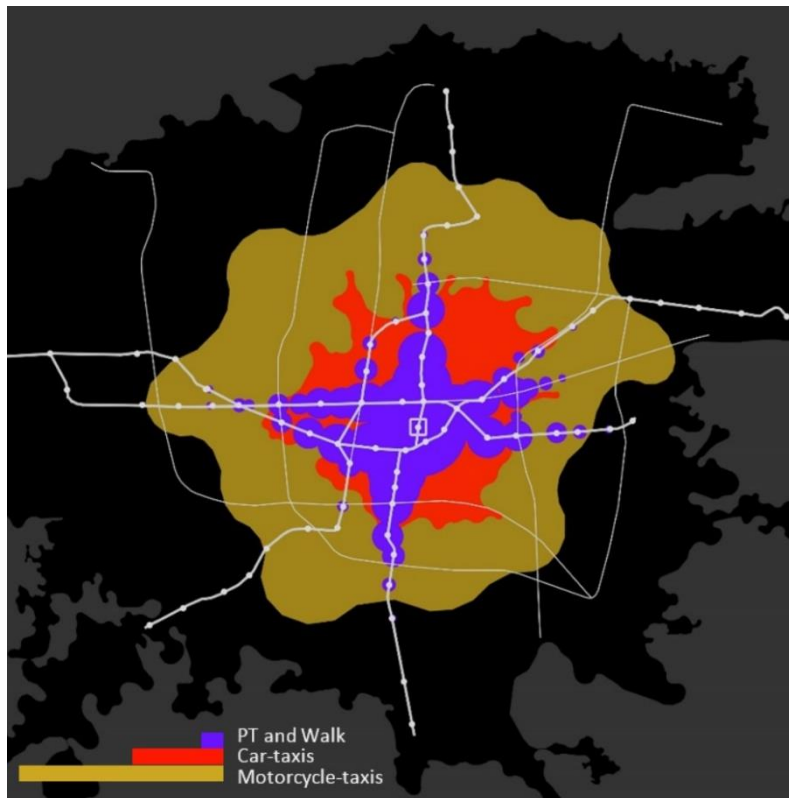


Figure 8.3. 20-minute isochrones: car-taxi, motorcycle-taxi and public transport
25km scale

The overlapped isochrone maps in Figure 8.3 illustrate patterns of mobility for different mode choices from the Saadi metro station. The isochrones indicate that the catchment of motorcycle-taxi during the morning peak period is far more extensive than that of car-taxi and public transport. The average area accessed by the motorcycle-taxi is about 155km² compared to 45km² for the car-taxi and 30km² for public transport. It is notable that while public transport access is generally faster than the car-taxi in the direction of main transit lines, this is not so for the motorcycle-taxi, which can cover about three and a half times the area and up to twice the range of car-taxi (Figure 8.3). Public transport is also competitive with the motorcycle-taxi over a few 20-minute travels during morning rush hours.

8.3. Morphological mix

8.3.1. Access networks

The development of the urban fabric in many stages over different times has produced a mixed yet irregular urban morphology with various block shapes and numerous dead-ends. The capacity of the urban network to provide pedestrian access from the central metro station is relatively low, with the catchment of accessible public space (CAPS_{5min}) of about 9ha over a 5-

minute timeframe. Some areas to the east of the station incorporate a more permeable urban morphology compared to the western side, which is linked to the smaller block sizes in the eastern part. However, in several parts the predominance of dead-ends and narrow lanes has constrained pedestrian access to transit. Urban morphology within the western half of the station area often accommodates large impermeable blocks that exist as significant barriers to pedestrian access. As Figure 8.4 shows the total length of public/private interfaces that can be reached over a 5-minute range from the metro station (AI_{5min}) is 11,995m. The relatively high AI_{5min} in the old core is linked to the predominance of very narrow lanes and dead-ends.



Figure 8.4. Accessible interfaces within a 5-minute timeframe
1km scale

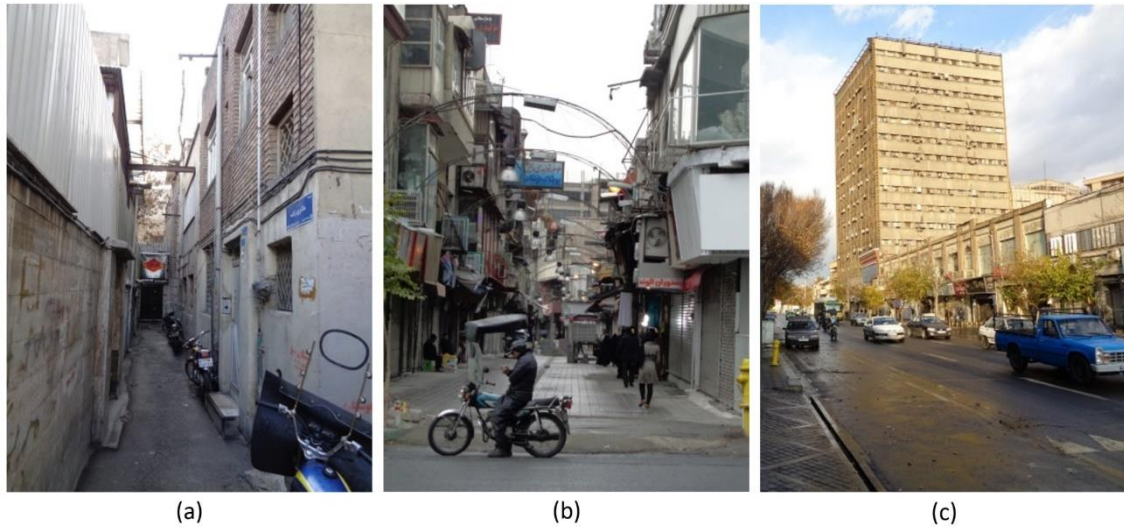


Figure 8.5. Street widths from narrow to wide

Streets in the study area vary broadly from minor streets to main streets. Figure 8.5 shows street widths from the narrowest (a), medium level (b) to the widest (c), ranging between about 2 and 30 metres with some exceptions of less than 2 metres wide. The street networks with the most common patterns of dead-ends and narrow laneways predominate in the eastern half of the station area. The dead-ends with widths of less than 3 metres are not accessible for cars as is evident in Figure 8.5a. Observations indicate that motorcycles frequently provide access to those areas with narrow entryways that are inaccessible for formal transit services. The minor streets at times appear as pedestrian-only connections varying between 8 and 18 metres in width (Figure 8.5b). An example of this pattern is Saf Street (former Sepahsalar Street) (Figure 8.15c) with about 18 metres width, which is currently a hub for retail sales of women shoes and bags. Beginning in the Qajar era, Saf Street has been recently transformed into a pedestrian-only public space, a block away to the east of the metro station. This transformation gave rise to disagreements among merchants and storekeepers as it closed the public space network to vehicle movements; however, since then the everyday needs of pedestrians were gradually fulfilled, which added to the streetscape value (Mofidi & Kashani Jou, 2010). Traffic is often one-way on the main streets (Figure 8.5c) with a few of them incorporating partially dedicated lanes for non-BRT buses passing in opposite directions such as Jomhuri Street.

8.3.2. Building densities

Figure 8.6 shows that the station area in the centre accommodates a mix of building heights around the metro station. In this pattern, buildings of one to six storeys are predominant. Some exceptions to this pattern are the high-rise developments, generally 9- to 17-storey commercial-office buildings distributed across the reference area. An example for this is the 17-storey *Plasco* building⁷ to the west of the station, laid out in the early 1960s. This building is known as one of the first tower-typology developments in Tehran that attracts a large number of visitors and workers from different parts of the city to its shopping centre and clothing workshops. The residential density is relatively low – less than 70 residents per hectare (see Chapter 4). However, the study area has a high job density, which is linked to work-dominated precinct around the major transit node.

The map of building footprints, lots and street network (Figure 8.7) shows the mix of certain building types at the scale of 1 x 1km as the study area is dominated by row houses, courtyards and pavilions. The gross coverage is generally high at 50%. Saadi is also characterised by a relatively high level of lot coverage, accommodating building footprints on about 65% of the lot areas. To the west of the station, the lower level of net coverage is linked to the sites of embassies and official institutions where clusters of private open spaces surround the built-up areas. Residential areas around the station have different lot coverages extruded up to a height of 6 storeys, with a dominance of 2-3 storeys. While several residential blocks on the eastern side of the study area accommodate old low-rise courtyard houses, others have changed to single-household row housing and from row housing to row apartment buildings over time. The greater lot coverage of about 80% is often associated with the low-rise houses with courtyard patterns. As illustrated in Figure 8.7, the pavilion type can be seen in the areas to the west of the station where embassies concentrate. These sites often incorporate the low-rise buildings surrounded by large open spaces with a lot coverage of less than 25%. The resulting gross FAR throughout the reference area is 1.54.

⁷ The high-rise *Plasco* building burnt down and collapsed after the data collection period (2017).



Figure 8.6. Building heights (storeys)
1km scale

1-2 3-5 6-9 9+ Storeys

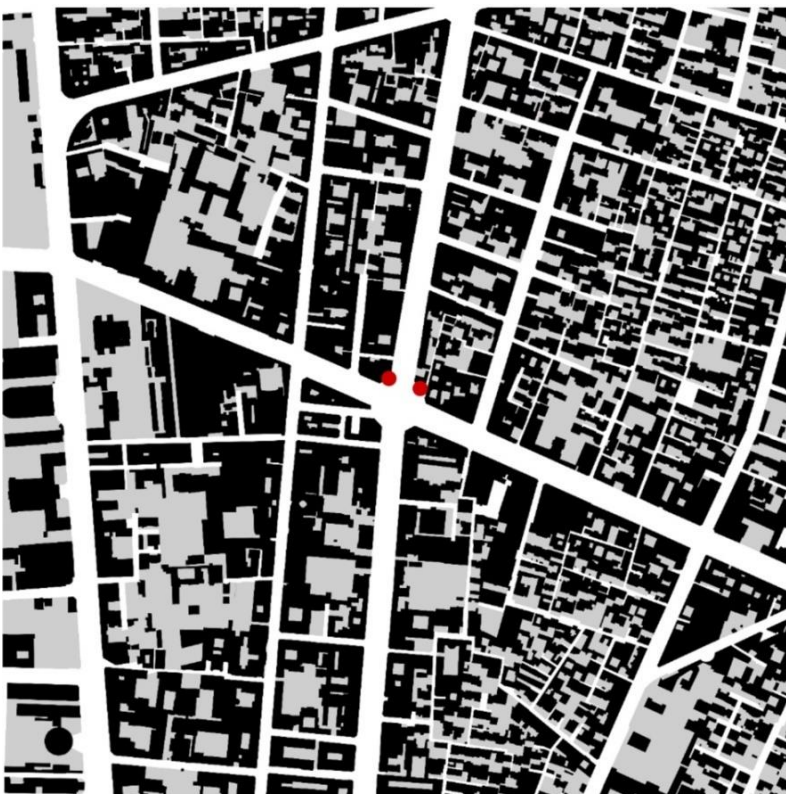


Figure 8.7. Building footprints, lots
and street network
1km scale

Footprint Private open space

8.3.3. Grain sizes

The map of grain size (Figure 8.8) shows that the study area accommodates a broad mix of lot sizes where the smaller lots are more concentrated in the eastern side of the station and the larger ones dominate the western side. Lots vary in size from minimum 60m² to more than 5,000m². Exceptions to this pattern are some institutional buildings and embassies especially to the west of the station, which occupy larger lots over 8,000m². Residential blocks are often characterised by the small-grain morphology in the study area. While lots of about 60m² have often constrained higher-density urban development in the residential hinterland, some small to middle-sized ones have incrementally densified from mainly single household courtyards to multi-storey apartment buildings. The mixed-grain urban morphology along main streets of Saadi and eastern Jomhuri enables a mixed building age to emerge and to be sustained in many stages over time (Figure 8.11e).



8.4. Functional mix

Figure 8.9 shows that more than half of the area is devoted to work and work/visit functions accounting for about 60% of the 100ha reference area (Figures 8.11a,b,c). Observation indicates

that the primary uses such as shopping centres, workshops, offices, banks and public institutions attract a pool of users from outside or inside the reference area varying from affluent consumers and business owners to those engaged in private enterprises and workshops such as working-class or middle-class individuals. Secondary uses that are sustained by the primary uses along most of the main streets include small retail shops and informal food stalls. The ways in which such functions operate in synergy throughout the station area is geared to a socioeconomic mix of higher and lower rental values as well as a formal mix of older and newer buildings. Fine-grained analysis of functional mix suggests that main streets often exhibit a rich mix of functions, accommodating buildings with vertical visit/work mixes. An example of this pattern is Lalehzar Street, which is devoted to a series of retail and work areas (Figures 8.9 and 8.10). The lots on this street accommodate retail shops on the ground level and workshops and storage areas on the upper levels. While heritage overlays have often restricted the potential for both grain subdivisions and amalgamation along the Lalehzar Street especially in the northern corridors, the functional mix has been substantially transformed. Lots with their former creative functions including cinemas, cafés and theatres were often converted into a series of storage areas and retail shops after the 1979 Islamic Revolution. In several parts, buildings have become abandoned over the years, creating derelict streetscapes. Closer to the station, there is generally a predominance of retail uses along the public spaces where old buildings are mixed with the renovated ones (Figure 8.11d). For instance, Saf Street is framed by a mix of old and new buildings as well as a range of various functions. In the areas with few heritage restrictions, numerous retail storefronts have been renovated to capture the attention of customers visiting the area. Such a competition does not often exist in the minor streets where the old buildings of production predominate. To the east of the station, narrow lanes and dead-ends are often lined by mono-functional buildings of live or work. There are not many diverse visit/live or live/work areas on the western side of the reference area, which is linked to the low predominance of residential uses. Ferdowsi Street along the western edge of the site does not accommodate a high level of functional mix as it is largely occupied by working-related urban developments such as public institutions and embassies. Some exceptions to this pattern are the mixed work/visit areas, which are devoted to commercial-office centres and retail shops (Figures 8.9 and 8.10).

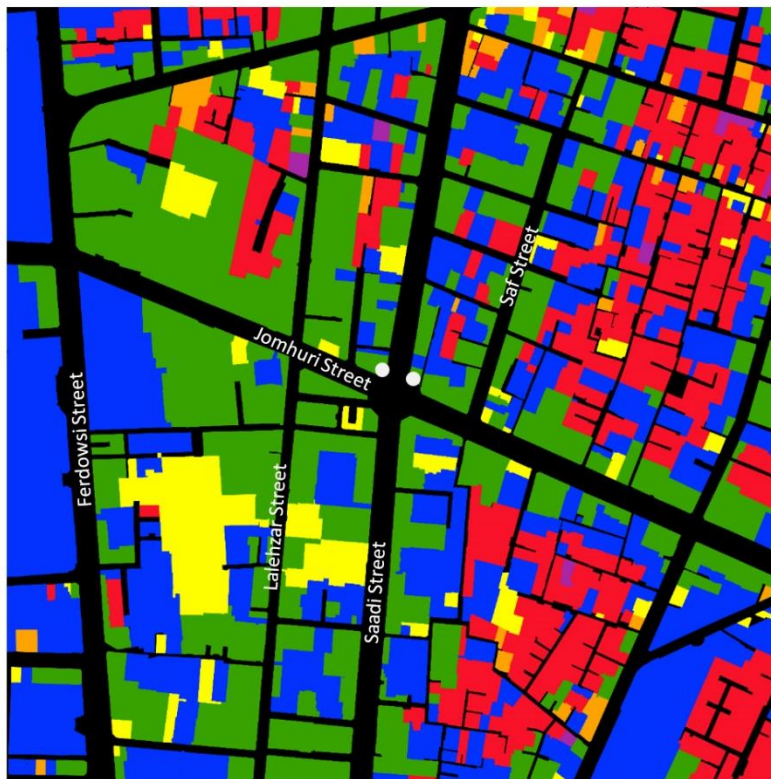


Figure 8.9. Functional mix
1km scale

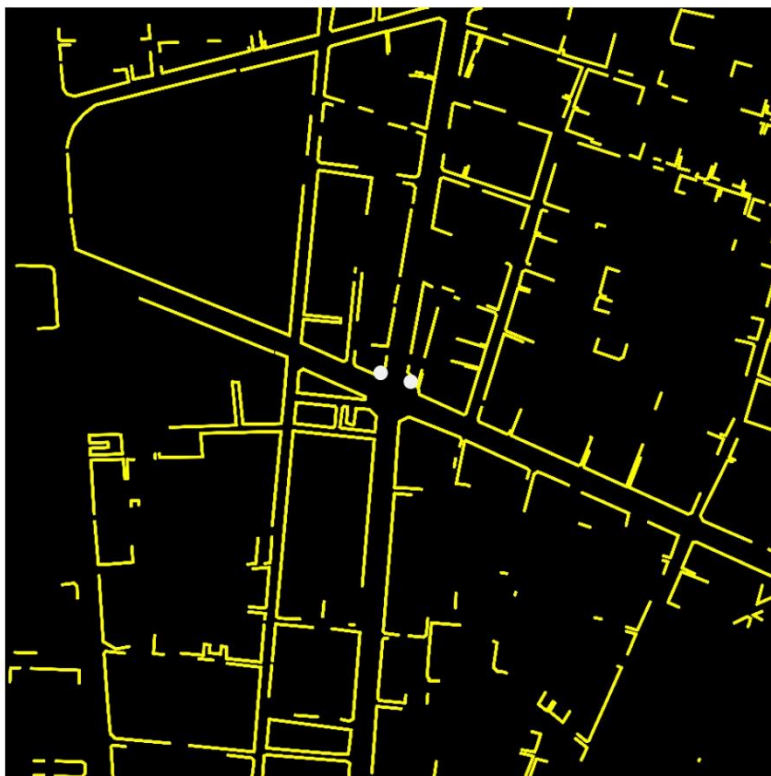
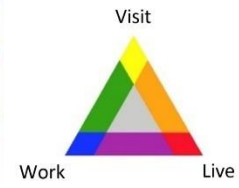


Figure 8.10. Retail edges
1km scale





(a)



(b)



(c)



(d)



(e)

Figure 8.11. Mix of functions and lot sizes

8.5. Streetlife

Figure 8.12 shows that main streets around the station are often appropriated for a wide range of activities varying between standing, sitting, informal trading and street performance. Sidewalks are often filled with a mix of stationary and mobile informal traders, consumers, people waiting for car-taxis and motorcycle-taxis and individuals meeting with others. Among the most vibrant public spaces of the reference area is Saf Street acting as a nexus for both retail and social transactions – informal traders setting up their small business (Figure 8.14a), people sitting and watching activities, women interacting with strangers and vendors on the pavements (Figures 8.14b,c) and so on. It is notable that sidewalks are physically open for different forms of appropriations where vendors, performers and others are provided with the opportunities to shape and organise space to meet their needs. Observation suggests that the predominant activities along the areas with lower presence of informal traders are passive ones – people watching the passing scene, individuals gazing at actions taking place and less frequently, men sleeping and reading newspapers (Figure 8.14d). Within the walkable proximity of major transit node, Saf Street is seen as one of the limited female-dominated areas. This is partly linked to the ways female-related goods and products are sold along the retail edges and the degree to which public spaces are appropriated by informal traders. By contrast, the intersecting streets are largely male-dominated where the work and retail entries are used continuously by male workers and shopkeepers. An example of this pattern is shown in Figure 8.11b where footpaths are often informally encroached and codes are transgressed – retailers put their goods and services on view for the passers-by by organising them next to the store entrance and out on the pedestrian spaces; many shopkeepers appropriate the entire width of the entrance area and even the steps to stack up their goods and park their motorcycles.

As illustrated in the map of public activities (Figure 8.12), main streets close to the station are well utilised for informal trading. The practices of urbanity in public spaces are largely infused with a mix of informal appropriations – more or less temporary territorialisation of footpaths, station entries, stairs and doorways, street furniture and so on. Observations also indicate a high level of competition between the formal market and informal trading within public spaces. Figure 8.15e shows how informal traders' activities can loosen up the formal space around the station. The trader appropriates nearly the entire width of a footpath to draw the attention of customers shopping at formal markets or other informal traders. Therefore, such loose practices (activities such as informal trading) are closely linked with loose forms around the transit node as boundaries between private and public are negotiated specifically regarding the ways private actions and appropriations spill onto public space. Loose forms (or loose parts) here are linked to the elements that are moveable and flexible such as chairs, vendor goods, stands, trolleys and food stalls. Loose practices here refer to the ways the same area is used for different uses – for instance, footpaths along Saf Street exhibit activities and appropriations by women, informal traders and street performers at the same time.

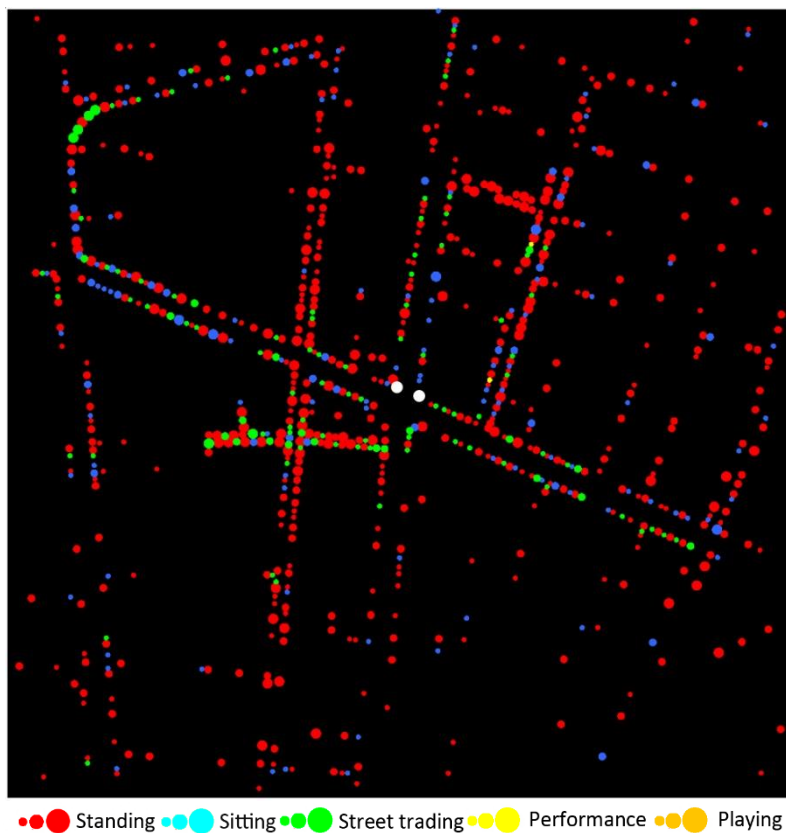


Figure 8.12. Mix of activities
1 km scale

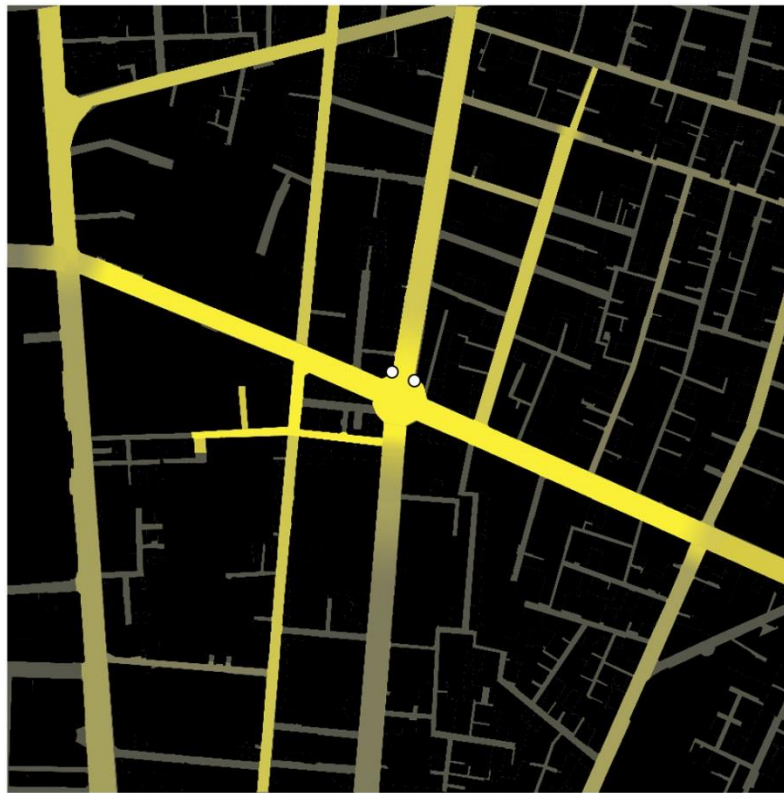


Figure 8.13. The midday-peak volume of pedestrian flows
1 km scale

Fine-grained mapping of gender mix shows that public spaces are largely male-dominated throughout the study area (Figure 8.17)⁸. One can observe a predominance of men along some main streets where the mix of work and visit urban functions as well as retail stores selling male clothing and industrial devices concentrate. Exceptions to this pattern are the areas with the informal food stalls and the busy station entries where the appropriation of edges by vendors attract groups of females during peak activity periods (Figures 8.15b,c,d). The empirical material here indicates that activities often grow from the edge toward the middle of the footpaths. Another male-dominated pattern is evident on the western edge of the station area where formal and informal currency activities and large-grain work-related functions predominate (Figure 8.17). During morning peaks, metro entries become sites where male passers-by often outnumber women as many working-class and middle-class men head towards the working areas (Figures 8.14e and 8.16c).

There is a close connection between the range of products and services offered by formal retailers and gender differences in the use of public space around the metro station. In contrast

⁸ This is also congruent with the census statistics, due to which the number of male to female inhabitants is estimated at 120:100 within the reference area, a significantly higher ratio than the average in Tehran (104:100) (Tehran Municipality and Tehran University, 2011).

to the male-dominated patterns of most main streets, a few pedestrian-only minor streets appear that largely attract women to their retailers selling female-related goods (Figure 8.17a). A further key issue here indicates the ways in which the products offered by informal traders target the dominant gender group in public space. This is part of the story of the main streets of Saadi and Jomhuri where male vendors are clustered in the areas with the dominance of men and attuned to provide those kinds of goods and products that are in demand by most of the male users (Figures 8.16d,e). Figure 8.17 shows a male-dominated pattern of use along the sidewalks of the north-western part of the reference area, known as the informal currency exchange hub of Tehran. Clusters of male traders exchanging currencies only a few steps away from the formal currency exchange stores lined along the intersection of main streets. Hence, informal trading here is correlated to what is being sold in the nearby formal shops. During midday peak activity periods, male traders stand, sit on the motorcycles and the entrance steps to buildings or wander around, looking for customers who wish to buy or sell currencies (Figure 8.16a). The clusters of vendors here attract a large number of visitors to their informal business, which causes congestion in some cases. Informal trading in such urban public spaces is not a male-only business. A few female traders are observed along the retail edges where women are the dominant gender group. This can be considered a process of escalation through which female traders are not only attracted to those areas with a high volume of pedestrian flows, but also to those that benefit from a considerable number of women.

In contrast to the public spaces that are open to different forms of appropriation and social transactions, some less vibrant urban spaces appear where the concentration of large-grain developments has produced a lower volume of streetlife. Examples of this pattern are southern Ferdowsi Street and southern Saadi Street where footpaths are used for a limited range of stationary activities. The footpaths here exhibit less use and appropriation of space by women, informal traders and street performers. The low concentration of informal traders and performers along embassies and public institutions indicates a high-level of control over space and public life. In effect, such areas become the domain of the state control, which formalises their usage to create an 'orderly' image of the city (Bayat, 1997, p. 63).

In public spaces close to shopping centres, informal traders generally compete with motorcycle-taxis for footpath space (Figures 8.16a,b). While informal traders and motorcycle-taxis offer different services, they both benefit from a high level of visibility in public space and both

appropriate spaces with a high volume of pedestrian flows. The ways informal traders cluster in the already congested areas of the public space network can attract more customers and cause high level of congestion and competition where traffic gridlock becomes inevitable. It is important to note that while motorcycle-taxis' appropriation of footpaths can escalate until pedestrian traffic is blocked, informal trading has an interest in keeping pedestrian access open because at the point of excessive congestion, traders may lose their business (Peimani & Dovey, 2017).



(a)



(b)



(c)



(d)



(e)

Figure 8.14. Mix of activities and gender differences



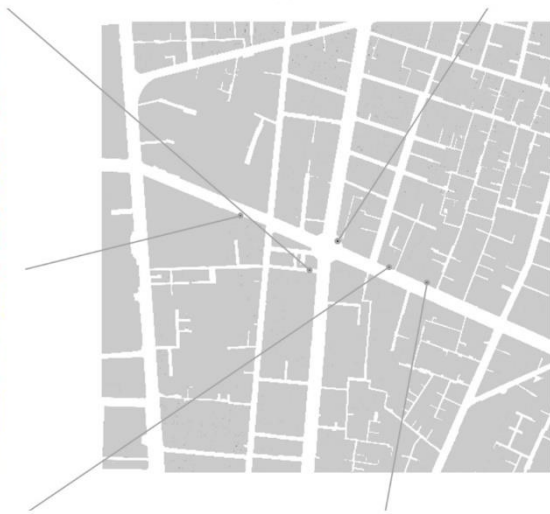
(a)



(b)



(c)



(d)



(e)

Figure 8.15. Mix of activities and gender differences



(b)



(c)



(d)



(e)

Figure 8.16. Male-dominated public spaces and the competition between vendors and motorcycles
Figure 8.16a by Paul Kristoff (2016).

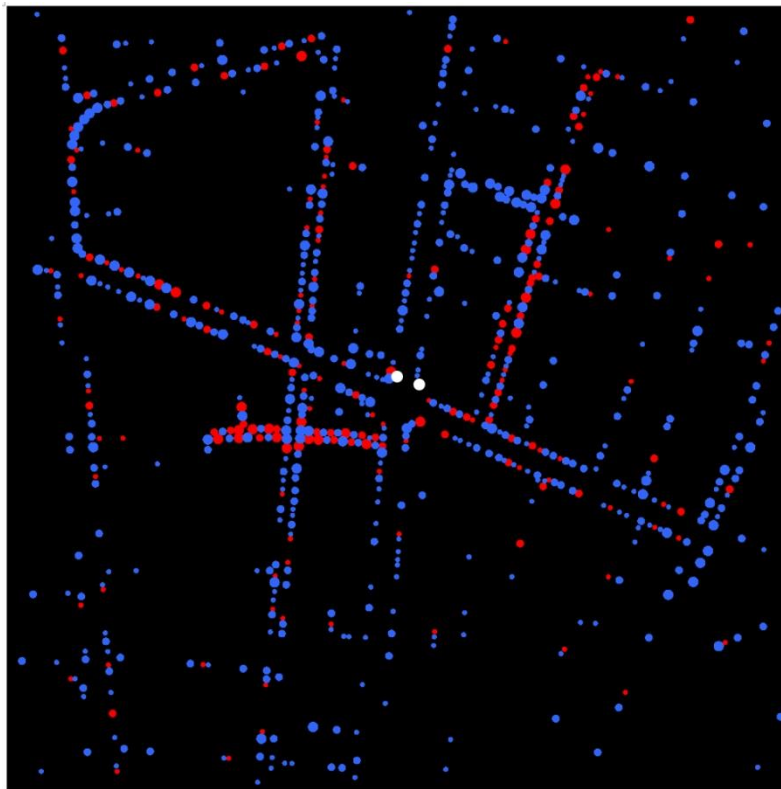


Figure 8.17. Gender mix
1 km scale

●● Female ●● Male

8.6. Potential for change

Saadi often accommodates mixes of different functions and built forms at the centre of the urban metro network (Figure 8.18), facilitating efficient connection to the city via its relatively high-volume public transport. The complex relationships between physical arrangements and transgressive activities have tested the boundaries of what is allowed and what is desirable about public life in the vibrant sidewalks closer to the station. However, some of its heavily-controlled public spaces have shown a low level of public activities and informal appropriations, which is unlikely to contribute to the socioeconomic vitality and streetlife intensity. The station area accommodates gendered public spaces, which are filled with multiple and shifting appropriations – more or less temporary territorialisation of footpaths, busy metro station, entrances of shopping centres and so on. The empirical findings discussed in this chapter suggest that while parts of the studied urban assemblage have been covered by heritage overlays, it offers significant potentials for change around the metro station not only in its built forms but also in its spatial patterns of public activities as well as gender differences in the use of those spaces.

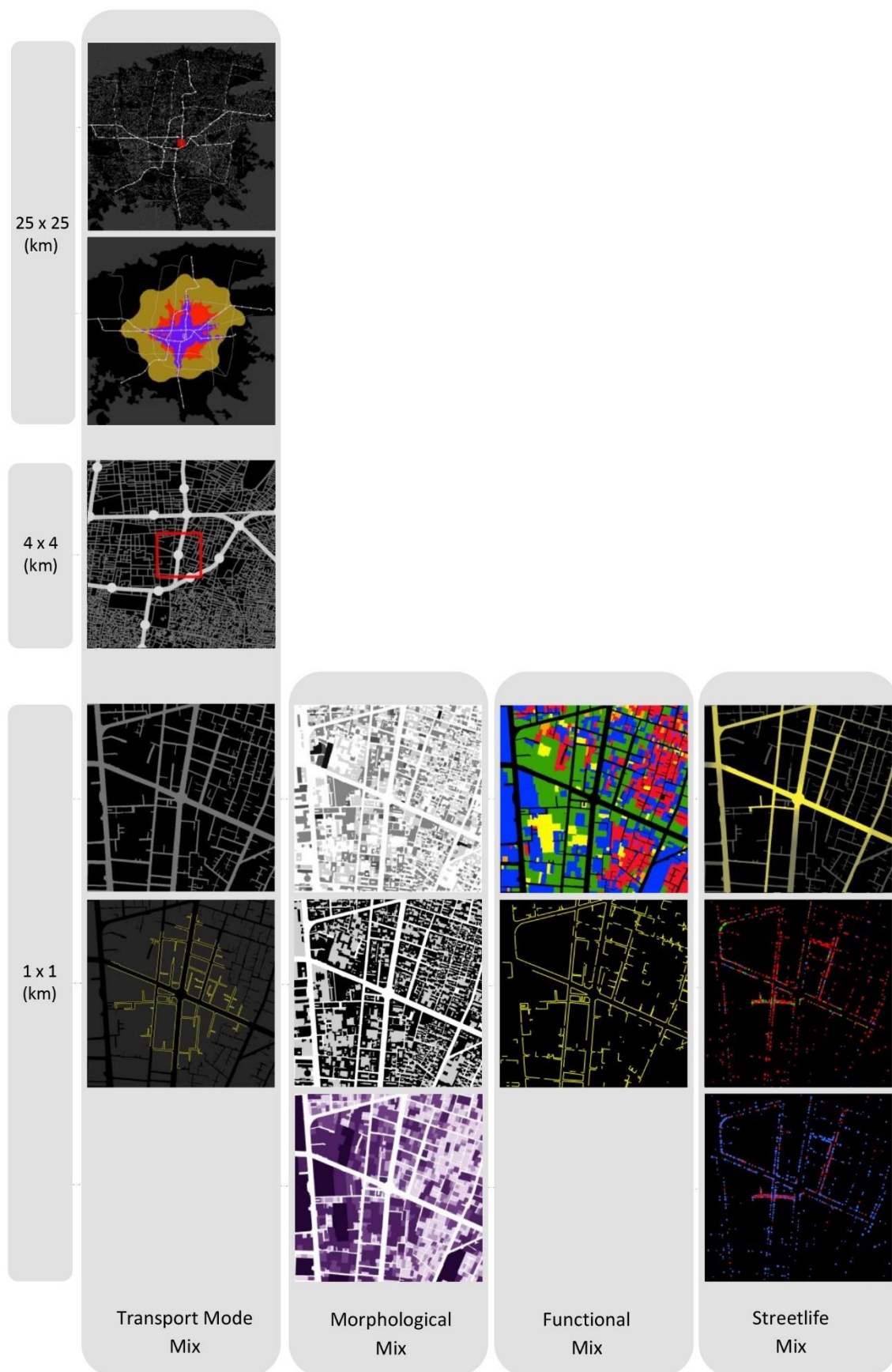


Figure 8.18. A map of maps

Mix of transport modes

The key findings of isochrone mappings indicate that while the studied area is well served by formal high-volume transit, motorcycle-taxis are still the fastest mode of transport. Nevertheless, their transgressive practices are generally subject to concerns, conflicts and contestations. The use of motorcycles within most pedestrian spaces was damaging to the economic productivity and public life of the studied station area. These conditions were often dismissed by authorities and thus remain subject to a degree of formalisation through setting the footpath rules for motorcycles, conducting surveillance and enforcing the rules. There is a further key issue here suggesting that the north-eastern and south-eastern areas are disconnected from high-capacity mass transit. Therefore, the provision of frequent and high-volume formal modes of public transport such as metros and BRTs could provide the leverage to achieve a mode shift for their broader catchment areas.

Morphological and functional mixes

The analysis of building heights, footprints and lot sizes indicate that the majority of areas to the west of the station is characterised by the large-grain embassies and public institutions, which incorporate low levels of coverage with vast private open spaces. Such large lots in the networks of impermeable blocks have reduced diversity of functions and have often produced less vibrant urban environments around the central station. The quest for locational advantage results in clustering of embassies in capital cities' financial districts – 'place symbolism'. At global scale, it is the image of those sites that matter. However, such impermeable large lots constrain any transformation at urban design scale.

While heritage codes constrain intensification in some blocks, some residential and work clusters to the east of the station have potentials for redevelopment. Here, incremental change of small grain morphology can substantially contribute to the transit-oriented intensification. Yet, this needs to be imagined as part of a much broader assemblage incorporating density, resident resistance, market demand and so on. In addition to the work-dominated areas to the west of the station, the mixed functions of work and visit are often located within large lots producing impermeable blocks around the major transit node. However, large lots are seen as development opportunities as they have the potential to be subdivided and therefore to increase permeability.

Some open parking lots as well as underground parking floor areas appear around the major transit node with car access dominating the street. There is a strong case here to prohibit direct car access from the main streets that offers the prospect for producing walkable urban frontages. Another issue suggests a high volume of on-street parking throughout the area. This condition links with the current planning statutes in the city, which requires at least one off-street car park area per new dwelling in the residential developments and a parking area per certain square metres of floor area within the office-commercial centres. However, many of the recently developed apartment buildings within the dense urban fabric of the eastern part of the station and the office-commercial developments lack the required parking area – developers construct buildings without providing the required parking areas by paying the fines to the municipality. If this policy continues, the affordability and the yield on those developments will increase, as will the on-street parking on many lanes and streets of the subject site.

Streetlife mix

The public spaces that are open to multiple uses and appropriations create a vital urbanity for all, extend the right to perform one's desired activities while considering the presence and rights of other individuals. In many cases the single action had the potential to bring together other activities and create spaces for spontaneous appropriations. In the presence of other groups of individuals, children and street performers are attracted to linger and play in public space. People begin to comment on the performer's play, which results in short conversations as well as social transactions among strangers. The continuous network of public spaces incorporating the density and mix of activity patterns as well as people's easy access draw in diverse groups of users in terms of age and gender especially young women, and therefore enable a greater degree of spontaneous social encounters.

9. THE EAST: SARSABZ



9. THE EAST: SARSABZ

Introduction

This chapter focuses on a case study called Sarsabz in the eastern Tehran, district of Narmak. It investigates the connections and synergies between urban morphology, functional mix, everyday streetlife and mobility patterns within walkable proximity to the Sarsabz metro station. The study area was primarily planned in the 1950s as a part of the first eastern suburb, Narmak, for middle-class people (Costello, 1993, p. 147). This plan was a response to the major socio-spatial transition period (post-war) in the city (see Chapter 4) where the massive 'low-cost housing' projects became the 'solution'. This period witnessed the fast-growing middle class and the development of modern urban planning. Until 1951, any peripheral land in the city was under private ownership. However, as a result of an urban regulation in 1951, they were placed under the control of the government led Construction Bank, due to which four different suburbs as new townships were laid out to accommodate people of various income (Amirahmadi & Kiafar, 1993, p. 124). Narmak was the first state-planned new township following a modern approach. According to this plan, a 400-hectare land was divided into nearly 8000 plots with varying sizes of 200 to 500 sqm for single-storey houses (Costello, 1993, p. 147). In addition to that, a further 200 hectares were planned to incorporate public open space networks. In 1993, the municipality of Tehran offered considerably higher built densities due to a policy known as *density-selling*, which resulted in the transformation of low-density buildings into high-density built forms. Thus, the population of the district increased to about 336,000 people by 1996 (Costello, 1993, p. 147) and about 378,000 in 2006 (Tehran Municipality and Tehran University, 2011).

9.1. The study area



Figure 9.1. Sarsabz study area

The study area for analysis comprises one hundred hectares of land surrounding the Sarsabz metro station. The metro network was extended through the subject area in 2005 and is located in the eastern part of the urban metro network (Figure 9.1a). The area is divided from north to south by Resalat Highway and east to west by Ayat Street (Figure 9.1c). Close to the intersection of Resalat Highway with Ayat Street is Sarsabz metro station with two entrances about 100 metres apart. As Figure 9.1c shows, metro entrances are located along Ayat Street, divided by Resalat Highway. Resalat Highway runs east to the centre of the city conveying a large volume of vehicular traffic (Figure 9.2). As a key transport node in the city, Resalat Roundabout sits close to the reference area from the west (Figure 9.1b). To the south of the study area, Ayat Street connects with Haft-Hoz Square, which is one of the most vibrant public open spaces in the city. This public space attracts a large number of day-visitors to its vibrant retail edges.



Figure 9.2. Resalat Highway

9.2. Transport mode mix

The study area is well served by multiple modes of public transport. Metro and bus rapid transit networks have facilitated a large part of daily travels across the reference area since their operation. Figure 9.1a shows how these networks connect the case study area to the surrounding areas. The BRT network runs east-west along the Resalat Highway intersecting with another BRT line (running south to the centre of the given area) nearly at the centre of the study area. The BRT network does not entirely include dedicated lanes in the east-west direction. This means that a part of the network runs in mixed traffic, which is delayed by increasing car traffic. By contrast, the BRT network that runs from southern Ayat Street to the centre of the study area can provide high volume transit as it enables the express buses to pass through the dedicated lanes in this direction.

The overlapped isochrones in Figure 9.3 illustrate patterns of mobility for different mode choices including motorcycle-taxis, car-taxis and high-volume public transport (metro and BRT) over 20 minutes across the study area. It is notable that the motorcycle-taxi access zone is far larger than catchments for other transport modes in nearly every direction. The average area accessible by motorcycle-taxi from Sarsabz station is about 160km^2 compared to 55km^2 for the car-taxis and 25km^2 for public transport. Public transport competes well with the car-taxi in most of the directions as shown on the map. The exception to this pattern is the north direction where the

BRT, running south to north, does not extend to the northern part of the study area. The general pattern of relationships between morning-peak travel modes indicates that motorcycle-taxi is obviously the choice of mobility mode when time is a critical issue.

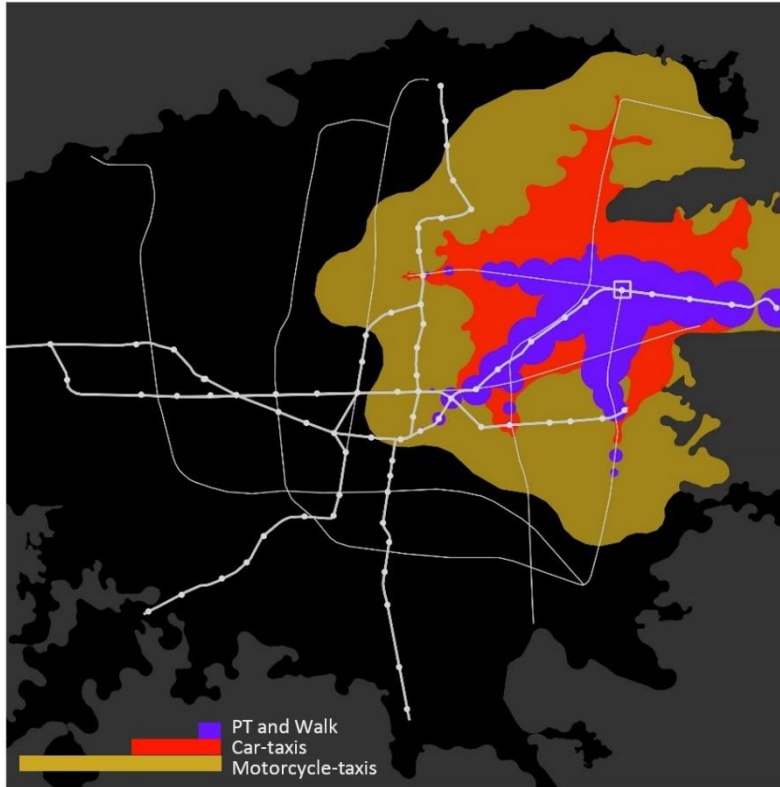


Figure 9.3. 20-minute isochrones: car-taxi, motorcycle-taxi and public transport
25 km scale

9.3. Morphological mix

9.3.1. Access networks

The standardised access network in Sarsabz station area is a result of formal modernist planning, according to which urban blocks and a number of neighbourhood parks connect through a regular grid structure. Streets were laid out in the 1950s following a rigid hierarchical network where each neighbourhood park branched into two or four cul-de-sacs. The cul-de-sacs were primarily designed as pedestrian-only areas, which together with the local parks aimed to constrain the through traffic. However, as observations showed, currently cars can enter these cul-de-sacs. Urban blocks in the reference area do not incorporate much variation in terms of configuration with perimeters ranging from 250 to 550 metres and block lengths varying between 60 and 140 metres. The accessibility from the metro station to the surrounding areas is relatively high, with the CAPS_{5min} of about 11 hectares. This catchment resulted in part from



(a) Resalat Highway



(b) Ayat street

Figure 9.4. Disconnection of the pedestrian network along main streets

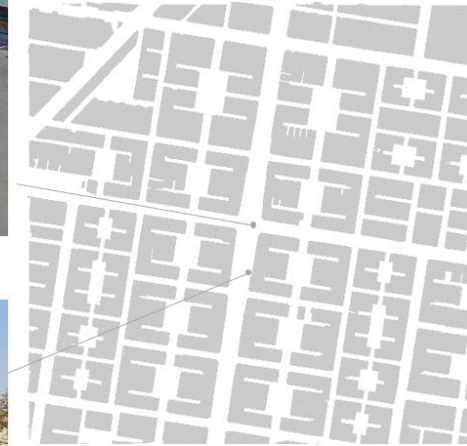


Figure 9.5. Accessible interfaces within a 5-minute timeframe (AI_{5min})
1km scale



(a)



(b)



(c)



(d)

Figure 9.6. Street widths from narrow to wide

the large number of parks distributed across the study area. At smaller scales, pedestrian networks are disconnected by numerous cul-de-sacs – despite the fact that a property may have less than 20 metres distance from the closest main street, one should walk 300 metres to get to the same spot. This becomes a more important issue when the block length is at its highest range. The pedestrian movements are constrained along southern Ayat Street and Resalat Highway by the fences along the BRT lanes (Figure 9.4). The access between two parts of the road is only enabled via a pedestrian bridge or small gaps at least every 500 metres along the fences. People often informally cross the Resalat Highway without using the pedestrian bridge with long stairways. The total length of public/private interfaces that can be reached over 5 minutes from the Sarsabz metro station (AI_{5min}) is about 11,970 metres (Figure 9.5).

Streets in the station area vary broadly from cul-de-sacs, minor streets to main streets and highways. Figure 9.6 shows street widths from the narrowest (a), to the widest (d). Cul-de-sacs, with the width of nearly 8 metres, generally exist within residential blocks. Minor streets, with an average width of 10-20 metres, are generally enclosed by residential blocks, with a few exceptions where blocks incorporate a mix of different functions. A highway, with an average width of 25 metres carries a heavy vehicular traffic. This type often accommodates both residential and multi-functional buildings. Some

main streets have an average width of 50-60 meters, which are often enclosed by multi-functional developments.

9.3.2. Building densities

The focus of this section is on building types and heights and the ways in which they spread throughout the study area. Figure 9.7 shows that Sarsabz is dominated by attached row houses. Environmental considerations of light and climatic conditions (Costello, 1998), as well as the traditional land division regulations resulted in the north-south orientation of these housing plots. In each housing plot, the length to width ratio is estimated at 2 to 1, allowing a suitable area for built-up space in the northern end and an open space in the southern end that serves the building with sufficient air and light. Sarsabz is characterised by relatively low gross coverage of 35% and a net coverage of 59%, which to a certain degree, follows the regulated lot coverage in Tehran's master plan of 1970. The building heights map (Figure 9.8) shows that the areas along Ayat Street and close to the metro stations are dominated by low-rise buildings of 1 to 3 storeys with a few exceptions of buildings with 4 storeys. Along Resalat Highway most buildings are in the range of 2 to 5 storeys, with only a small number of 6-storeys developments. By contrast, residential areas throughout the study area show clusters of higher-density buildings. The height of these buildings varies broadly from 1 to 6 storeys, with the dominance of 5- to 6-storey new buildings. The resulting gross FAR is 1.26. The residential density is relatively high – about 160 residents per hectare (see also Chapter 4).



Figure 9.7. Building footprints, lots and street network
1km scale

Footprint Private open space



Figure 9.8. Building heights (storeys)
1km scale

1-2 3-5 6-9 9+ Storeys

9.3.3. Grain sizes

Figure 9.9 shows the grain sizes throughout the reference area. Lot sizes range from minimum 65m^2 to maximum 1200m^2 including some exceptions of large-grain developments with visit and work uses. The map of grain size shows that a large part of the residential areas is characterised by small to middle-sized lots. Exceptions to this pattern are the recently developed buildings, which occupy amalgamated lots. This has enabled a mix of grain sizes within some blocks close to the metro station. Figure 9.12d shows a new building on a large amalgamated lot, which co-exists with small-grain housing developments. More than half of the visit and work functions along main streets occupy small-sized lots. By contrast, few shopping centres and office buildings occupy large grains ($>500\text{m}^2$), which coexist with the nearby small-grain urban morphology. Figure 9.12e illustrates a part of the northern Ayat Street, which accommodates buildings with different ages and grain sizes. The diversity of building age is enabled to a certain degree by the small lot sizes clustered in the northern Ayat Street and Resalat Highway, which is capable of providing enterprises with different rental values. While the reference area has been shaped according to modernist planning principles, the staging of development and the mix of layers since its formation have produced an irregular urban morphology along its main streets.



9.4. Functional mix

As illustrated in Figure 9.10, a vast area of the station area (about 48%) is devoted to housing resulted from the mass housing modernisation projects during the 1950s. However, there is a relatively high level of mix along main streets with different functional mixes – whether vertical or horizontal. The most mixed streets are the main streets (Ayat Street and Resalat Highway) where a rich mix of attractions and retail edges create visually vibrant and diverse texture to the streetscapes (Figures 9.11 and 9.12c). Areas along the main streets and close to the transit nodes generally accommodate buildings with a vertical mix, which comprise retail on the ground floors and office (green) or housing (orange) above. Functional mix along Ayat Street differs from Resalat Highway which has more offices, enterprises, educational buildings and small supermarkets (Figures 9.10 and 9.12a). By contrast, minor streets and cul-de-sacs are often residential with local shops and educational facilities. The primary uses along the main streets including offices, enterprises, mosques and shopping centres attract users during the midday and evening peak hours. The presence of such mixed primary uses sustains secondary uses such as a broad array of food stalls, clothing and retail shops. As the map of functional mix shows, most visitation sites are local parks surrounded by residential blocks, which incorporate fixed play and sport furniture for different users (Figure 9.12b). These parks have a lower level of attraction relative to the other visit attractions especially retail edges.

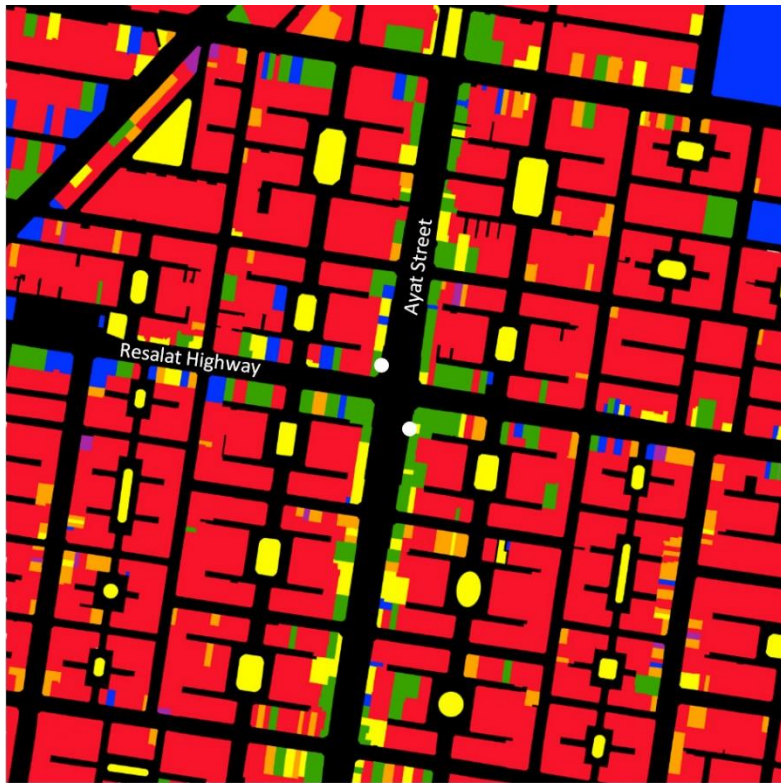


Figure 9.10. Functional mix
1km scale

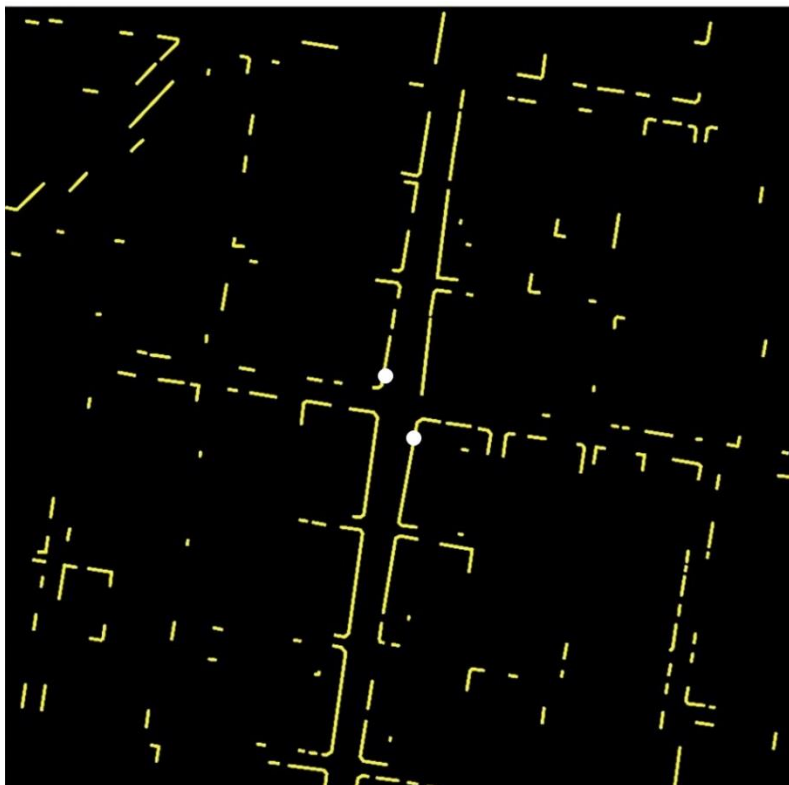
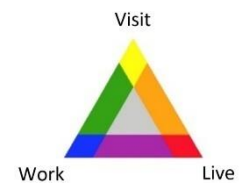


Figure 9.11. Retail edges
1km scale





(a)



(b)



(c)



(d)



(e)

Figure 9.12. Mix of functions and grain sizes

9.5. Streetlife

Fine-grained analysis of activities (Figure 9.13) shows that while some public spaces in the reference station area are appropriated for a wide range of public activities, others (such as residential streets) do not accommodate this variation (Figure 9.17e). Figure 9.14 shows that the highest volume of pedestrian flows (nearly 500 pedestrians over 10 minutes) is in the southern section of Ayat Street where sidewalks (10-16 metres wide) are meeting places for users of all gender groups, ages and social classes; they are public spheres for women doing shopping or interacting with informal traders (Figure 9.17a); male individuals standing along the pathways and watching the passing pedestrian scene (Figure 9.17d); children sitting with their peers after school time. What contributes vitality to Ayat Street, are the public spaces onto which most of the shops, services and informal food stalls extend their business (Figure 9.17c). Closer to the metro entries, streets are informally encroached and codes are transgressed by numerous retailers as they use and appropriate sidewalks to put their goods and products on view. Similarly, merchants hang an array of clothes and handbags on racks in front of their stores, encroaching upon the public domain; food retailers display dry food, vegetables and spices in buckets or open shelves; outside the formal stores, informal traders display glass boxes and buckets for different perfumes and ask passers-by to try them; young musicians carry out street performance close to the retail edges during the midday and evening rush hours where a high volume of streetlife flows on the sidewalks.

By contrast, Resalat Highway does not accommodate a wide range of activities and groups of users (less than 200 people per 10 minutes during midday peaks) along its sidewalks. The lower volume of pedestrian flows here corresponds with the narrow sidewalks (about 3-4 metres) and lack of street furniture, which involve a significant change in the patterns of stationary activities. The stationary activities are often limited to the informal trading. Observation suggests that informal traders mostly concentrate on the corner of the blocks where there is a greater volume of pedestrian flows. During the working hours, motorcycles are often parked along the sidewalks adjacent to the work-related functions. Some visitors and informal traders use the motorcycles as a place to sit and talk to the nearby people.

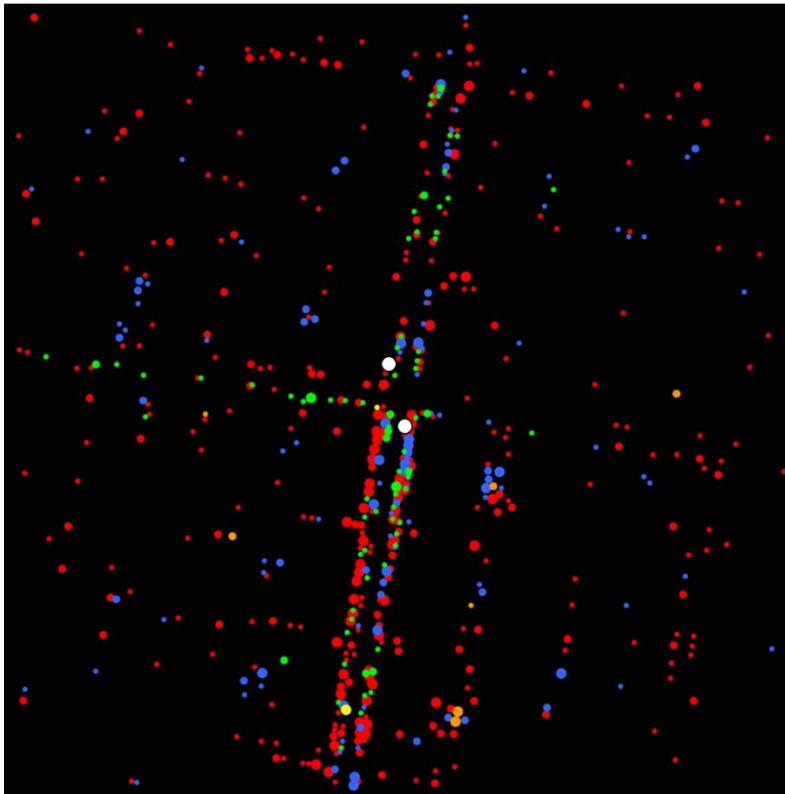


Figure 9.13. Mix of activities
1 km scale

● Standing ● Sitting ● Street trading ● Performance ● Playing



Figure 9.14. Weekday midday peak
pedestrian flows
1 km scale

High Low

Informal traders generally set up their business along the sidewalks where the volume of pedestrian flows is relatively high. Figure 9.15 shows the ways in which informal traders engage with public spaces to meet their needs. They use urban furniture and 'loose parts' (Nicholson, 1971) to signify their territories and display their wares. Different ranges of parts can be divided based on the fixed/unfixed continuum (see chapter 3). According to this, most of the informal traders in the studied area can easily move, except for those with more fixed food stalls. This issue becomes important when the state exercises control over public space by 'street cleansing' due to which many traders are evicted from the sidewalks. There is a further key issue here regarding the ways the concentration of informal activities and loose parts on the sidewalks generate congestion of pedestrians in the already congested areas. This lends itself to what Bromley (2000) calls 'the problem', arguing that the traders are concentrated in the areas with pre-existing flows and their agglomeration attracts more flows and congestion. The density of informal trading reaches its highest level in the midday and evening peaks along the sidewalks of Ayat Street, which causes congestion and blocks easy access to the adjacent formal businesses. The everyday streetlife observations indicate that the areas face a daily change of public activities. During the morning rush hours, a few vendors occupy the areas where the work-related flows are dominant such as public transport nodes. Figure 9.15d shows a shoemaker occupying the same spot every morning who offers service to the people walking to their work. Yet, in the midday and evening peaks, informal traders are clustered close to the retail edges where the number of visitors reach their peak.

As the map of gender mix (Figure 9.16) shows, women are the dominant users of retail edges and street trading along Ayat Street. Women visiting this particular part of the study area often do so in groups and may initiate short conversations with strangers while investigating the goods that are on display on the sidewalks (Figure 9.17a). This is linked to what Whyte (1980) calls 'triangulation' where an external stimulus triggers strangers to interact with each other in public space. A series of fixed elements such as chairs and tables with umbrellas have been located along the edges of sidewalks, which can afford a greater mix of activities (Figure 9.17d).



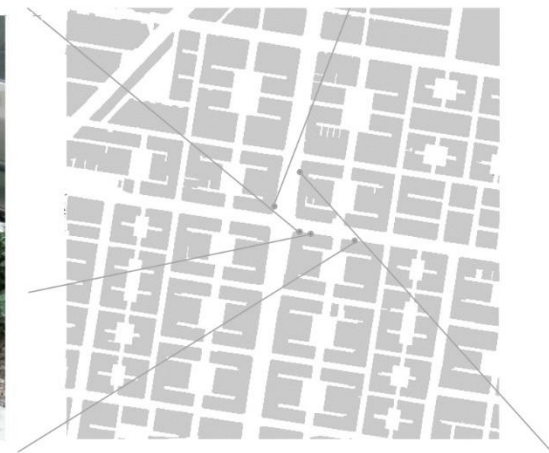
(a)



(b)



(c)

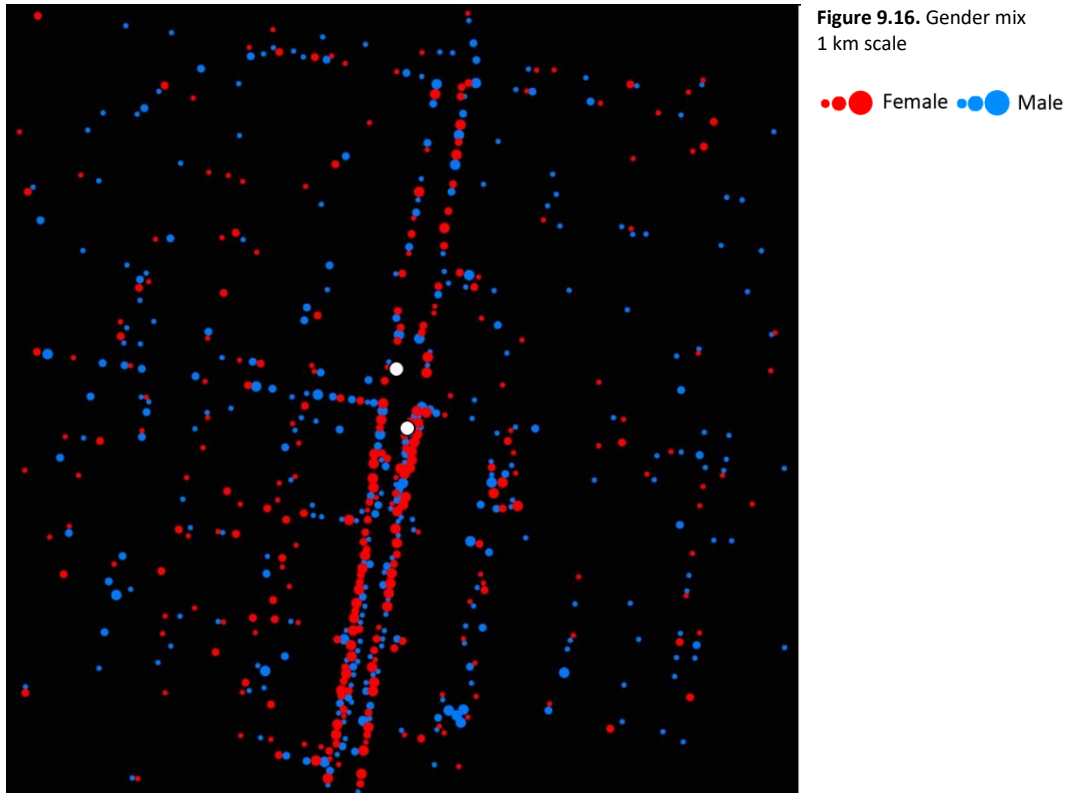


(d)



(e)

Figure 9.15. Informal trading



One of the observed patterns of use incorporates the ways in which informal trading is linked to the spatiality of gender differences in public spaces. This link is manifested not only in how informal trading attracts female users to particular parts of the public space, but also in the ways in which the products offered by street vendors target the dominant gender group. This is in part the story of the eastern transit node where informal traders are present in the areas with the dominance of women in the public space and attuned to provide those kinds of goods and products that are in demand by most of them. The majority of informal traders in the reference area are men with a few number of women and children involved. Female traders sit on the ground along the retail strips and sell their homemade products. This relates to an escalating process through which women as informal traders are often concentrated not only in the areas with a busy pedestrian flow but also to those parts of public spaces that benefit from a considerable number of female users (Figures 9.17b,c).

According to the census statistics, the ratio of male to females is estimated at 102:100 within the reference area, a fairly lower ratio than the average in Tehran (104:100) (Tehran Municipality and Tehran University, 2011). Direct observation suggests that the station area benefits from a mix of gender groups with a dominance of women along its north-south retail

edges. There is not a mix of gender groups along the main east-west axis (Figure 9.16), which is linked to the fact that the main east-west axis is predominantly an area of official and institutional buildings with a low volume of pedestrian flows and a high volume of through vehicular traffic. Therefore, the census data of men and women living in a given area does not necessarily indicate the people involved in activities within public spaces.

As observation and visual recording indicate, patterns of gender mix in neighbourhood parks and residential blocks are relatively different from those along the main streets. Figure 9.16 shows that residential clusters generally accommodate a mix of different groups distributed unevenly across the station area. Exceptions to this pattern are the local parks with fixed seats and sport furniture surrounded by residential blocks. Some of the parks specifically the ones adjacent to the work and visit functions are temporarily appropriated by different gender groups. Observation indicates that every morning some male and female users are attracted to these public realms to do sports, while during the midday rush hours these areas are often appropriated by the elderly meeting with their peers or school children playing while their parents are talking to each other. During the evening peaks, young groups are the dominant users of the space.



(a)



(b)



(c)



(d)



(e)

Figure 9.17. Mix of activities and gender differences

9.6. Potential for change

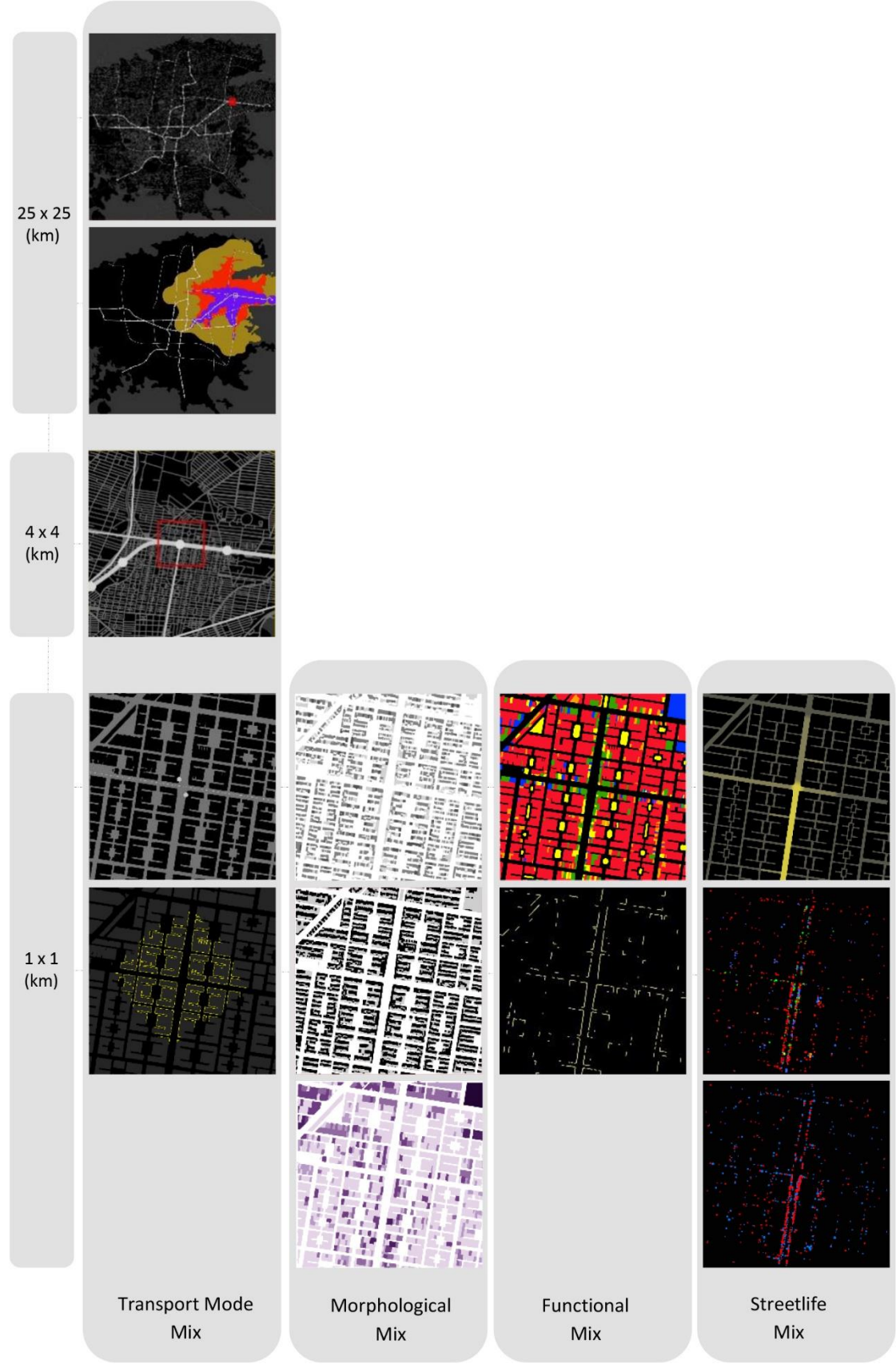


Figure 9.18. A map of maps

Sarsabz is not similar to those ideal transit-oriented urban design models identified in the global literature. While most areas in this case study sit adjacent to the metro station, they have not been intensified based on this proximity. This is linked to what Cervero et al. (2002) argue as lacking functional connectivity to transit – whether in terms of the functional mix composition, station accessibility, or site design. To conclude, the chapter seeks to provide a brief summary of the key findings about synergies and possibilities for transformational change associated with the mix of mixes – morphological, functional, streetlife and transport mode mixes (Figure 9.18).

Morphological mix

The analysis of the studied area demonstrates how the access conditions of urban morphology within a walkable distance of metro station can enable or constrain the intensities of streetlife. The catchment of accessible public spaces is relatively high around the studied metro station, which results from the predominant grid street network and local parks. However, the impermeable patterns of cul-de-sac structure constrain access to the transit node. To improve access conditions, there is a potential here for demolishing and redeveloping the immediate locations to the station entries.

The analysis results of the studied transit node indicate that urban intensity and building density are not strongly correlated. Closer to the station, most of the areas with high intensities of streetlife have lower building densities. By contrast, residential blocks incorporating higher building densities do not necessarily generate intensive streetlife. This links to the idea that urban intensity does not simply increase with the building densities, yet is a synergistic effect of a larger assemblage (Dovey & Pafka, 2014).

Functional mix

The mix of primary and secondary uses and different forms of co-functioning between them have maintained streetlife vitality along main streets at different times throughout the day. The diversity of lot sizes here enables synergies between smaller and larger scales of production and consumption. These two scales reciprocally attract and draw upon one another. By contrast, mono-functional residential clusters are the sites with significant potential for transformational change. Few micro-scale changes have been under way in these areas where new larger-grain buildings with a mix of retail and housing functions have been replaced with the former smaller-grain residential developments. Hence, the close connections of home to shopping, school and

recreation within residential blocks as well as the transactions between multiple owners (occupying newer amalgamated lots and older buildings with small lots) can contribute to the social and economic vitality and intensive streetlife around the transit node. However, the excessive replacement of older residential functions with new large-grain dwellings can run the risk of removing the rental gaps between different buildings and go some way towards producing a homogenous environment.

Streetlife mix

The study showed contrasts between main streets and the rest of the areas regarding the ways public activities are spatially manifested. Ayat Street showed a good example for how social and physical affordances and a high intensity of streetlife are enabled; physical design within its sidewalks enables a mix of unexpected activities as well as informal appropriations and the emergence of stationary activities thus affords other types of activities. However, most of the residential clusters especially those along the minor streets have not been used and appropriated for their full potential. This is linked to the ways residents of such areas mark their territories and exercise control over space and its users. Therefore, public space becomes enclosed with territorial boundaries, controlling urban public life and social encounters between different groups of users. A key capacity for change here is linked to the ways informal activities especially street trading can loosen up the spatial striation of the urban public space and increase its physical and social affordances.

A main finding of this chapter involves the capacity of informal trading in enabling and construing public activities around the major transit node. Finer-grained analysis of this urban assemblage suggests that informal trading can soften the boundaries between spaces of pedestrian circulation and spaces of market and exchange. The empirical material suggests that the concentration of informal traders in the already congested areas can also block pedestrian flows, constrain opportunities for vendors and constrain access to the formal markets. In effect, the virtuous cycle of encouraging vibrant streetlife and economic productivity closer to the station can become problematic and enter a vicious cycle of overcongestion and losing marketing opportunities. This is what Bromley (2000, p. 15) calls the process of 'hyper-agglomeration' due to which many complaining vendors have no choice but to leave their territories as a result of severe competition and congestion caused by heavy pedestrian traffic.

The case study of Sarsabz provides insights to the ways in which women's presence in these public spaces is linked to the predominance of retail edges, loose parts, sidewalk width and informal trading at the micro-scale. It also shows that women's use and appropriation of public realms are a key condition for enabling high volumes of streetlife. The empirical material discussed in this chapter confirms Spain's (1992) argument that there is a reciprocal relationship between patterns of use and appropriation and gendered spaces. The gendered patterns of use along the main streets also link to Darke's (1996) arguments that while females benefit from the opportunities offered by urban diversity and heterogeneity – whether in formal, functional and social terms – they are negatively affected by not only the ways male domination has been intensified in urban public spaces but also by the ways modernist zoning is based on stereotyping gender identities and roles.

Mix of transport modes

The findings of the studied area show the ways motorcycles have various advantages over formal modes of transport while contributing problems in everyday urban life. The capacities to start travel and park without any delay and be faster than other formal transport systems in the congested areas are among their key advantages. However, the ways shopkeepers and informal traders use their parked motorcycles as a place to sit especially on the narrow footpaths; or many day-visitors park their motorcycles on the sidewalks; or their capacity to manoeuvre through pedestrian traffic along the most vibrant sidewalks and to transgress the formal codes of the city can be often unsafe, posing a threat to the economic and public life of the city. Therefore, any attempts at their formalisation that brings enforcement of sidewalk codes can remove a part of the advantages that produce the significant gaps between motorcycles and other modes of transport. Such enforcements would also ease flows of pedestrians and expand their access to the metro station.

The analysis of catchments during the morning rush hours has shown that while BRT systems can provide high-volume public transport, they contribute several problems. The case study shows the 'not all dedicated' BRT lanes along the west-east axis where express buses become infrequent and far from competitive as they run through mixed traffic with cars. Second, the analysis of Sarsabz foregrounds problems of 'blockage', which is related to the ways BRTs block transverse pedestrian connectivity through their long fences along the arterial roads. Thus, a few limited micro-scale interventions such as narrow gateways in fences (at least every 500

metres) with no traffic lights and pedestrian bridges have proven relatively inadequate. Hence, to explore possibilities for change along the BRT corridor requires a way of thinking that connects BRT's capacity in providing high volume transit at the city scale with its associated urban design dimensions across the walking catchment.

10. THE WEST: NAVAB



10. THE WEST: NAVAB

Introduction

Navab station lies in the inner-western parts of the city's metro network. The walkable area around the metro station is roughly divided in half by the Navab Highway, which has been playing a key role in facilitating the north-south connection of the city during the last decades. The study area is surrounded by neighbourhoods with residential, commerce, industrial, cultural, political and military functions, most of which operate at the city scale. Until the late 1850s, a large part of this area was outside the city boundary. Since then, a part of the site has gradually been allocated for residential developments. In the 1920s, the morphological transformation of the neighbourhood paralleled the rapid growth of the city, which followed modernist planning ideas. The construction of large roundabouts together with a network of wide straight boulevards were authorized by the Street Widening Act of 1933 (Mazumdar, 2000). The municipality of Tehran aimed to connect Navab street to the major arterials and airports at the city scale (international in the south and domestic in the west), which meant extending the street by cutting through old fine-grain urban morphologies (Madanipour, 1998, p. 79). To secure this costly plan financially, the municipality issued a bond in late 1994, which comprised commercial, retail and office developments. This followed the 1993 plan by which the municipality of Tehran offered considerably higher built densities through bonus zoning (Madanipour, 2006). In the late 1990s, the major part of the scheme was implemented replacing a large number of decayed and dense dwellings with new housing developments (Madanipour, 1998). As the case study has gone through cycles of change over time, both socially and spatially, the present chapter opens up the contentious questions of how the existing mix of functions and morphologies in Navab connects to the mix of everyday mobility choices; and what would be the synergies and capacities for change embodied in them; how the connections and spillovers between morphological, transport mode and streetlife mixes play out in this particular urban assemblage?

10.1. The study area



Figure 10.1. Navab study area

The study area for analysis includes one hundred hectares of land surrounding the Navab metro station (Figure 10.1a), which is located in the inner-western parts of the city. The station area has a considerable significance due to its proximity to the intersection of the north-south and west-east main axes of the city. The area to the north sits close to a major transit road, Azadi Street (Figure 10.1b), which links the two key roundabouts of east-west connection – Azadi and Enghelab. The study area is divided by Navab Highway (Figure 10.1c), the main arterial road, which was constructed by extending the former Navab Street in the late 1990s. The widened road was meant to facilitate the north-south link of the city. Each divided edge accommodates a vertical extrusion featuring residential blocks and commercial office centres adjacent to the key transit nodes and corridors (Figure 10.2).

The metro network was extended through Navab in 1999. The station comprises two entrances about 100 metres apart on each side of Navab Highway. The network plays a key role in conveying the traffic between north and south. It also attracts a large volume of the population from surrounding areas, which has an impact on everyday life of the reference station area. As Figure 10.2 shows, Navab Highway sits on one of the major underground

road tunnels of the city (Tohid Tunnel) (Figure 10.1b), which was laid out less than a decade ago. As the first north-south tunnel of the city, it carries a large portion of the vehicular traffic, facilitating the connection between the Navab Highway and arteries to the north of the city.



Figure 10.2. Navab Highway

10.2. Transport mode mix

The station area connects to the city via different transport modes, ranging from metro, buses and cars to motorcycles. In this sense, the connection is facilitated by metro to the east-west axis of the city and BRT to the affluent neighbourhoods of the north as well as the southern parts of the city. Located along the highway, close to the metro entrances, are the BRT stations with a large number of people waiting for the buses during peak times. BRT system along the Navab Highway partially includes dedicated bus lanes (Figure 10.3), meaning that in several areas, express buses run through mixed traffic with cars and are delayed when the car traffic gets heavy. The overlapped isochrone maps in Figure 10.4 show transport patterns for different modes including motorcycle-taxis, high-volume public transport (metro and BRT) and car-taxis within 20-minutes from Navab station. A motorcycle-taxi enables a greater range of accessibility compared to any other mode of transport in almost every direction. The area accessed by motorcycle-taxi is about 155km² compared to 40km² for the car-taxis and 25km² for public transport. Metro enables public transport to compete with car-taxis in the east-west direction of key metro lines during the morning peak. However, the BRT is non-competitive in the north-south direction. While public transport is often faster than the car-taxis in the direction of key

metro transit lines, it cannot compete with motorcycle-taxis. Motorcycle-taxis provide access to about six times the area of public transport and about four times the area of car-taxis.



Figure 10.3. BRT station along the Navab Highway with partially dedicated lanes and wider station spacing

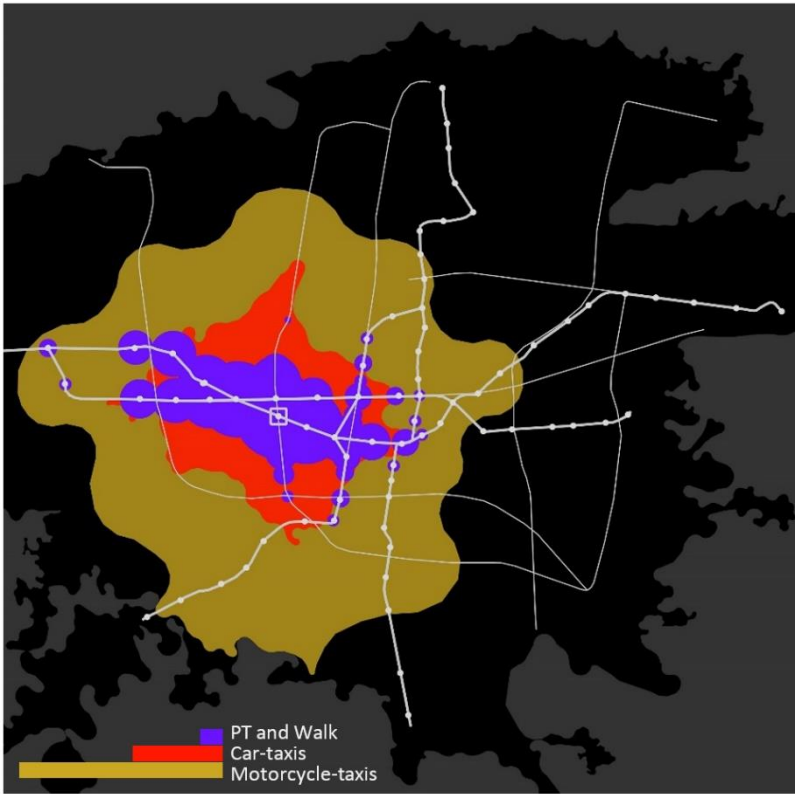


Figure 10.4. 20-minute isochrones: car-taxis, motorcycle-taxis and public transport
25km scale

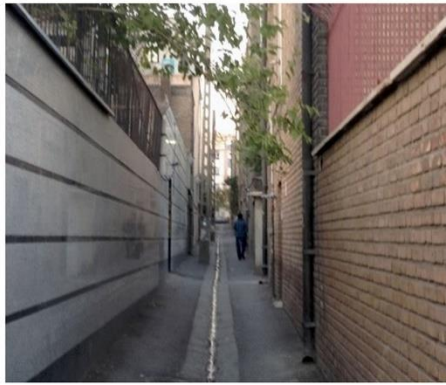
10.3. Morphological mix

10.3.1. Access networks

This section explores how different layouts of routes and streets make up the access network in the reference station area. The recent redevelopments transformed the local access network and replaced the former Navab Street with the highway, which incorporates 12 lanes of fast-moving car traffic. This process was followed by cutting through the old dense morphology of the subject site area (Madanipour, 1998). As a result, most of the street networks to Navab Highway are blocked by large impermeable blocks, which make local trips longer. The pedestrian network is also disconnected along the Navab Highway by the BRT fences. The access is rarely facilitated by small gaps, pedestrian bridge and a short underground connection between the two metro entrances, showing that the vehicular traffic is often privileged over pedestrian traffic in the reference area. This condition results in many informal crossings along the highway as illustrated in Figure 10.5. In addition to that, pedestrian flows are not entirely continuous along the pathways of the densified edge due to the impact of limited width, stairs, slopes and areas with no designated crossings. Observations indicate that most of the local streets of Navab carry a heavy vehicular traffic during the peak hours and intersections within the local network are generally choked with cars and motorcycles. This is linked to the fact that many people prefer motorcycles to other modes of transport for their everyday mobilities, particularly during peak hours.



Figure 10.5. Informal crossings



(a)



(b)



(c)



(d)

Figure 10.6 shows street widths in the study area varying from lane-ways and minor streets to main streets and highway. The most residential streets are 2 to 5m wide (a). Laneways and minor are ca. 5m wide, which allows car access (b). In addition to the most common patterns, main streets have widths of 20-30m (c) and the highway is about 50m wide with six lanes on each side (d).

Urban blocks in Navab vary broadly in perimeter ranging from about 200 to 600m. Exceptions to this pattern are a few small blocks with perimeters below 100m. The accessibility within a walkable distance from Navab station is mixed, with the catchment of accessible public space ($CAPS_{5min}$) of about 8ha where highly inaccessible areas co-exist with relatively accessible spaces. The examples for the inaccessible parts are the ones with the elongated rectangular urban blocks (e.g. 55 x 240m) throughout the study area, which exist as barriers to pedestrian flows. This is particularly the case along the highway where pedestrian access from the station to the attractions within back streets are obstructed. Many of these attractions are located in the blocks with numerous dead-ends. As Figure 10.7 shows the total length of public/private interfaces that are accessible from the metro station within 5 minutes is about 13,670 metres. Both measures of $CAPS_{5min}$ and AI_{5min} indicate that a large number of attractions appear throughout the given area to which the access network has not been often well connected.

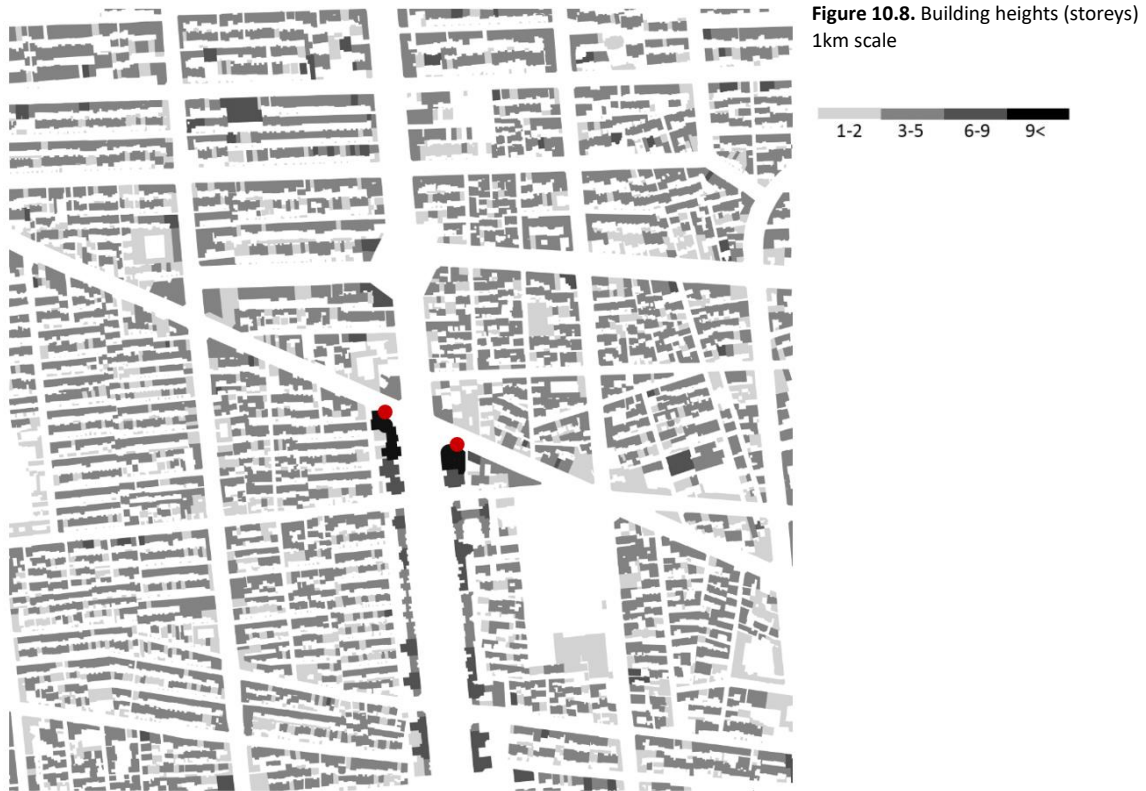
Figure 10.6. Street widths from narrow to wide



Figure 10.7. Accessible interfaces within a 5-min timeframe
1km scale

10.3.2. Building densities

The map of building heights (Figure 10.8) shows the vast bulk of the study area is made up of relatively fine grain and high-density developments. Heights in the site area are mostly three to five storeys, with several one- to two-storey buildings. The few exceptions to this pattern are the new high-rise developments, generally six to fifteen-storey apartment blocks lining the main arterial road (Navab Hwy). As part of the redevelopment process of Navab, the old low-rise buildings along the existing highway were demolished and made way for the modern buildings associated with high built density. The two commercial-office towers (darkest grey areas in Figure 10.8) extruded up to fifteen storeys in proximity to the station, are currently accounted as the key landmarks of the subject study area. The resulting building density is a gross FAR of 2.85.



The map of building footprints, lots and street network (Figure 10.9) shows the dominance at the neighbourhood scale of row houses, courtyards, slabs and towers. Some blocks still accommodate old low-rise courtyard houses, while others have changed to row houses over time ranging from medium to high built densities. Clustered adjacent to the new highway, are the slab blocks together with the towers on each side. The gross coverage across the station area is about 39% with a net coverage of 60%, which to a certain degree, follows the regulated lot coverage in Tehran's master plan of 1970. Due to this planning regulation, the residential blocks with row housings generally include 60% of lot coverage and 40% of the yard across the reference study area. As illustrated in Figure 10.9, a large area exists in light grey close to the station, which was an under-construction private open space without any built areas at the time of data collection.



Figure 10.9. Building footprints, lots and street network
1km scale

Footprint Private open space

10.3.3. Grain sizes

The map of grain size (Figure 10.10) shows how the station area is characterised by the fine-grain urban morphology. Lot size is generally small, with a few exceptions of larger grains occupied by new developments along the highway. Lot sizes vary from 50 to 5,000m², with the exception of a site under-construction, that is 15,000m². The largest buildings often cluster around the major transit nodes and along Azerbaijan Street with a few of them dispersed across the reference area - these are mostly garages, car-care service centres, car showrooms and warehouses. Prior to the densification project, lot sizes along the former Navab Street were typically small. The modernist redevelopment rapidly changed the formal mix of the old dense edge along the street. Since then, new buildings have been erected on large lots with uniform facades, which lack specific character or any distinct formal features (Figure 10.13e). In contrast, a mix of old and new buildings occupy the small-grain morphology, in the areas to the rear of the modern edge (Figure 10.13c), which has emerged and been sustained over many generations. Figure 10.13d shows how old structure of the study area with a different range of functions is terminated by a modern high-rise tower. The new densified areas depict a rupture from the context rather than being a part of it. Buildings in the residential hinterlands are mostly

small, representing clear constraints on transit-oriented intensification. While individual attempts were made to replace and upgrade parts of the old residential blocks, some areas remain deteriorated and as such the overlap of different layers of development over time has produced a mix of lot sizes in the subject area.



10.4. Functional mix

As Figure 10.11 shows, the study area is predominantly residential (approx. 49%) on the smaller streets with different levels of functional mix on the major streets. The most mixed streets are the east-west Azerbaijan Street and eastern Jomhuri Street (Figures 10.13a,b). The minor north-south street (Rudaki St) is also highly mixed along its entire length. Along these main streets, small-grain retail uses predominate as shown in Figures 10.11,12. Office, hospital, local firm, bank, school, workshop, automobile gallery and car-care service centre are among the primary uses that attract people from outside or inside the area to Navab. The pool of users drawn to the station area varies from affluent consumers to those who come to work in private enterprises as working-class and middle-class people. The primary functions generate and maintain ancillary uses such as restaurants, small retail shops and temporary food stalls along

some of the main streets, which add to the vitality of the area. Along the main streets, there is also a high level of vertical mix as shown in the predominance of orange and green sites. For instance, the areas close to the intersection of Rudaki and Azerbaijan Streets are occupied by buildings (light grey areas), with rich vertical mixes as they accommodate employment, housing and retail uses. Clustered around the main metro and BRT stations are the mixed areas of visit, work and live functions, which mediate a greater streetlife intensity. In addition to that, there have been a few attempts to insert one-storey retail stores into the underground connection between the two metro entrances. The modernist development on Navab Highway does not incorporate any major functional mix (Figure 10.11). Retail edges are also limited along this axis (Figure 10.12). Figure 10.11 shows a large work area (blue) to the east of the station, which was under construction at the time of data collection. Located adjacent to this site are some office buildings and services including auto galleries and car-repair workshops.



Figure 10.11. Functional mix
1km scale

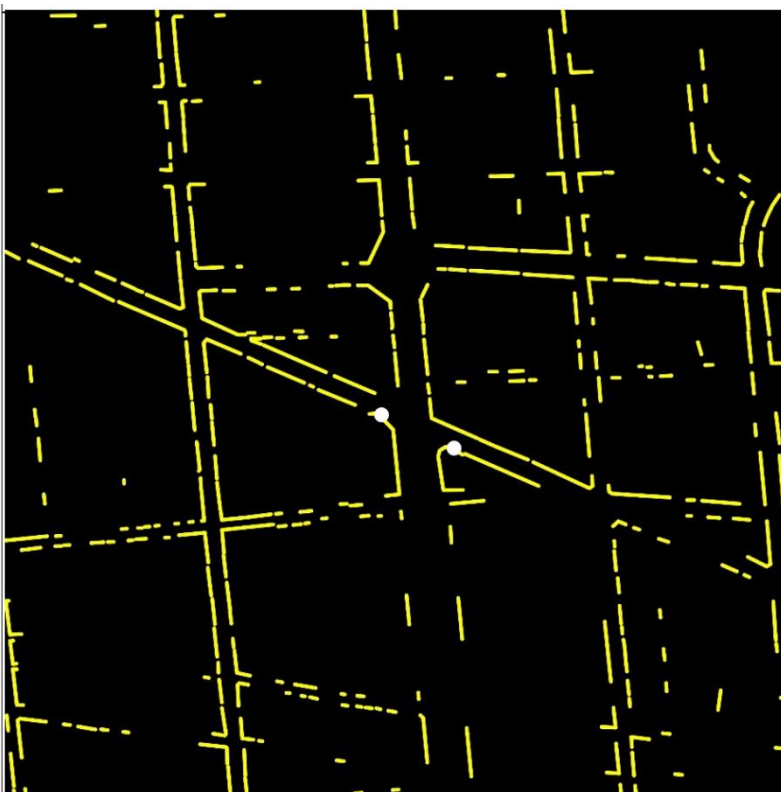
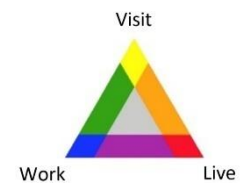
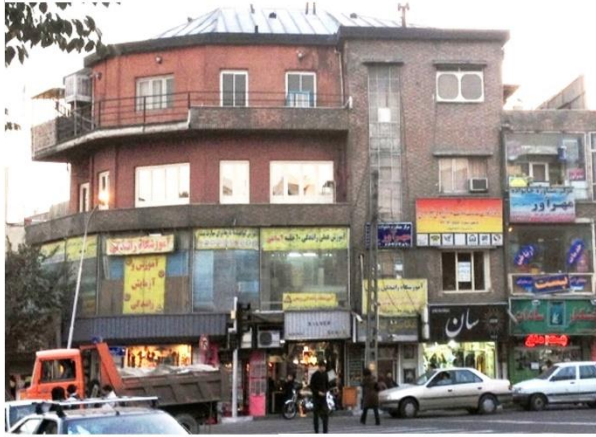


Figure 10.12. Retail edges
1km scale





(a)



(b)



(c)



(d)



(e)

Figure 10.13. Mix of functions and grain-sizes

10.5. Streetlife mix

10.5.1. Mix of activities and gender differences

As is evident in Figure 10.14 most of the everyday pedestrian flows are on the main streets. The commercial office towers close to the metro station attract a large number of people during the midday and evening peak hours when vehicular traffic congestion builds up and pedestrians cluster around transit nodes and corridors. Streetlife volume as well as the diversity of public activities rise significantly throughout these areas (Figures 10.14 and 10.15). Some people sit and observe, while others purchase goods from the vendors or walk to the shopping centres. School children on their way home linger in groups along the areas in proximity to the station. By contrast, the newly developed high-rise edge of Navab Highway follows a completely different pattern where a low range of public activities is observed (Figure 10.16d). As is evident in Figures 10.14 and 10.15 there is a clear distinction between the old mixed urban morphology and the modern redeveloped section along the Navab Highway. Most of the local streets leading to the highway are turned into dead-ends or blocked by concrete barriers, thereby preventing vehicular access (Figure 10.16e). As a result, such areas are appropriated for parking, which do not contribute to the vitality of streetlife as they are not mixed with a wide range of everyday activities. There are a few areas with urban furniture that afford stationary activities. To the west of the station, a broad array of shop-window products encroaching upon the public spaces makes some footpaths resemble exhibitions. Women often stop by individually or in groups of two to check out the goods offered by shop owners and informal traders whereas male users especially merchants stand or sit individually at their storefronts observing passers-by or advertising their products and services. This offers a place for social behaviour and encounters where people appropriate space to fulfil their needs and exchange information. During morning peaks, observation suggests vibrant scenes within some back streets to the station where people initiate conversations with strangers while waiting in line to get their fresh bread from the local bakery. Flows of pedestrians become dominated by the rhythms of work in morning rush hours. Considerable numbers of men and women are heading for the bus, metro or motorcycle-taxis while some others are waiting for the car-taxis. Main streets become crowded as the people and vehicles approaching and traveling across the network; they may become the busiest and noisiest due to the predominance of children going to their schools on foot or their parents' motorcycles.

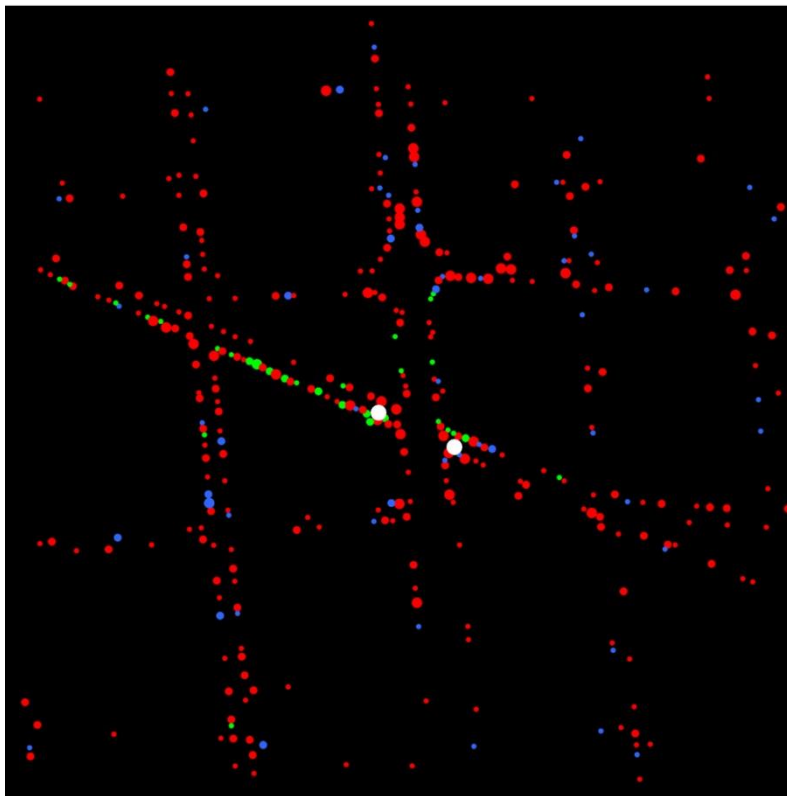


Figure 10.14. Mix of activities
1km scale

● Standing ● Sitting ● Street trading ● Performance ● Playing



Figure 10.15. The midday-peak
volume of pedestrian flows
1km scale

High Low

There is negligible use of public space for performance or play throughout the station area. Close to the schools and other crowded nodes, retail shops and informal traders start their trading to offer goods and services to the crowds of people. Informal trading is concentrated along Azerbaijan Street where sidewalks are filled with a miscellany of retailers and people standing in groups. Walking along the footpaths, informal traders emerge extolling their goods in a loud voice to attract pedestrians' attention. "You will not find any cheaper than this!" the vendor claims. A few steps away, an informal trader sits on a mobile wheelchair from which he has tied a cover to shelter him and his goods from the rain (Figure 10.17c). Flows of people especially women are attracted to the informal traders as they inspect their products and initiate short conversations with the strangers nearby; or many may negotiate a lower price with the vendors. Adjacent to the metro station, informal traders can be seen more often down the sidewalks where they are attracted to the congested areas and attract more flows of people (Figures 10.17a,e). Other key sites for informal trading are metro entrances where the presence of mobile vendors and hawkers has closely geared to the possibility of attracting more customers. They often take the risk of standing on the stairs to sell their products; or they display some of their goods on the stairs where they are more visible to the passing pedestrians. In effect, their mobility level not only offers them the possibility to more easily escape from a 'street cleaning', but also it enables them to move to the areas of highest volume of pedestrian flows and women's presence. The common practice in the reference area is that informal trading along the retail edges mostly attracts females in groups standing and talking to each other (Figures 10.18 and 10.19), creating areas where gender mix is rather evenly distributed or female users outnumber male users. This is contrasted to the male-dominated pattern within public spaces.⁹ Informal trading in Navab is predominantly a male business. Figure 10.17 shows some examples of the ways male informal traders appropriate public space to serve their small market. Mobile vendors often spread out their goods on the sidewalks using fixed street furniture, fences, mats, paper boxes, temporary stands and so on, or they may sell their goods while they walk along the places with a high volume of pedestrian flows. Observations suggest that the more fixed vendors use a blank interface to hang their goods. In this case, vendors often negotiate with the shop

⁹ According to the statistics of 2006, the ratio of male to females is estimated at 102:100 within the reference area, a fairly lower ratio than the average in Tehran (104:100) (Tehran Municipality and Tehran University, 2011). However, as Figure 10.19 shows, men are the dominant users of public spaces in Navab. Therefore, it can be argued that census statistics do not necessarily predict gender differences in public spaces.

owners to utilise a part of their property (Figure 10.17b). Figure 10.17e shows a temporary stall that is attached to the office-commercial tower adjacent to the station. During the midday peak hours, it attracts local workers and visitors purchasing food and sitting in its small informal space. A few blocks away, close to one of the busiest intersections of the reference area, a part of the sidewalk is occupied by a detached newspaper kiosk, which has a prefabricated structure (Figure 10.17d). During the peak periods, this small temporary kiosk attracts a large number of male pedestrians and motorcyclists; male individuals often stop by for a few minutes to look at the newspapers and share their thoughts with neighbouring strangers. Observations suggest that such fixed and informally constructed newspaper kiosks along the sidewalks are often tolerated,

revealing of the ways they are negotiated with authorities and nearby formal markets.

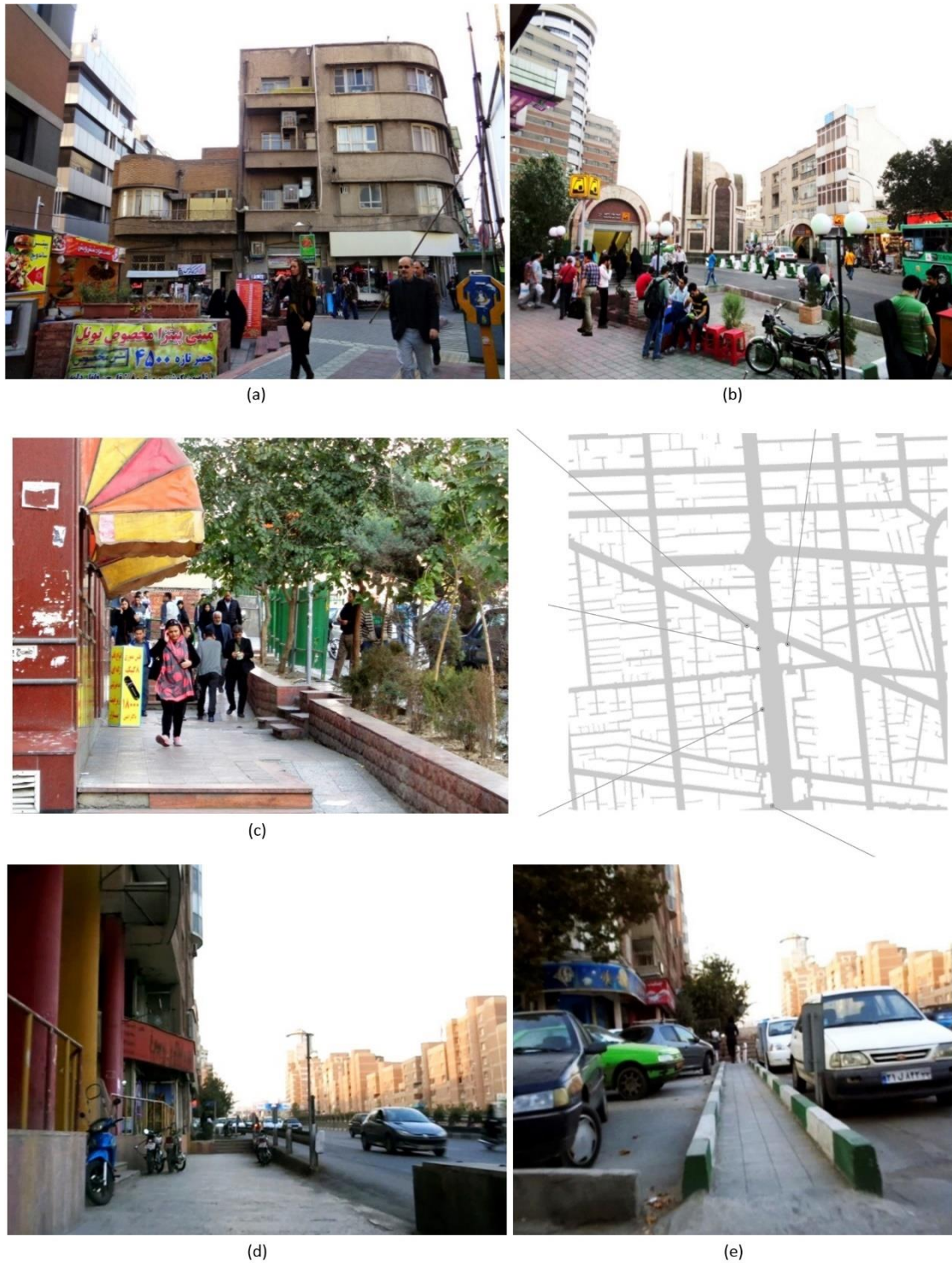


Figure 10.16. Mix of activities and gender differences



(a)



(b)



(c)



(d)



(e)

Figure 10.17. Informal trading

Figure 10.18. Different patterns of streetlife in the same location during morning and evening peaks
Figure 10.18 left by <http://map.tehran.ir> (2016).

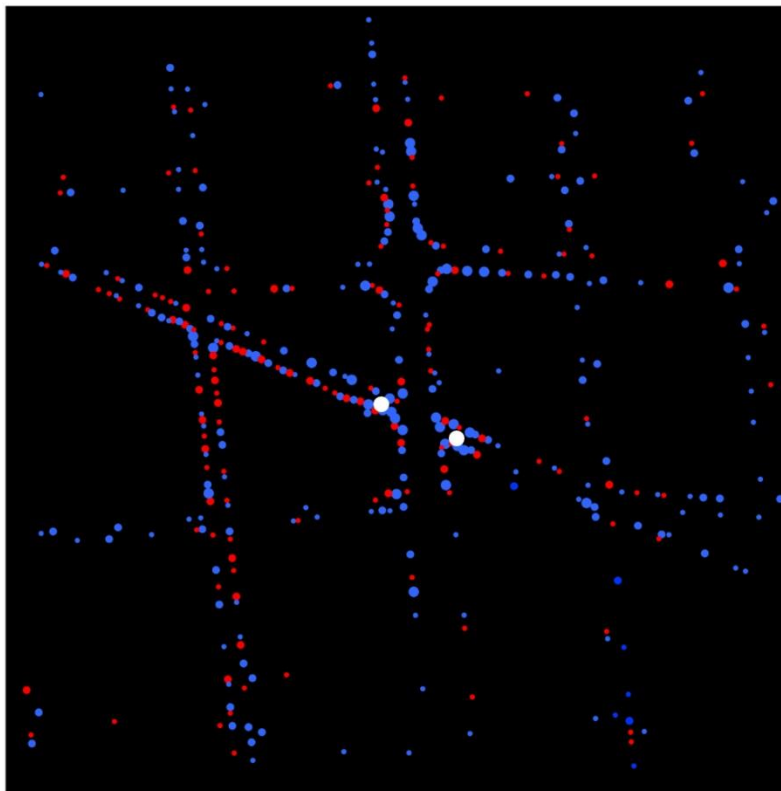


Figure 10.19. Gender mix
1km scale

Female Male

10.6. Potential for change

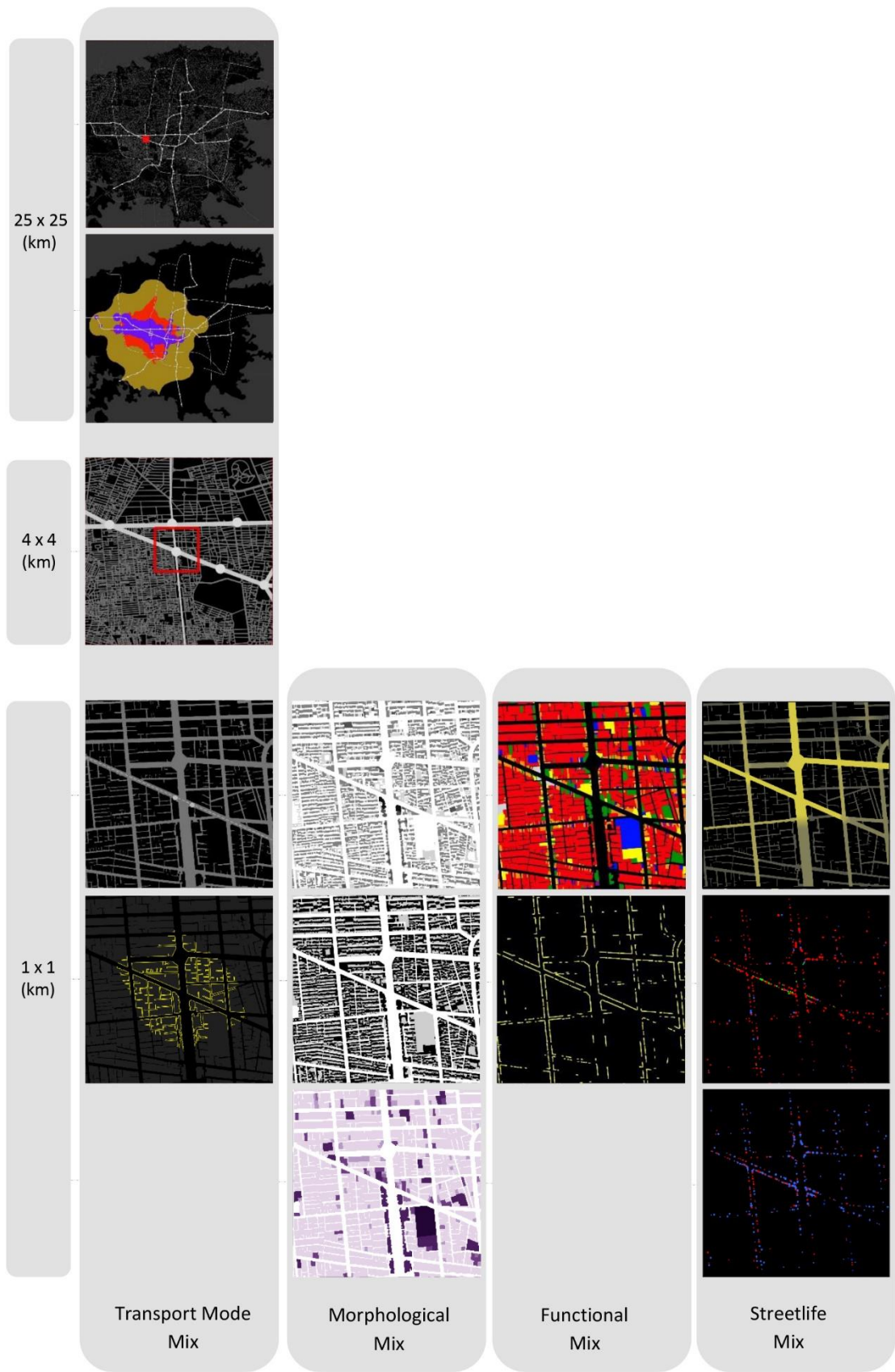


Figure 10.20. A map of maps

This chapter concludes with a brief summary of the key findings about the interconnections and synergies that emerge from a 'mix of mixes' – transport modes, built forms, functions, and people (Figure 10.20).

Mix of transport modes

The Navab case study in Western Tehran is car-dependent, poorly connected to BRTs, with the metro the only well-functioning formal mode of public transport and motorcycle-taxis the fastest informal ones. The transit isochrones clearly show how high-volume public transport could not compete with car-taxis or motorcycle-taxis especially in the north-south direction. Therefore, there is a capacity for transformational change along this axis where the provision of high-capacity and frequent public transport can provide the leverage to connect the subject station area with the city's northern and southern ends as well as producing modal shift for the wider formal public transit catchments during the peak periods¹⁰. While motorcycle-taxis are identified as a fast and effective mode of informal public transport in terms of start up without delay and parking, their transgressive practices are often unsafe and damaging to streetlife vitality and economic productivity. Hence, any formalisation attempts that relies on the enforcement of the sidewalk and road rules have the capacity to constrain their transgressive behaviour to a large extent and ease flows and movements along the pedestrian spaces.

Morphological mix

The fine-grained analysis of building heights, footprints and volume of streetlife suggests that while most of the areas in proximity to busy metro station and intersections benefit from a high level of built density, they do not necessarily generate a vibrant public streetlife as evidenced by areas of high-rise developments. This is linked to the idea that urban intensity does not simply increase with the increase in building densities, yet is a synergistic effect of a larger assemblage. The average fine grain developments within this particular transit-oriented assemblage have often accommodated a formal diversity where the mix of old and new buildings have often produced an irregular urban morphology. While the old and deteriorated buildings do not embody any specific heritage value, they have the potential to contribute to the socio-economic mix at the neighbourhood scale. In this sense, a mix of old and new buildings creates both high- and low-rental values (Jacobs, 1961). Yet, new developments often have the most profitable

¹⁰ Metro line 7 has been recently opened connecting the Navab station to northwestern and southeastern parts of the city.

value in the market since they need a high level of investment for being renovated or redeveloped. There is little scope for large-grain developments and the broad range of uses and activities that are accommodated in them, primarily due to the fact that the subject station area is small grain. While such a small-grain morphology has produced a layered urban fabric over time, it constrains density and urban intensification around the metro station. This supports the argument made by Dovey et al. (2017) that smaller lots and very narrow sites are major constraints for intensifying transit corridors as they yield substantially the lowest average densities of any site type.

Any understanding of the synergies and capacities for transformational change in this transit-oriented urban assemblage requires attention to questions of station accessibility. While Navab Highway facilitates vehicular movements between southern and northern parts of the city, it constrains flows at the neighbourhood scale. In effect, it works as a barrier to pedestrian movements within close proximity to major transit nodes where the possibility of developing a walkable public space has been exchanged for a 50-metre-wide highway. This condition clearly contributes to a higher level of car-dependency and compromised design outcomes on the dense urban fabric of the studied area. Therefore, any design and planning attempts with the prospects for wider streets and new highways to accommodate more cars and vehicular traffic need to be rethought. Another important issue here is that narrow and single access sites within the station area constrain car access. Observations also suggest that the use of private vehicles and motorcycles and the volume of on-street parking are relatively high as street network is poorly connected at the neighbourhood scale. This can be due to the fact that planning statutes within the station area currently require at least one off-street parking space per new dwelling; however, as observation indicates many of the recently developed apartments within the narrow sites and modern high-rise buildings along the highway lack the required parking area. This is linked to a common trend in the city according to which developers could build taller buildings with more dwellings without providing the required parking areas by paying the fines to the municipality. Such a policy has proven popular among the development industry, but controversial with inhabitants and the ways in which it can pose significant impacts on the surrounding environments. While this policy constrains car access within some blocks and increases the affordability and the yield on those developments, it can contribute to both an increase in the number of on-street car parking and parked motorcycles on the pedestrian spaces. In short, the problems of pedestrian accessibility and the growing car-dependency

remain the central goal of most intensification projects around major transit nodes, which is subject to the understanding of the ways any micro-scale urban design intervention work in synergy with good public transit infrastructure and policies that put more pressures on the car access and to rethink off/on-street parking strategies of most new developments.

Functional mix

Fine-grained analysis of functions demonstrated a relatively low level of mix around the metro station. The emergence of the synergies between different functions is confined to some main streets. However, the large mono-functional areas of housing with about 50% of the reference area can open up new possibilities for transformational change through accommodating more mixed-use developments – both vertically and horizontally – and a better integration of that with the transport networks. The modern edge along the highway and most of the minor streets embody potentials to accommodate visit-related functions, and more importantly, retail edges as they often require a more direct access to flows of trade and everyday movements of people. Furthermore, the high value of accessible interface in this transit node is linked to its capacity for a greater degree of functional mix and active edges; geared in turn to the possibilities for different forms of socio-economic exchange and production.

Streetlife mix

The analyses of everyday activities and gender differences indicate the male-dominated pattern of use and appropriation within most public spaces, with fewer public realms where women are the most common users of space. According to this pattern, a large number of male workers are attracted to the work-dominated areas and women's engagement in public actions is often confined to the areas with retail edges and informal trading during peak activity periods. Thus, it can be argued that there are correlations between the presence of retail edges, informal trading and women's presence in public space.

There is a further key issue regarding the ways informal trading has more or less temporarily taken over the existing public spaces around the station. The emergence of such temporary uses and appropriations are geared to the ways boundaries are blurred between the spaces of retail, act and consumption (Stevens, 2007) as well as the degree to which urban environments are loosely regulated (Bishop & Williams, 2012), different forms of control are exercised and negotiations over space are contested. These reclaimed and appropriated urban sites as

evidenced in the areas with informal stalls attached to the modernist high-rise development, often challenge the conventional notion of public and the making of space. The areas to the south of the station and along the residential clusters have the capacity to accommodate a broad range of temporary uses. They are potential meeting sites for people of all genders, ages and social groups; they are potential places where everyone mingles seamlessly with other individuals. Temporary uses and informal tradings here have the potential to increase affordances, which is linked in turn to the emergence of vibrant urbanity and economic productivity in this particular transit-oriented assemblage.

11. DISCUSSION AND CONCLUSION

Introduction

Much of the discourse concerning transit-oriented urban design has emphasised the importance of creating more dense, mixed use and walkable urban morphologies with good transit connectivity in addressing the challenges of car-dependent and sprawling urban environments – particularly those that characterise North American and Australian cities. These studies also note that attempts at re-assembling car-dependent cities require a multi-scalar and multi-disciplinary approach, which focuses on the ways issues of transport, urban morphology, functional mix and sociality intersect at different scales. While the key interest for this study is at the urban design scale, these issues cannot be seen in isolation from the larger scales. This has been also the case in more congested cities where urban informality plays a key role in both streetlife intensities and the socio-economic productivity of the city.

This study has focused on urban design dimensions associated with TODs in Tehran as an example of a less formal city. It has investigated how morphological, social and infrastructural issues interconnect to operate in different ways within five different locations of Tehran. Previous chapters showed many similarities between the five transit nodes; yet there are also differences due to their location in the city, their socio-spatial assemblage of buildings, people and activities and the extent to which they have been shaped by various forces for change. This chapter concludes this study by discussing the ways station areas work across the city through four different lenses of density, mix, access and streetlife. These four lenses also set a framework for what the space of possibility is for a more transit-oriented Tehran. The maps in this chapter are arranged to show comparisons between sites in terms of density (Figure 11.1), mix (Figure 11.2), access (Figure 11.3) and streetlife (Figure 11.4). The numerical calculations are juxtaposed with the maps where appropriate to show relations between the spatiality and the metrics. This chapter concludes with a summary of the ways Tehran's TODs are different from more general TOD models and then reflects on the role of TOD as an urban design strategy in the context of less formal cities.



Figure 11.1. Density – gross coverage, building footprints, building heights and gross floor area ratio

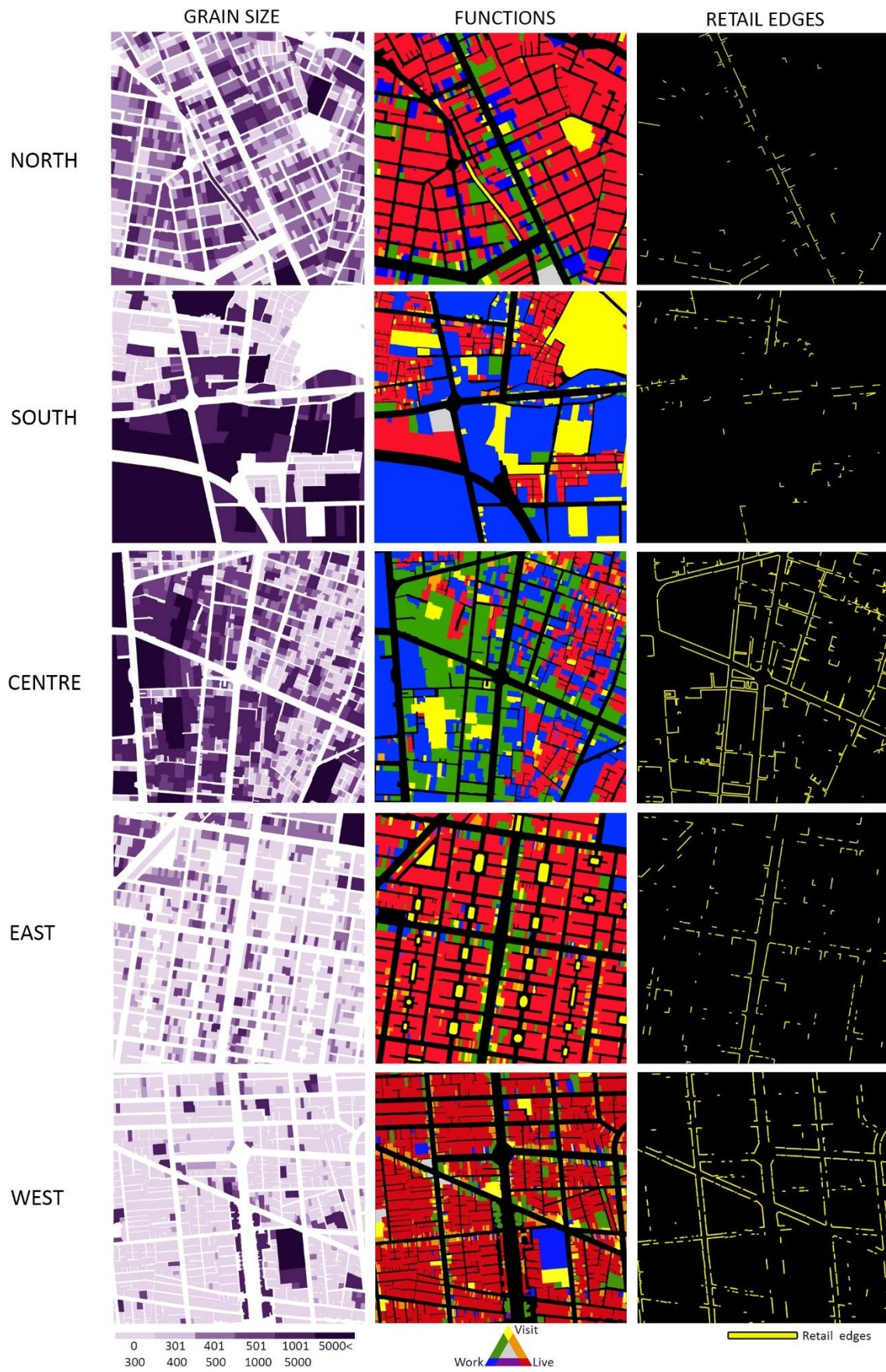


Figure 11.2. Mix – grain size, building functions and retail edges

11.1. Density

The chapter now turns to the density of station areas and explores the ways it is linked to the urban morphology and streetlife intensity. A key point to note here is that in none of these cases is density concentrated around the transit node. In most locations building heights and coverage are evenly distributed (e.g. east, west and north) while in the south and centre the density is displaced away from the metro station (Figure 11.1). It is important to note that this is not a longitudinal study and due to the lack of comprehensive data on the morphogenesis of these different stations it has not been possible to rigorously judge the transformations (over 15 years) in relation to the metro. However, the thesis has articulated whatever data that has been gathered about the rate of change happening around those stations and whether it differs from the rate of change across the city as a whole. Indeed, there is not much evidence of intensification around Tehran's major transit nodes after the Metro was built. The thesis identified some changes around the stations – as evidenced within construction sites and new housings or the lack of change such as vacant and abandoned construction lots. It is notable that any changes within station areas of Tehran have not been the results of any TOD planning and policies.

Building height and gross coverage alone are insufficient for understanding transit-oriented development. The eastern and western transit nodes, for instance, have similar gross coverage values of 35-39% although the spatial characteristics are substantially different. The greater building heights in the fine-grained west corresponds to a higher gross floor area ratio (FAR) than that of the east. It is notable that the measure of FAR mediated by building heights and gross coverage can deliver different morphological conditions within the 100ha station areas. For instance, a relatively similar FAR in both the central and eastern transit nodes is associated with different morphologies enabling different degrees of urban intensification. The modernist eastern transit node has a far smaller gross coverage and relatively smaller building heights than those in the central transit node. A combination of FAR and other controls such as building height and coverage is necessary to estimate overall potential for urban intensification around transit nodes.

11.2. Mix

Mix of grain size

A key question involves the extent to which the grain size of transit-oriented morphologies can enable and constrain urban intensification. The evidence from the studied transit nodes partly supports the argument that an urban area of small lots offers more opportunities for incremental transformation due to distributed control, and also produces a formal diversity in building design – “the smaller the increment of land ownership, the more variety created in the environment” (Moudon, 1986, p. 141). Concentrations of small-grain morphologies in the west and east are often confined to intimately-scaled residential developments, while they encourage diversity of functions, retail edges and ownerships along the main streets close to major transit nodes (Figure 11.2). While extra small-grained morphologies especially in the west with multiple owners and single access lots of about 50m² have often constrained the plot amalgamations, some small to middle-sized ones have incrementally densified from 1-2 storeys to 4-6 storeys, and diversified from mainly single household courtyards to terraced houses and multi-storey apartment buildings. By contrast, there have been less constraints to site amalgamation and increased heights (to medium) within residential clusters of the east. In such relatively modern station areas with the dominance of small to mid-sized lots and regular grid street networks, regulations (e.g. height limits and building types) not only have produced uniformity but also constrained the level of adaptability of function.

Large lots can be seen as primary increments of transformational change. This has been evidenced in the south and less commonly in the centre where lots of more than 5,000m² predominate around the stations. The potential for redevelopment here incorporates two processes: subdivision and wholesale transformation. While large lots are essentially impermeable, they have the potential to be subdivided and therefore to increase permeability. This condition is linked to the higher risk of investment return and land loss while increasing the permeability of the public space network close to the station. Wholesale transformation, by contrast, might be privileged by land owners mainly because they do not need to negotiate for public space improvements and increasing permeability. The capacity of extra-large lot sizes for higher levels of functional mix in both redevelopment plans can be largely constrained by land-use zoning ordinances.

The morphologies of mixed-grain sizes differ markedly in the ways they attract functional mix, retail edges and pedestrian flows and mediate development capacity around major transit nodes. With its mixed lot sizes, the central station area has often housed a rich mix of functions and tenants over many generations, enabling synergies between larger and smaller scales of production, exchange and consumption. While the street edges here mostly have heritage values that may restrict the capacity for transformational change, some continue to be neglected as they are seen to be abandoned and dilapidated. It is also important to note that most areas of the old core have evolved into a particular urban morphology (density, mix and access) that is somehow at its limit – cannot change without complete demolition.

In contrast to the centre, mixed-grain morphology in the more modern spatial structure of the north has generally produced less varied streetscapes and an urban landscape devoid of life except along the main streets. While there have been attempts for site amalgamation and incremental change in the small to middle-grained residential areas and less frequently in retail edges, the capacity for development around the station is constrained by building codes, land-use zoning and small-grain holdings. It can be argued that the dominant grain size is an inverse proxy for enabling functional mix unless there are building codes or functional zoning. Therefore, to establish development capacity limits within any station area, lot size needs to be analysed in relation to other dimensions of formal mix (e.g. lot shape), capacity of the access network, building codes, zoning ordinances, subdivision regulations, market forces and heritage overlays.

Mix of functions

As evidenced in most studied cases, there is not much mixed-use densification around major transit nodes. This is linked to what Cervero et al. (2002) refers to as lack of functional connectivity to transit in terms of functional mix composition – urban developments that are physically near major transit nodes yet fail to capitalise upon this proximity. In this sense, the eastern, western and northern transit nodes appear as predominantly residential (approximately 50%) with mix confined to main streets (Figure 11.2). The southern transit node is work dominated (over 40%) with some mono-functional residential areas and visit attractors (not floor area related such as parks). While the central transit node partly accommodates developments with dilapidated conditions it still has the highest mixed urban fabric among all the five transit nodes with significant visit/work attractors (green) and less frequent mono-

functional areas of work and live. This mix in the old centre has been sustained over many generations and cannot be linked to the operation of the metro, which is only 15 years.

Functional zoning and regulations can constrain functional mix within walkable proximity to existing transit. This is congruent with the argument that zoning codes limit functional mix capable of encouraging local retail and transport connectivity at regional scale (Knaap and Nelson, 1992). This condition has been evidenced in the eastern, southern and northern cases where the mono-functional districts have produced low intensities of streetlife around the stations. The challenge and capacity for change here is reliant on how and what forms of regulations best enable the emergence of functional mix; hence, the insertion of retail edges into the ground-level of live or work buildings (with mostly blank street frontages, garage doors and car entries) can encourage a productive urban landscape as these edges often require a more direct access to flows of trade and everyday streetlife.

The vitality of streetlife close to the stations can be killed off by clusters of segregated industrial ruins and substantial tracts of storage land where the networks of flows and synergies between different functions are eradicated. This is evidenced in the south where such unused and marginal areas around the station embody forms of potential for transformational change that extend beyond their actual forms. On the one hand, industrial ruins or the abandoned areas can be seen to create opportunities “for doing things differently outside the ordinary, regulated space of the city” (Edensor, 2007, p. 235). In this sense, the presence of temporary activities and low-cost appropriations can be a stimulus for the future permanent urban developments, and can attract a pool of potential users, both women and men, from the middle class and north’s affluent districts of the city to use the marginal spaces in the south. On the other hand, while functional zoning and regulations often restrict transformations, a push from the government (e.g. introducing a tax-free zone) as well as the looseness of regulations would encourage mixed-use and mixed-income urban developments around the station.

Another common practice in transit nodes especially those that characterise South Tehran is the large consumption of urban space given over to parks. While attempts at improving the quality of urban environments through developing these parks in the less privileged south are identified as a ‘good practice’ by the UN Habitat in 1996 (Madanipour, 2011), the inserted parks are often empty public areas devoid of people and urban life. A further key issue is that although public

parks contribute to the greater catchment of accessible public spaces, there is nothing to catch in such spaces. Hence, the concentration of public parks within walkable proximity to major transit nodes can constrain the opportunities for an intensive urban assemblage.

11.3. Access networks

The studied transit nodes – particularly in the west and east – indicate that the car access often dominates over pedestrian access as in most public spaces pedestrians need to climb up onto the bridge or climb over BRT fences to access the station. This condition shows that the tension between pedestrians and cars has often remained unresolved.

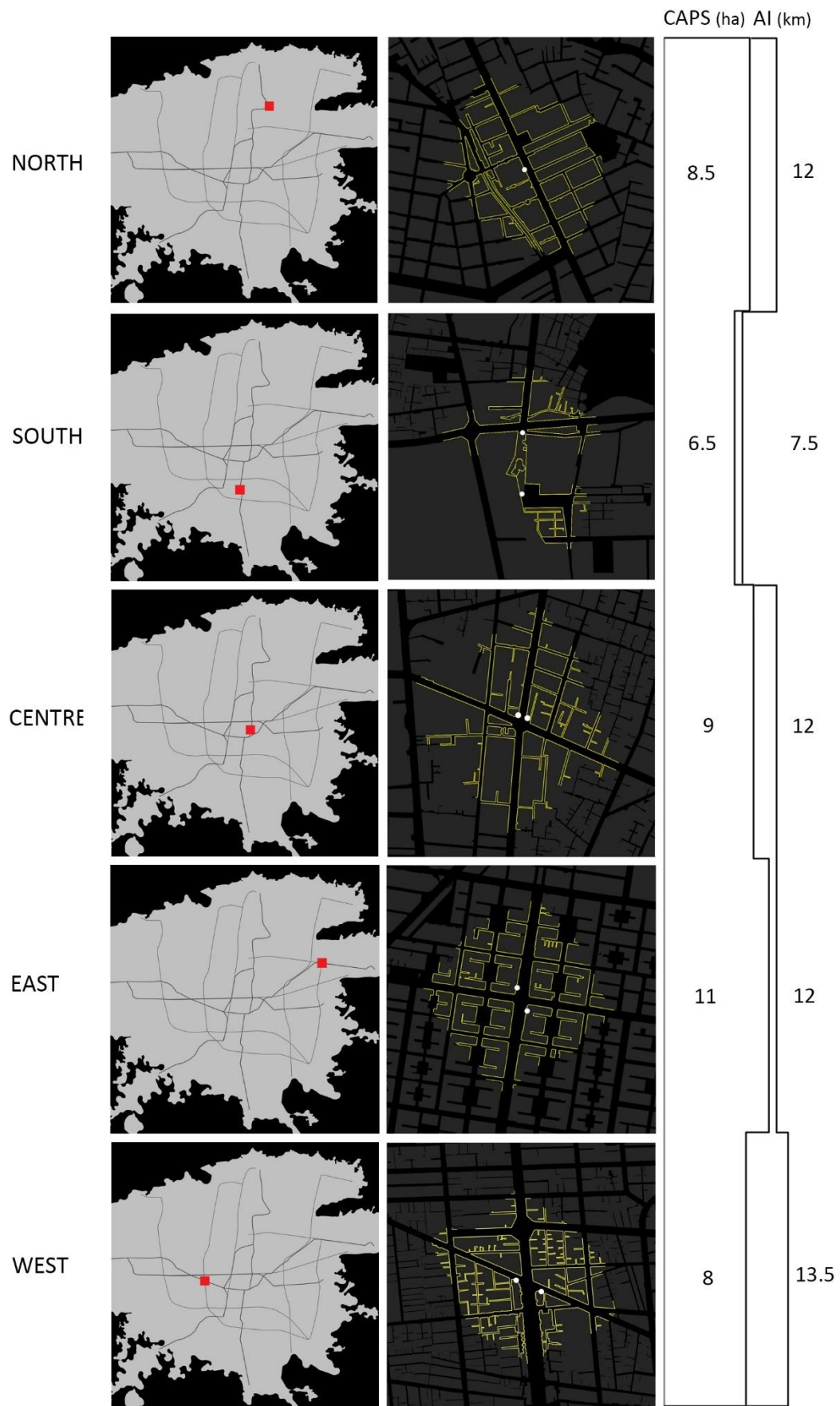


Figure 11.3. Access – location of stations in the city, accessible interfaces (AI_{5min}) and catchment of accessible public space (CAPS_{5min})

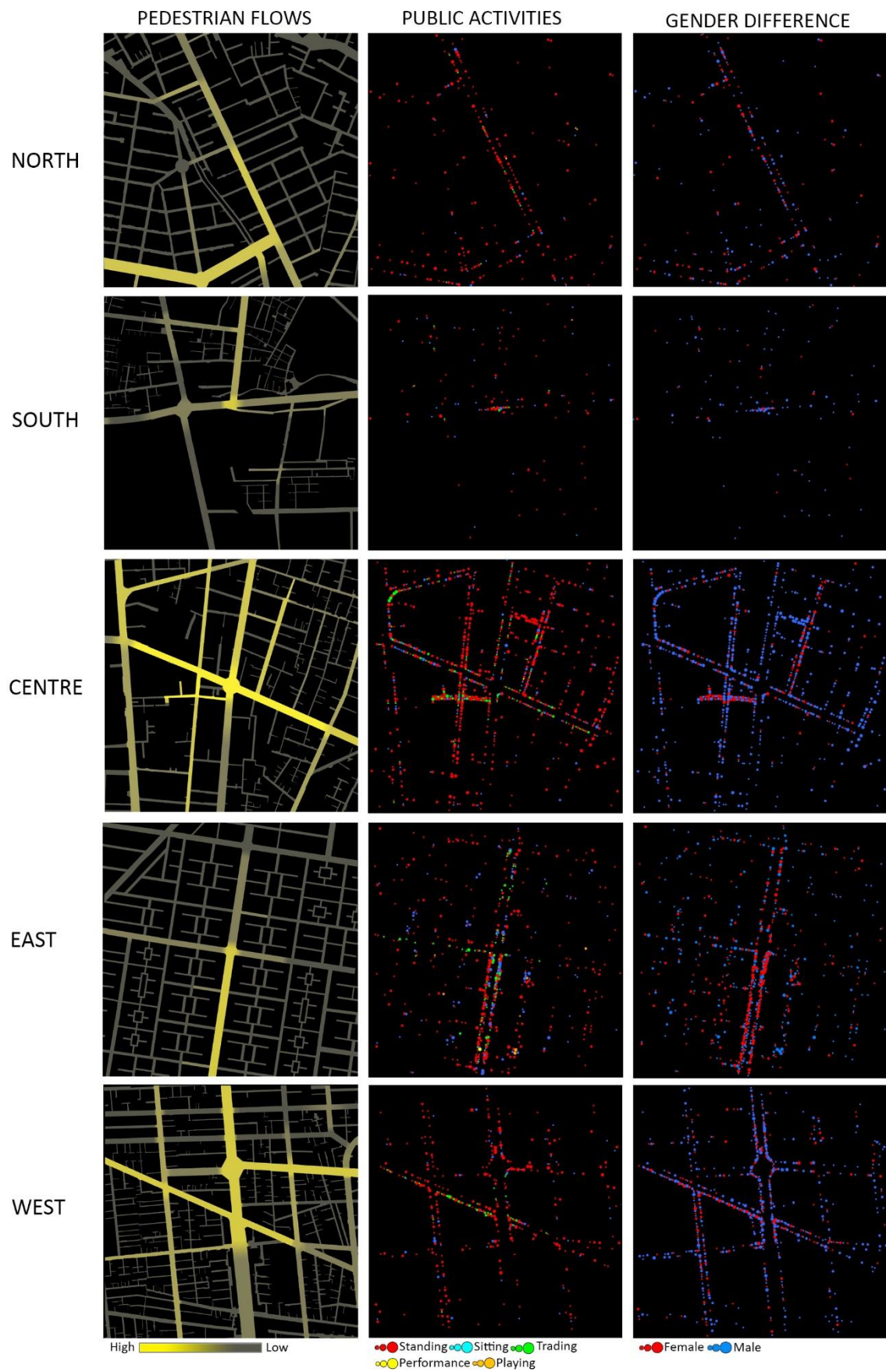


Figure 11.4. Streetlife – pedestrian flows, public activities and gender

Figure 11.3 shows that the public spaces one can walk to within 5 minutes do not necessarily correlate with the measure of AI_{5min} – the measure of what one gets access to. The industrial south is the least walkable transit node among the five cases, which is linked to the predominance of large impermeable blocks as well as the gated open spaces. This condition has also produced the lowest AI_{5min} of any other transit node. By contrast, the eastern case with its regular grid network has the largest catchment of accessible public spaces ($CAPS_{5min}$) among the five cases. Yet, it is notable that the large difference between the eastern case and the others in terms of $CAPS_{5min}$ has not produced a large difference in the patterns of AI_{5min} . This condition can be linked to the network of local parks within the eastern transit node. Further, the low $CAPS_{5min}$ in the west has produced the greatest AI_{5min} among all the cases, meaning that one can get access to interfaces but not much public space. This condition is linked to the small-grained morphology and numerous narrow lanes and dead-ends. Therefore, it can be argued that to understand the performance and potential transformation of street networks in a transit-oriented development requires a focus on both measures of $CAPS_{5min}$ and AI_{5min} ; the high value of $CAPS_{5min}$ around the station is not consistent with the concept of a TOD when there is not much to catch within a catchment. It is notable that a higher $CAPS_{5min}$ will not always produce a greater AI_{5min} . The studied cases also suggest that the streetlife intensity and the capacity for socio-economic transactions cannot be simply predicted by the AI_{5min} yet is a synergistic effect of a larger assemblage including the number of entries and diversity of functions.

11.4. Streetlife

Mix of activities

The potential to manipulate loose parts (e.g. moveable chairs, tables, food stalls, retail goods, hawker pushcarts, motorcycles) and appropriate street furniture around transit nodes contributes substantially to the walkability and flexibility of use of public space. This is the case in the central, eastern and western cases, which accommodate sites with a rich mix of stationary activities and appropriations close to the transit nodes. However, the rigidly controlled spaces of the affluent north are linked to the low concentration of intensive encounters and low volumes of streetlife. This supports Carr et al.'s (1992) argument that the capacity to change the position of more or less movable furniture and elements can afford many possibilities for people to modify their behaviour and mediate either conversation or anonymity in public space.

Some forms of loose parts can invade pedestrian networks and damage the economic and public life of the city. Examples for this pattern are seen in almost all station areas (less frequently in the affluent north) where motorcycles are afforded with the opportunities to appropriate pedestrian spaces in proximity to busy nodes. It is notable that their use and appropriation of footpaths is geared to their capacity to intimidate and thus displace the flows of pedestrian traffic.

The urban ecology of the station areas in the east, centre and west comprises both formal and informal economies. These cases show the ways different forms of self-organised activities can loosen up the spatial striation of the public space and maximise its physical and social affordances, which are linked to the emergence of vibrant urbanity and economic productivity. Informal trading is often attracted to pedestrian traffic that is in turn mediated by urban attractions. Such activities are clustered in close proximity to the busy nodes such as metro entries, shopping centres and along the most accessible public spaces from the station. This is linked to the fact that such self-organised activities are a key dimension of the urban DMA (density, mix and access) as argued by Dovey (2016) – they are attracted to those areas where possibilities are afforded by the morphology and functional mix.

Traders' appropriation of space is not only geared to high flows, but also to the capacity of authorities in exercising strict control over space and its users. This is evidenced within the heavily-controlled northern case where there is a low appropriation of space by traders. While often seen by the authorities as marginalised and damaging to the larger-scale off-street market (Fadaee & Schindler, 2017), street trading encourages vibrant streetlife and economic vitality around transit nodes. Such temporary uses of space thus take place in a precarious setting where access to property rights and permission to exchange goods are not granted (Madanipour, 2017). The threat of heavy fines and even forced eviction through a 'street cleansing' operation, act as deterrents for informal traders.

The evidence suggests complex relationships between informal trading and motorcycle-taxis. Informal traders often negotiate their use of space within the heavily-controlled interstitial places between retail edges and transport roads. Their goods and vehicles dominate both sidewalks and roads, pushing the boundaries of urban regulations. Motorcycle-taxis also reclaim a centrality in public space as they operate as transport services orienting flows of traffic. In this

way, while informal traders and motorcycle-taxis offer different services in self-organised and creative ways, their presence is geared to both pedestrian flows and visibility in the public realm. One further issue is that informal trading benefits from keeping pedestrian traffic open – that may otherwise produce severe competition (with other vendors and motorcycle-taxis) and gridlocks due to which many traders will leave their territories. This is what Bromley (2000, p. 15) calls the process of ‘hyper-agglomeration’. Motorcycle-taxis’ use of public space also escalates until it consumes space and blocks pedestrian accessibility – unlike informal traders, motorcycle riders have no interest in maintaining walkability.

The ways informal trading is viewed and formalised vary remarkably across the city as authorities struggle over questions of elimination, tolerance or regulation. The state could hardly tolerate such active use and appropriation of public space and therefore "waged a protracted war of attrition against the street vendors" (Bayat, 1997, p. 54). The self-organised tactics of everyday life cannot be simply controlled from the top-down. Such enforcement of rigid official regulations without a sophisticated understanding of the ways formal and informal economies co-function produces a large gap between these two systems.

The ways in which urban design can respond to the challenge of informal trading in Tehran’s station areas relies on an understanding of how it works in relation to streetlife around transit nodes and makes livelihood for the urban poor, rural migrants, young unemployed and low-skilled labourers. Important in this regard is that in any public space within walkable proximity to the transit nodes, informal trading will be attracted to busy nodes with a high volume of flows. While micro-scale design of public spaces can constrain the capacity for such informal activities, they can be damaging to economic, social and public life of the city. A better response within the transit-oriented urban developments is the provision of generous public spaces in proximity to the metro stations and BRT corridors to encourage economic productivity as well as retail vitality to take place and become formalised over time.

Gender difference in the use of public space

There is a gender bias inscribed into the ways public space is used in Tehran's transit nodes (Figure 11.4). As discussed in Chapter 4, such a gender bias is linked to the city's north-south spatial divide due to which the affluent north has more balanced gender mix within public spaces compared to the male-dominated spaces of the poorer south. This is also linked to the ways territories are made within station areas. Urban poverty is seen as a key determinant of exclusion from the public spaces of the south – young women and children are often excluded from public life partly due to unemployment, poverty and being marginal to the city. Such an exclusionary effect of urban poverty in public space was previously identified in other cities by Brown (2006).

The challenge of gender bias in South Tehran indicates that the operation of public space hinges on gendered messages in which females' presence and actions are constrained. In effect, the gender division of public and private spheres (Drucker & Gumpert, 1997; Franck & Paxson, 1989; McDowell, 1983) has been a key instrument of women's exclusion within the southern transit node since it relegates them to the private space of the home and proscribes them from frequent use and appropriation of public space. Unlike in the south, women in the north are not confined to their homes and private space but more engaged in public space activities.

Women's rights to appropriation and participation in public spaces around transit nodes can be significantly restricted through the practices of control. The northern and eastern cases outline the constraining capacity of the morality police during evening peaks in controlling the behaviour of women in proximity to busy transit stations and entrances of shopping centres. This condition is often seen in the westernised and modern parts of the city (Amir-Ebrahimi, 2006), which confines many female users to the quasi-public spaces where the morality police cannot enter due to the issue of ownership.

Lack of anonymity is also one of the key issues that constrain women's presence and actions in public space in southern transit node where people control every movement particularly younger women's. This is in contrast to the north wherein individuals do not accost each other for how they behave and what they wear in public space (Amir-Ebrahimi, 2006). This lends itself well to Lofland's (1989) argument that the capacity of individuals to engage in public activities arises partly from their anonymity in public realm. This condition is also linked to another form

of restriction imposed by gender-based social norms. Since there are often social norms and sanctions against women performing activities such as smoking and meeting up with men in public space, quasi-public spaces become places where codes are often transgressed and females are provided with an opportunity to temporarily escape from the imposed restrictions. This is to say that while territories are often strictly coded within public spaces around key transit nodes, quasi-public spaces (with private ownership) are relatively deterritorialized. The concentration of shopping centres and modern cafés in the well-off northern and eastern cases provide opportunities for young women and men to achieve greater freedom in socialising and appropriating quasi-public space with less fear of police intervention (Figure 11.5); many female and male teenagers hang out, display or show themselves off to draw attention of strangers, especially from the opposite gender and make eye contact with them without necessarily making any purchases. This is congruent with Eeden's (2006) argument that within such quasi-public spaces, female consumers conform to the constructs of a *flânerie* since they are afforded anonymity and the freedom to stroll and socialise. Indeed, women's right to encounter strangers and appropriate public spaces around transit nodes generate more challenges relative to men.



Figure 11.5. Women's freedom in socialising and appropriating quasi-public spaces

Despite the fact that women's presence and activities in public space are constrained by the issues of control, poverty and gender division of public and private spheres, they are often encouraged by the ways informal trading plays out around major transit nodes. As is evident in the eastern, central and western cases, this connection is often manifest in how the predominance of women in public space is linked to the concentration of informal traders and the ways their offered goods and services target female customers. While informal trading in Tehran may appear to be largely a male-dominated business, some female traders emerge on

the female-dominated sidewalks along retail edges. This can be considered as a process of escalation through which female traders are attracted not only to the public spaces with a high volume of pedestrian flows, but also to those that benefit from a considerable number of women around major transit nodes. In other words, a change in the presence of women in public space is linked to a change in the prevalence of informal traders, their offered products and the vitality of streetlife.

The spatial manifestation of women around transit nodes is related to the ways affordances for action are offered by the retail edges and their appropriation of public space for display purposes. The fact that many pedestrian spaces are informally encroached by retailers and their loose parts in the eastern, central and western cases, is linked to the ways women are served with various opportunities to investigate the goods on display and encounter strangers. In this condition, a diversity of retail uses draws in optional actions, which in turn encourage informal social activities. Such a concentration of intensive encounters is often absent within the over-controlled northern transit node where retailers are not allowed to occupy sidewalks. This is congruent with Franck and Paxson's (1989) argument that the temporary use of loose parts can attract more female users than do the fixed uses.

11.5. Transport modes

BRT systems

While BRT services can facilitate high-volume transport, they give rise to several problems. To achieve such high-volumes they need dedicated lanes, which enables high-speed buses to pass each other. Yet BRTs become infrequent and far from competitive because they often run through mixed traffic with cars and motorcycles. This is congruent with the ways a BRT is defined by the Institute of Transportation & Development Policy (ITDP) as "a high-quality bus-based transit system that delivers fast, comfortable and cost-effective urban mobility through the provision of segregated right-of-way infrastructure, rapid and frequent operations and excellence in marketing and customer service" (Wright & Hook, 2007, p. 11). The findings from the western and eastern cases foreground the problem of 'blockage' – where BRTs intersect with the metro stations there is the problem of blocking the walkable network. This is the case along the major Navab Highway in the western station area where BRT lanes and stops are located in the middle of the artery. Attempts to deal with this issue such as creating narrow gateways in fences (at least every 500 metres) without traffic lights and providing footbridges

have proven inadequate. Such a problem ties in with the problem of 'separation'; BRT connections in Tehran are effectively separated from streetlife and often prevent intensive developments close to the major transit nodes. Dovey (2016) argues that BRTs often adapt to the key traffic arteries of car-dependent environments in a way that locks in a level of inefficiency – whether in terms of accessibility, functional mix or density.

A key challenge that one might speculate as BRT services continue to grow in more congested cities like Tehran is whether to invest in expanding or enhancing the existing BRT networks or to invest in constructing new, faster and higher-capacity metro networks. To answer this requires a multi-scale understanding of both advantages and problems that are associated with BRT services. Their capacity in providing high-volume transit is likely to be limited by their not-all-dedicated lanes in several parts of the city. In this condition, any investment in not-all-dedicated lane BRT services will induce road traffic congestion. Another issue is that BRT services with their fenced exclusive areas (in medians or along the edges of busy roads) will continue to constrain pedestrian connectivity as well as separate bus lanes and stops from urban life as long as micro-scale design solutions do not approach such problems. As argued by Cervero and Dai (2014), the constrained capacity to leverage TODs and create permeable areas for pedestrians around major transit nodes and corridors stem from BRT services being seen primarily as transport rather than city-shaping investments. Therefore, to explore forces for change along BRT corridors in the western and eastern station areas requires a way of thinking that connects BRT's capacity in providing high-volume transit at the city scale with its associated urban design within the 100-hectare catchment. This is reliant on a more effective integration of high-volume BRT services with pedestrian accessibility and higher density and mixed-use developments in proximity to major stations.

The relations of informal to formal transport

The five case studies incorporate evidence showing that motorcycle-taxis have become a burgeoning mode of informal public transport across the city where they largely emerge to fill the gap of the more formal bus and rail services. As traffic jams have become an inevitable part of the driving experience in everyday life and public transit has remained hindered by the lack

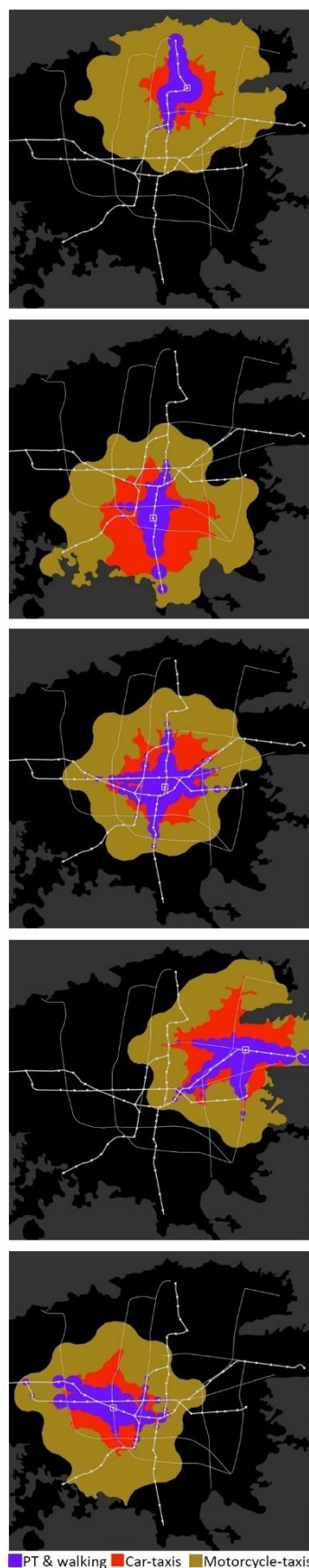


Figure 11.6. Transport access isochrones

of investment and the impenetrable access networks (with narrow and twisting streets) especially within the old fabric of the city, motorcycle-taxis have started to operate as self-organised, informal solutions. While such vehicles are often formally registered, they are not formally identified to provide public transportation (Cervero, 2000; Venter, 2013). Motorcycle-taxis play a key role in facilitating everyday mobility across Tehran and like other cities of the global South, constitute a much larger informal economy by creating job opportunities for the urban poor, rural migrants, young unemployed and low-skilled labourers (Sengers & Raven, 2014; Tiwari, 2005).

The findings from the five cases show how the relations between motorcycle-taxis and other more formal modes of transport facilitate everyday mobility within Tehran's congested access networks (Figure 11.6). This condition is linked to the capacity of motorcycle-taxis in filling the gap of the more formal public transport systems, facilitating access to the urban areas where other public transport services refuse to travel, and operating as what has been termed 'feeders' in transport studies – mobility services that feed patrons to other high-capacity, frequent modes of transport. While there are no stations designated for motorcycle-taxis, they often wait in proximity to the metro entries and operate as the final or initial legs of a metro journey, connecting the station to the travellers' living, working or visiting places. Therefore, these informal services have increasingly become central to the survival and economic productivity of the Metro system in Tehran, enabling its passengers to reach the high-volume transport to and from their living areas, especially those located deep in the city's marginalised urban fabrics. As pointed out by Sopranzetti (2013), the more 'modern' high-

capacity transport systems (e.g. metro and Skytrain) need the 'backward drivers' to collect their working-class and lower-middle-class customers; its viability is simply reliant on them.

Motorcycle-taxis in Tehran hold several key advantages over car-taxis and public transport services – capacity to squeeze, transgress and park/start without delay. Firstly, they can squeeze through the gaps between cars/pedestrians in congested roads/parking lots/sidewalks as well as the small openings in the urban fabric (e.g. fences, walls, bollards and narrow lanes). This is close to what Sopranzetti (2013, p. 282) calls “meandering path-seeking approach” that lies in the enhanced capacity of motorcycle-taxis “to find a path where there is no space by navigating, negotiating, and leveraging their presence, information, and skills”. Such a capacity under the condition of congestion is geared to the ways they filter between slow-moving or stopped traffic and lane-splitting fast-moving traffic (Taylor & Márquez, 2000). Motorcycles can slip through to the front of the queues at traffic lights and cluster a few metres away from the first cars and buses. Once the traffic light turns green, they take advantage of the open road and continue to their journey without any delay. As evidenced in all five cases, motorcycle-taxis face less barriers to accessibility than any other form of public transport and they are engaged in taking advantage of their profound knowledge of the shortcuts and back-alleys, performing manoeuvres and negotiating with cars and buses across all access networks from trafficked streets to major arterial roads.

It is a common practice for motorcycle-taxis to transgress formal codes and circumvent traffic regulations to gain an advantage that is not easily achieved using other modes. Such a transgression enables motorcycle-taxi drivers to skilfully take the risks of manoeuvring through traffic. According to the findings, the most common examples of transgressive acts incorporate driving the wrong way up, one-way streets, BRT dedicated lanes and car-restricted areas in the central core of the city; and using pedestrian spaces. The use of sidewalks is a shortcut to avoid the clogged traffic; sidewalks often become *de facto* motorcycle lanes during the peak activity periods.

The final advantage of motorcycle-taxis is about their capacity to park and start without delays close to the best pick up locations (e.g. metro entries, shopping centres, main intersections) where car-taxis cannot simply access. The capacity to start without delay is about gaining an approximate 5-minute departure advantage, which is contrasted with buses and car-taxis. While

the discussed advantages – the capacity to squeeze, to skillfully transgress and to park/depart without delays – are strongly geared to the smaller size of such informal services (at least compared to the more formal car-taxis and buses), they can get amplified when they occur in places with unenforced regulations. For instance, pedestrian spaces without enforced regulations and parking controls often get clogged with the motorcycles strangling pedestrian flows and at some points forcing them to walk on the streets.

There is a gender bias inscribed into the ways in which motorcycle-taxis are used to facilitate everyday mobilities in Tehran. Due to gender-based limitations or religious and cultural norms, women can only ride a motorcycle with a *mahram* family member (e.g. for women: brother, father, uncle, etc). Hence, women's sharing of space with non-*mahram* men is forbidden (Khatib-Chahidi, 1981; Peters, 2011). This is congruent with Loukaitou-Sideris's (2016) argument that women's mobility in most cities with large Muslim populations is constrained, for the most part, by cultural norms and religious barriers. However, the gender-based codes and religious norms are largely violated and often impossible to enforce as women do use motorcycle-taxis and they do so 'as if' the male driver is *mahram* to them. The fact that the informal industry of motorcycle-taxis has surfaced in recent years across the city facilitates the persistence of such transgressions. Therefore, any formalisation attempts such as registering the motorcycle-taxis with identifiable numbers, operating permits and vests to promote safety standards, would blow women's cover and ban them from using this efficient form of public transport. Indeed, gender bias curtails any formalisation practice since drivers who have formally become identified will lose a key part of their market.

Motorcycle-taxi drivers often exhibit contradictory positions in less formal cities, varying between indispensability, marginality and invisibility (Sopranzetti, 2013). On one hand, they operate as viable feeders in Tehran, creating channels that facilitate the everyday mobility of people from their place of living to the high-volume public transport services. In effect, such informal services are often tacitly accepted as central supplements to formal bus and rail services because most of the developing cities would grind to a halt otherwise (Cervero, 2000; Cervero & Golub, 2007; Guillen et al., 2013). On the other hand, they remain largely marginal to everyday life in both social and spatial terms. For some Tehranis these informal operators do not even exist; they rarely reflect on their indispensable roles in facilitating a major part of daily movements across the city. The invisibility of motorcycle-taxi drivers from the gaze of urban

residents, planners and policy makers is also geared to the ways low-skilled rural-to-urban migrants and working-class have been involved in the informal sector. Such invisibilities are not only manifested through spatial relocation, but also social and discursive ones. Only when streets are clogged with heavy traffic and there are only few available motorcycle-taxis close to busy nodes, the indispensability of these informal services to the ways in which the city works become evident. Therefore, it is within this dilemma that motorcycle-taxis function: invisible as long as they operate competently, visible in the cases of traffic congestion, road accidents and pedestrian space invasions.

Attempts at formalisation in recent years show how addressing the challenge of informal transport is a complex task that hinges on a sophisticated understanding of the relationships between formal and informal practices. For instance, parking stands on sidewalks in central Tehran are generally empty (Figure 11.7). In many developing cities authorities take a firm position deciding between the extremes of removal and outright acceptance (Cervero & Golub, 2007). However, this is a self-organised system that cannot be simply removed or resolved from above. Hence, degrees of formalisation are necessary in order to integrate more effectively and adaptably the informal transit network into the formal high-volume transport services (e.g. BRT and rail networks) to facilitate the everyday mobilities across the city without threatening public safety.



Figure 11.7. Parking stands

The observation and catchment analysis of motorcycle-taxis in the studied cases suggest that they gain advantage over other more formal public transport modes through their small sizes (e.g. capacity to squeeze and to park/start without delays) and greater capacities to transgress

regulations. Formalisation attempts cannot generally curtail the advantages that are linked to their small size. By contrast, their transgressive behaviour has a greater potential to be formalised under the reasons of danger, over-competition, invading pedestrian flows and posing serious threats to the economic productivity and intensive urbanity. Therefore, any attempts at formalisation through the enforcement of regulation and surveillance, particularly in pedestrian spaces have the capacity to constrain their transgressive activities and ease pedestrian traffic flow. This is likely to reduce the gaps between motorcycle-taxis and car isochrones resulting from the shrinkage in motorcycle-taxi catchment areas, but never to the same area as cars since the other size-related advantages will always continue.

The shrinkage in motorcycle isochrones produced by formalisation will directly influence the competitiveness of motorcycle-taxis over other modes including cars and high-volume BRT and rail networks due to which many passengers may change their patterns of mobility and move to other modes. Some may shift to car-taxis, which will create more congestion. It is important to note that investments in roads may provide temporary relief, but such practices often cause induced traffic. Other customers may switch to high-volume public transport, increasing congestion in both Metro and BRT networks. Investments in the provision of frequent, high-capacity public transport infrastructure can achieve mode shift for their wider catchment areas. Any formalization of motorcycle-taxis needs to be considered in tandem with the expansion of high-volume public transport networks.

If motorcycle-taxis are forced to formally identify themselves in Tehran (i.e. uniforms worn), as such then their cover as 'mahram family members' will be noticeable. Under existing social rules most female passengers will be excluded from the fastest and most reliable form of transport. Such informal practices would continue to meet the market in practice – formalization relies on the ways in which regulations are developed and implemented within a larger assemblage. Therefore, it is significant to understand how top-down processes are also dependent on forces from the bottom-up. In short, to understand the story about motorcycle mobilities, it is crucial to explore the complex interrelations between different formal and informal modes of transport, between different material and discursive processes and between different self-organised and top-down practices.

Future station areas

Here the chapter highlights the ways Tehran's transit-oriented assemblages are different from what can be found in the more formal TODs and then reflects on the role of TOD as an urban design strategy for the future station areas.

Using Tehran as a case study, this research contributes to a better understanding of the nexus between urban morphologies, transit networks, everyday mobilities and forms of urbanity. This is also key to the question of how basic TOD principles laid out in the international literature can be translated into urban design for station areas in the context of less formal cities. This study also contributes to the new-found accent on urban design dimensions in relation to TODs. While the primary concepts in this thesis have provided a good foundation on the ways in which TODs work, the applicability of them can be constrained across different contexts; this can be due to the governance system, availability of various transport modes, local culture, political and economic structure and so on.

This thesis adopts assemblage thinking to conceptualise TODs – different forces come together to make these places work – which cuts across any separation of sociality and spatiality. Such an approach that grapples with the complexities and multiple adaptations taking place around the transit stations has not been yet explored in studies on less formal cities. While there have been some attempts at measuring the accessibility of TODs in the more formal cities, none has been found in the context of less formal cities. In this sense, the two measures of CAPS_{5min} and AI_{5min} proposed in this thesis demonstrate that the high value of catchment of accessible public spaces around the station is not consistent with the concept of a TOD when there is not much to catch within a catchment. The global literature has long recognised public/private interfaces as a key issue in urban design and planning, while there have not been any attempts focusing on urban interfaces within TODs. Mapping urban interfaces within transit station catchments, this thesis demonstrates that the streetlife intensity and the capacity for socio-economic transactions cannot be simply predicted by accessible interfaces yet is a synergistic effect of a larger assemblage including the number of entries and diversity of functions. Although in the global studies on TODs isochrone mapping is becoming recognised as a useful method to analyse the accessibility of public transport and cars, few studies have focused on mapping motorcycle-taxi access from major transit nodes. While many TODs in North America and Australia have been built from scratch, heritage overlays can be a major challenge to intensification in the cities like

Tehran (particularly within station areas of the old city core). This is also linked to the fact that many transit nodes in Tehran have evolved into a particular morphology that is at their limits and cannot change without complete demolition. For the transit nodes with a higher capacity for transformational change, not any TOD specific planning regulation (e.g. allowing a higher Floor Area Ratio, zoning reforms and pro-development tax policies) has been deployed, which is contrasted to the global TOD policies. The thesis shows almost no evidence of gentrification around transit nodes of Tehran as it often takes place in the more formal cities.

Another contrast is about the co-existence of informal and formal markets within Tehran's transit nodes, which encourages vibrant streetlife and economic vitality. Mobility challenges in Tehran's transit-oriented assemblages are significantly different from those in the formal city. While there have been a number of studies on motorcycle mobilities in the less formal cities, the analysis and mapping of such mobilities have remained underexplored. This thesis demonstrates the ways in which informal transport modes including motorcycle-taxis gain the advantages over formal modes of public transport within Tehran's transit-oriented assemblages. It is also apparent from this work that gender-based rules in Tehran both constrain women's use of public transport and keep the industry informal. Another difference is that unlike in most formal cities (particularly in North European cities), TODs in Tehran are not cycle-friendly environments.

In sum, the resilience of a TOD and its emergent effects demand a broad understanding of the synergies and dynamics of change within and across different scales. TODs can adapt by constraining or enabling change at multiple scales. At the smaller scales, any transformation in the building height, grain size, functional mix and walkability can enable better flows at the city level, with a higher degree of intensification and greater capital gains. Also, the ways a transit node operates are impacted by macro scale interventions such as pricing, implementation mechanism, urban regulations and planning frameworks. In effect, every TOD can adapt to new and changing set of forms, functions and forces, resulting from either top-down planned interventions or bottom-up processes (incremental changes – often based on current market practices). Therefore, the potential of each case to produce intensification is reliant on both actual and possible interrelations at multiple scales. Hence, using the existing synergies from the findings enables projecting broad estimates regarding the possible reasons for why station areas in Tehran remain largely unintensified.

The findings from the five cases are specific to those five station areas (there is no straightforward formula for the ways TODs work); their complexity leaves room for multiple ways of interpretation and understanding. Nevertheless, the similar patterns across the five cases indicate that generalisations might be reasonably made. The variety of issues emerging from the five station areas suggest that although density, mix, access and streetlife intensities are key conditions to the functionality of a TOD, they are also inherently complex and the capacities for transformational change within each case can differ greatly from others. Therefore, while the findings of this study are encouraging, the synergies and possibilities for urban design transformation within TODs will remain a key challenge.

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