Analysing the relation between territorial fragilities and accessibility: a focus on individual dimension and needs.

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Abstract: This paper aims at examining the relation between territorial fragilities, mobility and accessibility: mobility as social practice interlocked in time and space, and accessibility as the possibility of an individual to access at different out-of-home activities. The main purpose of this paper is to answer to the following questions: is it possible to establish a relation between the level of accessibility of a given territory and its territorial fragilities? As matter of fact, many research in last twenty years demonstrated the causality between low level of accessibility and mobility related social exclusion. In this paper I will show how an interpretation of accessibility, based on individual's needs and opportunities, may help to establish a relation between low level of accessibility and territorial fragilities. Indeed, traditional accessibility approaches brought to a misrepresented narrative, that describes a high infra-structured territory also as a more accessible and stronger one. Thanks to a bibliographical review oriented toward redefining the concept of accessibility, this work will challenge this narrative. It will be proved that a more accurate definition of mobility and accessibility may demonstrate that remoteness can be, at the most, one among the many drivers that lead to territorial fragilities.

Keywords: mobility; accessibility; basic needs; territorial fragilities.

Introduction: putting in relation mobility and accessibility with territorial fragilities.

The main aim of this research is to understand if there is a relationship between the level of accessibility of a given territory and its fragility, and which kind of territorial fragilities may be generated by low accessibility levels. In order to propose, at a later stage of this work, operative solutions that, working on mobility and accessibility, may help to deal with territorial fragilities.

The word "fragility" calls to our mind the image of something that can break easily, this is because, in physic, fragility is the particular characteristic of certain materials to break-up when exposed to given forces. Nevertheless, when talking of territorial fragilities, it seems more appropriate to refer at the "low capacity of a system to deal with circumstances which are opposite to the system itself and create the condition for conflict[1]". To apply the concept of fragilities to a territorial system moves the attention toward a systemic dimension, given by the territory itself, and oblige us to consider processes and time. For instance, if we are considering a complex system such as a territory it is more difficult to identify a direct cause/effect relationship between the conditions that started the fragilization process and the elements that broke up, as one cause may have implications on multiple territorial elements.

Also accessibility has been given multiple meanings, according to different academic fields. To the extent of this research I will define accessibility as " the capability of individuals to participate in out-of-home activities" (Martens, 2017). Nevertheless, there is a dominant narrative, particularly diffuse in the field of transport studies, that identify accessibility with high level of infrastructure and fast connections and establishes a linear relation between high level of accessibility and urban growth and development (Hansen, 1959; Donati, 2009; Alampi and Messina, 2011), a narrative that suggests the idea that mobility is an essential requisite of the contemporary world (Kaufmann, 2011; Cresswell, 2010) and consider mobility "as education, as freedom, as modern" (Cresswell, 2010). According to

[1] From an unpublished text of F. Infussi about territorial fragilities (2019)

Luca Bertolini, for example, “since the industrial revolution, transportation and urban development have been tightly interconnected” (Bertolini, 2008), thus linking the concept of modernity with transportation and urban development and suggesting that a well infra-structured territory is also a more developed one. According to Bissel “the construction of transport infrastructure has often been viewed as the silver bullet that will solve commuting [and more generally mobility] problems once and for all” (Bissel, 2018), considering people mobility in the same manner of a liquid flowing through a pipe, larger is the pipe faster is the liquid, and assuming time and speed as the most important parameters to be considered when evaluating accessibility level. According to this narrative, that counters central fast places with marginal slow ones, a less infra-structured territory is less accessible and thus more remote and more fragile. Nevertheless, this narrative embodies some problems linked to the definition of mobility and accessibility: first of all, it matches mobility with transport; then, and related to the first one, it considers accessibility only as a spatial requisite not taking into account individual specificity and needs; last, and consequent to the first two points, it gives back a picture of territorial fragilities only as a consequence of spatial marginality and low level of infrastructures. As a consequence this approach does not allow to read territorial fragilities in its complexity and value fragilities only in the opposition to fast infra-structured and high accessible strong territory. Instead interpreting accessibility as the capabilities to reach opportunities and participate to out-of-home activities, links accessibility with other problematics that may generate fragility such as social exclusion and spatial injustice, as seen in figure 1. While the link between low level of accessibility and social exclusion has been extensively studied, particularly in U.K. after the constitution of the Social Exclusion Unit (2003) the relation within territorial fragilities is still poorly analysed and will be the subject of this research. Definitely accessibility, as a measurable dimension that connect individual and spaces, may help to understand territorial fragilities in its multidimensionality.

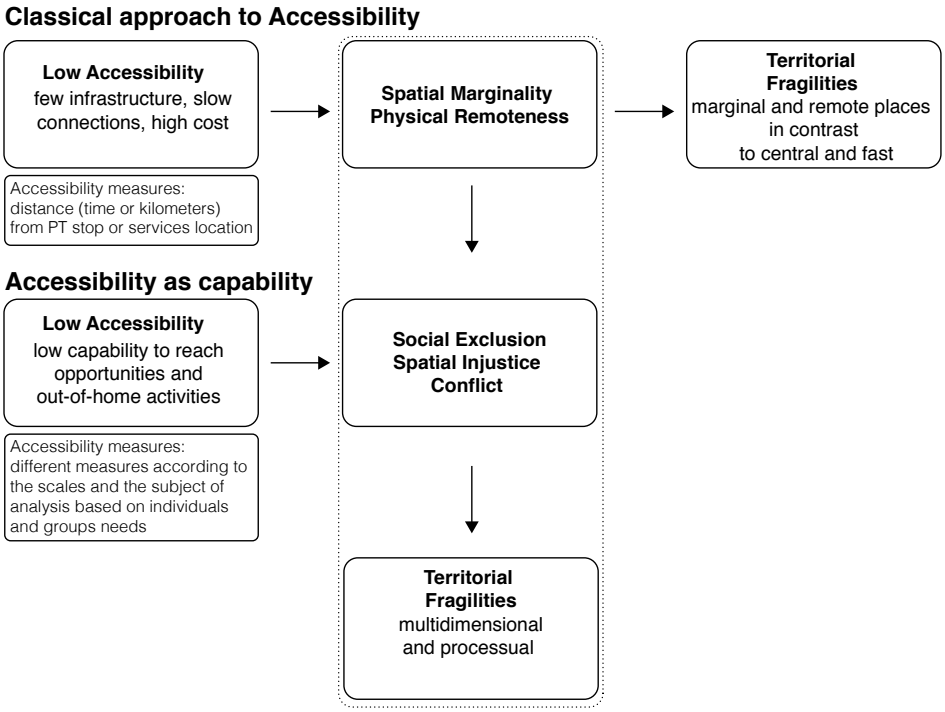

Figure 1

In the following paragraphs I will work on defining mobility and accessibility, building on bibliographical reviews, furnishing a more detailed and realistic image of the relations with territorial fragilities, and trying to invalidating the dominant narrative that a more infra-structured territory is also more accessible, developed, stronger and consequently less fragile one.

Reframing mobility and accessibility

It is nowadays well-established in different disciplinary fields, from transport studies to geography and urban studies, that mobility is passing through an important turn all over in Europe (Secchi and Pellegrini, 2010; 17), this process is expanding at the point that many scholars agree on the appearance of a paradigmatic transition in mobility (Bertolini, 2008; Sheller and Urry, 2006). The new paradigm asks for a redefinition of goals, processes and tools needed to plan and design urban mobility, and considers a broader range of modes, objectives, impacts, and improvement options of mobility (Litman, 2013; Faulconbridge and Hui, 2016). From a theoretical point of view, in its seminal book sociologies beyond societies John Urry (2000) suggested to replace the word mobility with mobilities. The use of the plural highlights the multiple types of mobility: corporal travels, physical movement of objects, imaginative, virtual and communicative travels (Urry, 2007), definitely we can consider mobility "as a single phenomenon that has the ability to take on different forms" (Flamm and Kaufmann, 2006). Furthermore we should also consider the different scales of mobility "from the small-scale of bodily movements, through infrastructural and transport aided movements to global flows of finance and labour" (Cresswell, 2011).

The idea of a mobility turn, although has been accepted in many different scientific fields it has not been apprised jet in urban design (Rosenberg and Shannon, 2018), where a dominant perception associates mobility only to physical movement and transport. Nevertheless "the way in which mobility is conceptualized and operationally defined [will] affects its application and research findings" (Kaufmann *et al.* 2004), thus interpreting and understanding mobility as a social practice interlocked in time and space will enable, also in the field of urban design, the elaboration of more convenient solutions to mobility related questions.

As matter of fact, the mobility turn underlines some important elements that can lead our reflection: 1) first of all, mobility cannot be understood only as the physical movement between point A and point B (Cresswell, 2010) but as a fundamental human activity that is revealed in different forms and at different scales; 2) second, mobility need to be studied with an interdisciplinary approach (Secchi and Pellegrini, 2010; Bertolini, 2008; Pucci and Colleoni, 2016; Rosenberg and Shannon, 2018) and touching different scales; 3) last, many scholars agree, nowadays, to consider mobility as a citizenship right (Secchi and Pellegrini, 2010; Carrosio and Faccini, 2018). To this regard François Ascher[2] defines the right to mobility both as the right to freedom and to be mobile in order to meet individual's needs and expectations and the right to ensure a minimum level of mobility to all member of society (Ascher, 2005).

The reference to mobility as right together with the need to match this right with general costs[3] of mobility draw attention toward the concept of accessibility (Colleoni, 2019; Sheller, 2018, Martens, 2017; Lucas, 2012; Pereira *et al.*, 2016, Pucci and Vecchio, 2019) . The notion of accessibility has been studied profusely in the field of transport studies. Following on this paragraph, I introduce some relevant interpretations of accessibility; the review presented in this paper is not pretending to be exhaustive, instead it focuses on those definitions that emphasize the complex nature of accessibility and interpret it as the capacity that allows individuals to reach opportunities and resources in order to be part of a territory and a community and, consequently, considers accessibility as a suitable principle to design more efficient, inclusive and equitable mobility system people-focused and needs-based (Pucci *et al*. 2019; Lucas, 2012). Many research projects have already demonstrated the causality between low level of accessibility and mobility related social exclusion (SEU 2003; Lucas, 2012; Kenyon *et al.* 2002), operationalizing an interpretation of accessibility based on individual's needs, and highlighting that "the transport and land use system can reinforce social exclusion by increasing generalized cost of travel for person at risk" (Schonfelder and Axhausen, 2003). Nevertheless, I believe that these interpretation of accessibility, based on individual's needs and

2. François Ascher identifies the "droit-liberté" et "droit-créance" (Ascher. F, 2005)

3. Mobility costs are not only economical but also social and environmental (Ascher; 2004; Sheller, 2018, Litman, 2013). The development of transport system involves negative impact at different territorial level: soil consumption due to the spaces occupied by car and mobility infrastructures (Sheller, 2018), congestion, emissions, noise nuisance, use of nonrenewable energy, and production of solid waste (Bertolini, 2008). Some authors also argue that an increase in physical mobility to tackle mobility-related exclusion is contrary to environmental aims; is financially costly; will take long time to be effective and is unlikely to meet all mobility needs of the all population (Kenyon, Lyons and Rafferty, 2002). To this reagrd, Bruno Latour also reasons about the relation between climate change scarcity of resources and the rise of social inequalities (Latour, 2018).

opportunities, may help also to study the relation between accessibility and territorial fragilities, which has not yet been deeply analysed.
In table 1, I synthetically introduce some definitions of accessibility highlighting for each of them the key factors. I started with a classical definition that clearly distinguishes between the different components of accessibility (individual and place) till to bring the attention toward definitions of accessibility more people-centred and based on capability approach. I consider those last very important as they allow a more multidimensional regard toward accessibility and call for new methods to measure and evaluate it. I finally consider also the concept of motility (Kaufmann *et al.* 2004), as it relates to accessibility but focuses "on the logic of the actor's actions" in particular looking at the reasons behind modal choice and localisation (Flamm and Kaufmann, 2006), and thus may help to question traditional methods to evaluate accessibility.

Author	Definition	Key factors
Colleoni, 2019; Cascetta, Cartenì, Montanino, 2012.	Characteristic of a place to be accessible or of an individual to get access at different places/opportunities	Traditional definition of accessibility according to place or people
Hansen, 1959.	The potential of opportunities for interactions with locations dispersed over space. Accessibility is a measurement of the spatial distribution of activity about a point adjusted for the ability and the desire of people or firms to overcome spatial separations	Accessibility referred both to person and context, the use of "potential" highlights the possibility to access as well as the measurability.
Pereira, Schwanen, Banister, 2016.	The ease with which persons can reach places and opportunities from a given location and be understood as the outcome of the interplay of characteristics of the individuals, the transport system, and land use"	Connection between individual, transport system and land use
Geurs and van Wee, 2004.	Focusing on passenger transport, we define accessibility as the extent to which land-use and transport systems enable groups of individuals to reach activities or destinations by means of a combination of transport modes	Accessibility as measure. Connection between individuals, activities and transport system. Measure of accessibility need to consider different components and perspectives
Handy and Niemeier, 1997	Accessibility is determined by: spatial distribution of potential destinations, the ease of reaching each destination and the magnitude quality and character of the activities found there. Accessibility is thus determined both by patterns	Land use + transport system + activities patterns and typology. Intuition in understanding the importance of people in measuring accessibility: the question of "wants and tastes".
Martens, 2017.	The capability of individuals to participate in out-of-home activities.	Accessibility as choice, giving center stage to people. Accessibility contain the possibility of engaging in out of home activities more than to the number of activities. Capability Approach
Jones and Lucas, 2012.	Accessibility provides measures of the degree to which people can reach the goods and services that society considers are necessary for them to live their daily lives, but with an emphasis on potential/capability rather than actual behaviours.	Emphasis on potential rather then actual, connection between people and land use, and attention to individual needs
Flamm, Kaufmann, 2006	"Motility" can be defined on how an individual or a group take possession of the realm of possibilities for mobility and builds on it to develop personal projects. Motility focus on the logic of an actor's action, in particular the reason behind the choice.	Potentiality of mobility and focus on the actor's action

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Table 1. Accessibility definitions

Traditionally, accessibility has been defined as a characteristic both of the place - passive - or of the individual - active - (Colleoni, 2019; Cascetta *et al*. 2012; Martens, 2017). Person accessibility, or active, refers to the ease of an individual to reach different activities; while place accessibility, or passive, is the attribute of an activity location to be reached by its users. This dualism between place and person, with an emphasis on the system performances instead of a focus on individual's needs,

limited the efficacy of traditional mobility and transport approaches in the design of mobility systems (Pucci *et al*. 2019); as matter of fact, traditional approaches assumed as main goal, the exploitation of mobility system by maximizing the distance travelled within travel and money budgets and therefore seek to enhance travel speed (Litman, 2013), furthermore, decision making in transport investments have been traditionally based on "aggregate demand" (Lucas and Markovich, 2011) and rarely considers individuals activities needs and capabilities of diverse populations groups, making it hard to design a system of mobility more inclusive and responsive to individual needs.
Since the seminal text of W.J. Hansen, who defined accessibility as "the potential of opportunities for interactions" (Hansen, 1959), combining person and place and moving the attention toward "the ability and the desire of people or firms to overcome spatial separation" (ibi), many accessibility definitions have given more attention to connect the different component of accessibility: individuals through people needs, what has been defined "wants and tastes" (Handy and Neimeier, 1997); land use, through the attention paid at the distribution of the different activities, density and quality of services; and transport system as the availability of different transport modes at different time and with different travel costs (Geurs and van Wee, 2004; Handy and Neiemeier, 1997; Pereira et alii, 2016). According to these definitions accessibility involves as much people as place, because places need to be "accessible to people in all their different circumstances" (Farringhton, 2007).

Accessibility as capability

All those reflections help to develop a new narrative of accessibility that considers access not merely as a transport issue but as a problematic that involves also land-use planning and the needs of individuals through the design of mobility and connectivity places (Farringhton, 2007). Definitions such as the one elaborated by Martens (2017) or Jones and Lucas (2012) emphasize the potential dimension of accessibility stating that what is relevant to be measured is not the actual number of activities, services or transport but the possibility of engaging in out-of-home activities. In this sense, accessibility is a capability, which is "the ability of human beings to lead lives they have reason to value and to enhance the substantive choices they have" (Sen, 1997), thus including in the definition of accessibility also the question of choices and personal development. Working on accessibility as a capability moves attention toward individuals and their choices of mobility. The idea of mobility as potentiality, is also at the base of the formulation of the concept of motility (Flamm and Kaufmann, 2006; Kaufmann *et al.* 2004). Motility has been defined as "the capacity of entities to be mobile in social and geographic space" or as the way in which entities "appropriate the capacity of socio-spatial mobility" (Kaufmann *et al*. 2004). Motility include: access, which refers to the range of possible mobilities according to place and time; competence, which includes skills and abilities of the individual; appropriation, that refers to how agents consider themselves appropriate and select specific options for mobility.
While considering accessibility based on actual number of activities reached and existing transport system - the functioning - allows a deep knowledge of the actual condition of accessibility and mobility: what an individual has succeeded in being or doing (Martens, 2017), working on accessibility as capabilities allows to consider also activities that are not possible to be reached as well as users that cannot be mobile at the moment - the capability - which is the range of beings and doings a person could achieve (Martens, ibi.). In particular, accessibility should be considered as a combined capability (Pereira *et al.* 2016) because of its importance to the development of other human capabilities and to reach basic needs.

Accessibility: measures and scales.

Notwithstanding the great quantity and quality of studies on transport-related social exclusion, overall in UK after 2001[4], that interpret accessibility as a capability and pose the accent on individual's needs, it is worth noting that those works explore the lack of activity participation among fragile groups of population but still use rough proxies to measure accessibility, such as, for example, the proximity to public transport stop (Martens, 2017).
Nevertheless, many different and sophisticated indicators of accessibility are already available in literature. Geurs and van Wee have made a very deep review of the different methods that can be used

[4] In 2001 Social Exclusion Unit have been asked to work on the problems experienced by people in reaching work and key services (SEU, 2003)

to measure accessibility (Geurs, van Wee, 2004). They identify 4 different components of accessibility: 1) land use component which analyses the land use system including distribution and demand of opportunities, 2) transportation system which describes the transport system, 3) temporal component which studies the availability of opportunity at different time of the day, 4) individual components which describes needs, abilities and opportunities of individuals. They also list 4 different perspectives to measure accessibility: infrastructure-based; location-based; person-based; utility – based. According to Geurs and van Wee, ideally an accessibility measure should take into account all those different components. Even though in practice "applied accessibility measure focus on one or more components, depending on the perspective taken" (Geurs, and van Wee, 2004). This is due to different factors such as the availability of data the ease to be operationalised, interpreted and communicated. Grieco (2006), instead, suggests to work in three main dimensions of accessibility : 1) place-based measures including opportunities and services within the immediate surrounding of a person, 2) social-category stratification of the community to identify social need, 3) person based measures, such as individual public transport user's profile of journey needs (Ohnmacht et al. 2016), adding, to the four dimensions considered by Geurs and Van Wee, the social one. Preston and Rajé (2007) suggested to use a matrix that combine area accessibility, area mobility and individual mobility to investigate accessibility in relation to social exclusion, and propose to use this matrix also to identify differences in accessibility between urban, peri-urban and rural areas. Last, research such as the one elaborated by Schonfelder and Axhausen (2003) tries to find a measure for dimensioning activity space, which is that part of the environment used by individuals for their daily activities that includes also the locations not necessarily visited yet, and thus investigates accessibility as a potentiality. In a recent work, van Wee (2016) added some further considerations to the review of accessibility measures, highlighting that accessibility measures should focus also, among others, on: short distances and slow modes, multimodality, ICT and perception of accessibility. Those works highlight the need to explore more the individual dimension of accessibility in order to identify individuals basic needs.

As matter of fact, defining accessibility as the capabilities of the individual to participate to out-of-home activities oblige to considers individuals activities, needs and capabilities of diverse populations groups, when measuring accessibility. Preston and Rajé (2007) suggested two possible approaches: the first one, a more disaggregated, requires extensive survey in order to collect information about individual users, its interest is in revealing a dense and detailed description of the phenomenon but is time and money consuming. A second approach, easier to operationalise, consists on the simulation of population interest based on census and available data and measure, a similar approach has been used by Pucci (Pucci *et al.*, 2019) to evaluate accessibility to work by public transport in the city of Buenos Aires. In my opinion, interesting results may be achieved by the combination of the two methods in different moments of the study and applied at different territorial scales.

As matter of fact, Jones and Lucas (2012) identify, in the existing literature, three different scales of accessibility: micro, meso and strategic. At the micro scale the measure of accessibility relates to the design of object and space and the ease with which people can perform various tasks. Meso level focuses on the neighbourhood level. Strategic accessibility, instead, is associated to town and regional dimension and put in relation land use pattern, transport network and activities desired by specific populations groups. Strategic accessibility is the most studied and documented both in policy perspective as well as in academic community (Jones and Lucas, 2012). Additionally a fourth level could be added, that considers long distance accessibility and deal with national scale, highlighting that measure of accessibility may differ also in consideration of the typologies of trips, long distances or everyday mobility, for example.

A possible way to look forward in the direction of establish a method to measure accessibility, paying attention to the fulfilment of individual basic needs, may be a category based approach that matches people and targets, ensuring that basic needs are delivered or may be delivered when and where they are needed. This approach may help to avoid social exclusion and the raise of conflict, offering solutions to deal with territorial fragilities. Although working on categories and groups still involves "a form of aggregation and tend to lose the richness of individuals' lived experiences" (Preston and Rajé, 2007).

Conclusion

There is still a dominant narrative that associate mobility with freedom and accessibility with infrastructure, a narrative that, since industrial revolution, describes transportation and urban development as interconnected and considers the construction of new infrastructure as a solution to

mobility problem and social exclusion. According to this narrative low infrastructured territories are remote and marginal, this marginality and remoteness are considered an indicator of fragilities. As matter of fact spatial marginality can be one of the many drivers that can lead a territory to be fragile, although empirical evidences may show that can exist very strong remote areas as well as fragile but central territories.

In this paper I have argued that this narrative is linked to a definition of mobility only as physical movement and focus only on transport and land-use components of accessibility. Instead defining accessibility as the capability of individuals to participate in out-of-home activities: 1) emphasizes potentiality rather than functioning, 2) allows to consider accessibility as a measures of the degree of connection between individual needs, transport and land use.

Clearly this definition of accessibility calls for more sophisticated indicators that could take into account simultaneously the different components and adapt to different scales of observation. I suggest that, even if still simplified and based on aggregated data, a possible way to look forward in this direction may be a category based approach that matches people and targets according to different scales and trips. Clearly a complete measure of accessibility have to be based on the combination of multiple accessibility indicators, each of them calculated on different scales and components. Next research step will focus on testing this approach to some areas in Italy.

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Enhancing urban-rural connectivity in non-metropolitan regions: a methodology in support to decision-making

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Abstract: Accessibility to services and opportunities is vital to achieve the EU goals of smart, sustainable and inclusive growth. Some territories are worse equipped than others in this concern, due to their intrinsic peripheral character. Their weak and scattered mobility demand has progressively made traditional public transport subject to efficiency savings and cut to the bone. Such measures contributed to worsen social inequality, as they affect especially those already vulnerable groups who do not have access to a car. In this light, to improve urban-rural connectivity is essential for granting equal access to services and opportunities and, in turn, greater social justice. Demand Responsive Transport (DRT) has been often seen as a panacea for all the circumstances where traditional services are not viable, but a range of barriers (institutional, cultural, technological and economic) suggests that its adoption is more challenging than it may seem. Drawing on the results of the ESPON URRUC project, the paper sheds light on this issue, exploring the variables according to which various DRT solutions may or may not prove viable in a given area. On this basis, the authors propose a transport policy toolkit that may support decision-maker aiming at enhancing urban-rural connectivity across Europe.

Keywords: rural areas; accessibility; policies; on-demand services

Introduction

Accessibility to services and opportunities is vital to achieve the EU goals of smart, sustainable and inclusive growth. Some territories are worse equipped than others in this concern, due to their intrinsic peripheral character. At the same time, the weak and scattered mobility demand that typically characterizes these areas makes traditional public transport inadequate and inefficient. As a consequence, in most of them public transport has been progressively subjected to efficiency savings and cut to the bone. Such measures contributed to worsen social inequality, as they affect especially those already vulnerable groups who do not have access to a car, due to physical, age or economic reasons.

In this light, to improve urban-rural connectivity is essential for granting equal access to services and opportunities and, in turn, greater social justice. Whereas the dematerialization of services and relationships may

help reducing the isolation of peripheral regions, physical accessibility to main centres is still crucial for territorial development, as it contributes to foster local economies and to increase the quality of life for those with inadequate or restricted access to services and opportunities.

Demand Responsive Transport (DRT) has been often seen as a panacea for all the circumstances where traditional services are not viable, but a range of barriers (institutional, cultural, technological and economic) suggests that its adoption is more challenging than it may seem, and that no one-size-fits-all solution exists. Taking stock of the literature on the matter and drawing on the results of the ESPON URRUC project – which addresses issues of urban-rural connectivity in non-metropolitan regions in Europe –, the paper sheds light on this issue, exploring the variables according to which various DRT solutions may or may not prove viable in a given area. On this basis, the authors bring forward a first draft of a transport policy toolkit that may support decision-makers aiming at enhancing urban-rural connectivity across Europe.

Next paragraph briefly presents general accessibility issues of remote areas; the URRUC project is then presented, describing its aims, case studies and related challenges; afterwards, the methodology used to develop the policy toolkit within the URRUC project is presented, and the summary of the results of its application to the case studies is shown. Concluding remarks highlight the preliminary results of the URRUC project, discuss opportunities and limits of the proposed toolkit and propose directions for further research.

Accessibility issues of remote areas

The first approaches to operationalizing the concept of accessibility were elaborated with reference to metropolitan areas in North America at the end of the 1960s (Hansen, 1959). However, in a couple of decades researches and studies acknowledged that accessibility problems were far more challenging in rural and mountain areas, where population density is generally low. This awareness is well summarized in the title of a famous book by Malcom Moseley published in 1979: “Accessibility: The rural challenge”.

When accessibility is dealt with in rural and mountain areas, which are significantly far from services and opportunities aggregated in urban centres, a change of perspective is required. Since the second half of the last century, most of these areas underwent intense processes of de-anthropization, that caused a reduction in the resident population and its progressive ageing. As a result, the number of potential users of basic services (such as education, health, etc.) in these areas fell below the critical minimum threshold of indivisibility; many local facilities had to be closed, and dependence on services concentrated in major cities increased.

At the same time, the low density and the scattered structure of the settlements (which are fragmented into small towns and semi-abandoned villages) make it difficult to activate public transport services. In fact, due to the low number of users and the dispersion of the origins and destinations of their trips, it is hard for these collective transport services to reach a sufficient level of financial and economic sustainability (Farrington and Farrington, 2005). Ownership of a private motorized mean becomes indispensable to access the services in the nearest main city, to the detriment of those who cannot afford or use a car, such as older residents, minors, low income families, etc.

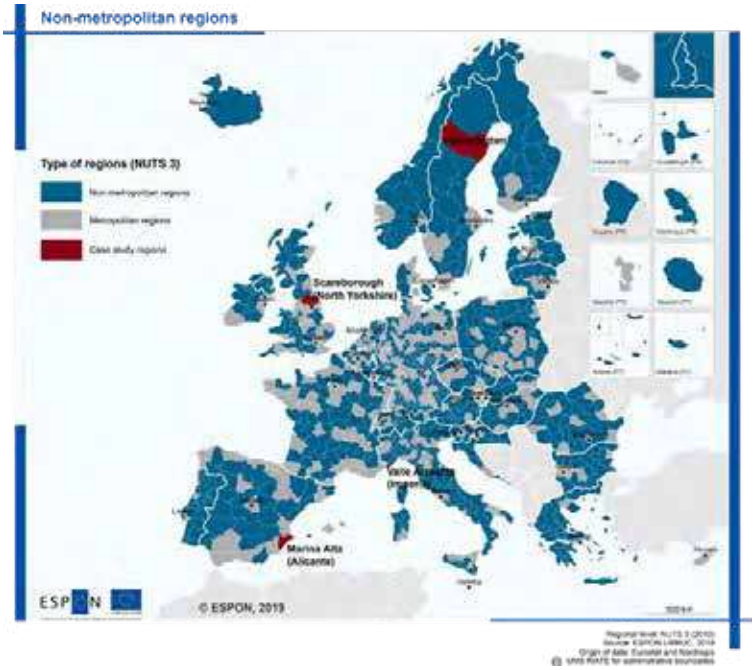
Moreover, physical inaccessibility of rural and mountain areas is often exacerbated by virtual inaccessibility. On the one hand, these territories are generally less covered by broadband infrastructure, which is essential for innovative solutions in providing those services (e.g. telemedicine and distance education) which are not locally available. On the other hand, a reduced digital literacy makes it even more difficult to activate such solutions (Malecki, 2003).

In the end, the issue of accessibility in rural and mountain areas is a vicious circle: reduction in the resident population implies the closure of most local services, which means less opportunities for studying, working, social interacting and so on; this underdeveloped condition increases the risk of further de-anthropization.

Therefore, even more than in urban centres, improving the accessibility of rural and mountain areas means acting on several fronts. It is not sufficient to strengthen transport infrastructures and promote more flexible transport services. It is also necessary to enhance the local territorial capital, bringing (or bringing back) in these areas, services, knowledge, social interactions, etc. (Gray, Shaw and Farrington, 2006; Schwanen et al., 2015).

The URRUC project and the territories at stake

Launched in June 2018 and lasting for one year time, the research project URRUC (Urban-Rural Connecctivity in Non-Metropolitan Areas) is funded in the framework of the European Territorial Observatory Network (ESPON). The main objective of the project is to contribute to improving connectivity and accessibility related to urban-rural linkages in four non-metropolitan areas: (i)Scarborough Borough, (United Kingdom); (ii) Marina Alta (Spain); (iii) Regione Liguria, Valle Arroscia and the Province of Imperia (Italy) and (iv) Region Västerbotten (Sweden) (Figure 1).



1. Territories under scrutiny in the URRUC project. Source: ESPON and University of Coventry, forthcoming-a

All four share similar characteristics. They are coastal areas with poor connectivity and access to inner, rural areas. The size and dispersion of their populous makes infrastructural development difficult. Major urban centres are located by the coast and suffer from congestion due to commuting flows at peak hours, also coming from inner areas. This is driven by the needs of rural households to access core services, employment opportunities, education and recreational locations, which are primarily found in the largest urban areas. Investment in transport infrastructures and services is inadequate to meet these demands, as the nature of these territories, with small, dispersed populations, makes transport provision economically difficult and hardly justifies expenditure. Optimising transport solutions is further aggravated by seasonal flows associated with tourism.

More in particular, most of the rural and mountain areas of Marina Alta (some of them being accessible, other more remote) lack of adequate access to services and opportunities, especially as far as those who don't have access to the car are concerned. Although the potential market for public transport is wide, public transport is almost not taken into account when planning a trip. Those who have access to the car use almost only this mean of transport, both because of lack of adequate alternatives and of a poor sustainable mobility culture. Weak

horizontal and vertical coordination, fragmentation of competences and different knowledge and priorities challenge the improvement of accessibility of rural areas, and flexible solutions face a rigid legislative frame and some resistance to change.

Rural areas and suburbs of Scarborough Borough Council currently lack alternatives to private car for connections and accessibility to Services of General Interests. Social objectives prevail in such areas, whereas also economic ones are relevant for Scarborough, so connectivity is crucial and road expansion is seen as a priority by the local stakeholders. Commuters mainly use the car (or the bike where possible) and are satisfied with their mobility; public transport is unreliable and used mainly for leisure, so those who don't have access to the car are very disadvantaged. The specific and general contexts which surrounds operational conditions pose some challenges, especially in terms of fragmentation of competences, competing priorities and limited influence of the local level on upper-tier ones. Economic and commercial criteria strongly prevail on social and place shaping ones, worsening territorial and social inequalities.

The towns and hamlets of Valle Arroscia are dispersed over a wide mountain territory, some of them being far from the main road axis of the valley. Most of trips are made by car, and the current public transport system fails to meet the need of the few who rely on it. Hence, while car users are not in search of alternatives, some user groups suffer from territorial assignment. Public transport is seen as a last resort and at the same time poses serious challenges to those who rely on it to get to main urban nodes. Fragmentation of competences, different priorities, lack of vertical coordination between stakeholders involved in transport planning and operation raise challenges. Furthermore, local stakeholder has scarce influence on upper-tier decisions and the legislation, licensing and operation of public transport pose some limit to the introduction of flexible transport solutions.

Västerbotten territory features rural settlements, most of them being accessible and some very remote. Territorial density is very low and long distances and unfavourable weather strongly affect some user groups (i.e. those who don't have access to the car or inhabitants of remote hamlets in winter). To date, public transport is almost not considered as an option, and there is lack of information of the existing services. Still, public transport is generally seen with some interest, as well as digitalization of services. Vertical and horizontal cooperation is hampered by lack of time and resources, and there seems to be no intention to increase investment in public transport nor to finance potential solutions to improve connectivity in a cost-efficient way.

With the support and direction from stakeholder representatives in all four territories, the project aimed at improving understanding of urban-rural mobility and accessibility challenge in these regions and to provide appropriate tools for improving connectivity and accessibility through knowledge transfer processes. Furthermore, the project it also focused at exploring the actual potentials for transferability of findings by engaging in theory and literature-based activities, in order to provide learnings applicable to other Non-Metropolitan Regions across Europe with similar urban-rural connectivity issues, supplying valuable knowledge and outputs. These outcomes specifically address the six knowledge needs detailed below.

1. How can efficient public and private transport networks and sustainable solutions be advanced to enable access to key services, activities, employment opportunities and commercial possibilities for the population in remote NMRs?
2. What are the potentials, opportunities, and challenges for developing flexible and sustainable urban-rural transport connections and systems in comparable NMRs suffering similar connectivity and accessibility challenges?
3. What innovative solutions can be utilised, such as demand-responsive transport systems? What potential impacts can emerging technologies associated with climate change, such as low emission and electric vehicles, have on modes of travel?
4. What institutional/administrative barriers associated with cross-agency services impede the efficient implementation of transport policy in remote/inaccessible areas?

5. What can be learned from existing practices in Member States in developing and maintaining flexible and sustainable urban-rural transport connectivity in NMRs?
6. How can existing and future transport policy and other relevant policies be further strengthened to support the development of flexible and sustainable transport solutions in non-metropolitan regions, including transport initiatives at EU-level?

In order to provide answers to these questions, the research team developed a specific policy toolkit that could support decision and policy-makers in conceptualizing and implementing solutions for their respective territories. The main characteristics of this toolkit are provided in the section that follows.

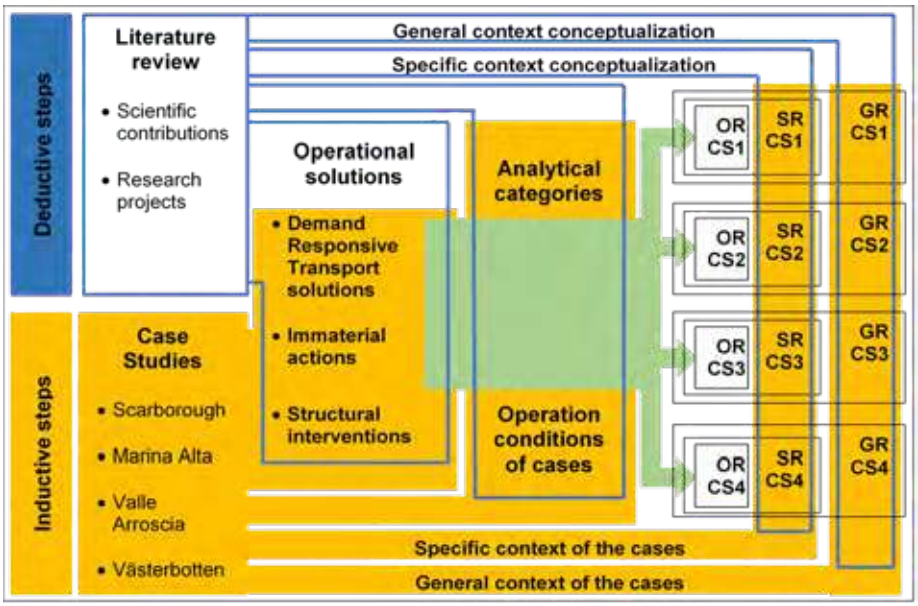
A policy toolkit to support decision-making

One of the main tasks of the URRUC project was to develop "policy recommendations to further strengthening transport policy and systems related to urban-rural connectivity and interaction in non-metropolitan regions". This task has been pursued through two separate but strongly interrelated research activities:

- Firstly, building on the case studies' analysis and on a thorough review of the scientific literature and recent research projects, the research team developed four sets of policy recommendations, fitting the operational conditions and meeting the specific and general challenges of the stakeholders' territories.
- The recommendations were then reflected upon in relation to their potential to fit other non-metropolitan territories in Europe, also on the basis of the NMR typologies identified in the literature and appropriately adjusted as a result of our analysis.

Bearing in mind the challenges and barriers to policy transfer and taking stock of literature on transferability (Dolowitz and Marsh, 1996, 2000; Cotella et al., 2015; Macario and Marques, 2008), a policy toolkit aimed at supporting decision-makers to enhance urban-rural connectivity across Europe is proposed.

More specifically, the methodology adopted to develop guidelines and recommendations for URRUC stakeholder territories and, in general, for European non-metropolitan regions affected by similar accessibility challenges, is composed of a number of complementary inductive and deductive steps, shown in Figure 2.



2. Methodological steps for the identification of policy recommendations (ESPON and Coventry University, forthcoming-b).

Firstly, a thorough literature review, focusing on both academic conceptualizations of the issues at stake and international research projects identifying good practices, led to the identification of a number of possible solutions aiming at improving accessibility and urban-rural connectivity in non-metropolitan regions.

Eleven possible alternatives to the private car were selected (most of them being Demand Responsive Transport solutions). Namely: bus on demand, car clubs, car sharing, feeder, ride-sharing, service delivery, shuttle van, social transport, taxis, shared taxicabs, village minibus. These possible alternatives were assessed against a set of analytical categories identified in the literature analysis (Ambrosino, Nelson, and Romanazzo 2004; Davison et al. 2012, 2014; Hunkin and Krell 2018; Loveless 2000; Mounce et al. 2018; Velaga et al. 2012; D. S. Wright 2013; S. Wright et al. 2014) and complemented by the case studies. These are:

- geographical coverage: what type of area is the service covering? Categories: rural accessible, rural remote, hill/mountain accessible, internal mountain, suburb;
- eligible users: who are the main users? Categories: territorial assigned person, commuter, student, tourist;
- type of use: which kind of use is the service meant for? Categories: single user/small group, collective users;
- booking: how does the users book their journey? Categories: phone (call/SMS), Internet (app/website), other (i.e. infopoint, on vehicle, etc..);
- booking: when is booking required? Categories: On day/real-time, in advance (> one day), repeating (on regular basis);
- timetable: how flexible is the timetable? Categories: on demand, fixed, mixed (i.e. on demand at fixed times);
- route flexibility: how flexible is the route? Categories: Fixed route, fixed route with possible deviations (i.e. within a corridor), fully flexible;
- routing pattern: where are users picked-up/dropped-off? Categories: one to one, one to many/many to one, many to many;
- vehicle size: what size of vehicle should be used? Categories: car, minibus/van, bus;
- price: what is the price for the user? Categories: free/discounted, paid/standard, paid/premium;
- financing: how is the service financed? Categories: subsidized, partly subsidized, commercial;
- performance objectives: what kind of goal is the service meant to achieve? Categories: economic, social, environmental;
- level of demand: what is the expected or measured level of demand (total passenger trips / total vehicle hours x trip length)? Categories: very low/less than 10, low/between 10 and 20, medium/between 20 and 50, high/greater than 50.

Subsequently, the relevance of each of the above-mentioned criteria and category was assessed for each of the four stakeholders' territories. In so doing, conditions were set for a pre-assessment, to check the fit of each solution in relation to the specific operational conditions of each of the stakeholder territories. As far as the operational level is concerned, also the relevance of some non-material and cross-cutting actions (digital platforms, territorial mobility management and dematerialization of services) was assessed for each case study, taking into consideration also the territorial level at which they would best be implemented, and possible criticalities and barriers in terms of resources, digital coverage and know how).

Beside the operational conditions, the analysis had shown that each of the four case study territory presents a set of challenges hampering accessibility and urban-rural connectivity. Building on the framework proposed by Davison et al. (2012, 2014), these challenges were divided in two macro groups (specific and general), each further characterised by sub-themes (market, consumers perceptions, stakeholders, policy and government, economic, sociocultural and technological features). Building on this conceptualization, the identification of the specific and general challenges that characterise the four territories at stake has allowed for the identification, for each of them, of two additional sets recommendations. Specific and general recommendations are meant to reduce the barriers that currently hamper the implementation of measures to improve accessibility and urban-rural connectivity.

Such recommendations were then further discussed with the stakeholders, in order to assess their actual priority and complexity in the respective territories. Combining the priority and the complexity of each recommendation, their deliverability was assessed on a scale of four (high, medium-high, medium-low, low).

Finally, each case study was provided with both detailed descriptions and summary tables showing the operational conditions, specific and general challenges which feature its territory, as well as operational, specific and general recommendations.

To fulfil the project's goal of providing recommendations for EU non-metropolitan regions, a comparative synoptic evaluation of the recommendations for the case studies was made, and the operational features of each of the identified transport actions, as well as the actual transferability of the suggestions aimed at solving the identified specific and general challenges were presented.

This policy toolkit supported the process of co-definition of recommendations for the case studies, and will serve not only to guide the action of local stakeholders, but also to set the ground for a proactive dialogue with the upper-tier administrations who are responsible for planning and providing the transport offer.

Application to the URRUC case-studies

Recommendations for each of the case studies were structured according to the structure described in the previous paragraph. The following subparagraphs summarize the selected operational specific and general recommendations for each case study, showing for each recommendation the priority, complexity and rate of deliverability.

CREAMA - Consortium for the Economic Recovery of Marina Alta

Table 1. Marina Alta. Synthesis of operational, specific and general recommendations

	Recommendation	Priority	Complexity	Deliverability
OPERATIONAL	Village minibus (mixed use)			
	Social transport			
	Bus on demand			
	Ride sharing			
	Service delivery			
	Railway			
SPECIFIC	Careful analysis of the real users' needs			
	Win the trust of commuters			
	On time, regular and accessible PT			
	Strengthen a PT friendly culture			

	Flexibility in transport and service provision				
GENERAL	More compact urban development model				
	More incisive and concertized planning				
	More flexible legislation				
	Horizontal and vertical cooperation				
	More funding				
	Better access to public transport				
LEGEND					
Priority		High	Medium-high	Medium-low	Low
Complexity		Low	Medium-low	Medium-high	High
Deliverability		High	Medium-high	Medium-low	Low

Scarborough Borough Council

Table 2. Scarborough. Synthesis of operational, specific and general recommendations

	Recommendation	**Priority**	**Complexity**	**Deliverability**
OPERATIONAL	Village minibus			
	Social transport			
	Shuttle van			
	Feeder			
	Digital platforms			
	Territorial mobility management			
	Dematerialisation of services			
	Structural improvements (road expansion)			
	Cycle paths			
SPECIFIC	Education travel for tertiary level users			
	Recognition of value of tourism for transport			
	Increase resource capacity for transport			
	Devolve local taxation			
GEN.	More streamlined planning processes			
	Continue support to business and education			
LEGEND				
Priority	High	Medium-high	Medium-low	Low
Complexity	Low	Medium-low	Medium-high	High
Deliverability	High	Medium-high	Medium-low	Low

Valle Arroscia

Table 3. Valle Arroscia. Synthesis of operational, specific and general recommendations

	Recommendation	Priority	Complexity	Deliverability
OPERATIONAL	Feeder			
	Bus on demand			
	Car and ride sharing			
	Service delivery			
	Smart ticketing / digital platforms			
	Territorial mobility management			
	Dematerialisation of services			
	Intermodal passenger transport			
SPECIFIC	Moderate degree of flexibility			
	Target policies to various users			
	Transport services for tourism			
	Transport consortium			
GENERAL	Legislative framework			
	Interaction among layers and sectors			
	Reverse marginalisation processes			
	Bridge the digital divide			

LEGEND				
Priority	High	Medium-high	Medium-low	Low
Complexity	Low	Medium-low	Medium-high	High
Deliverability	High	Medium-high	Medium-low	Low

Västerbotten

Table 4. Västerbotten. Synthesis of operational, specific and general recommendations

	Recommendation	Priority	Complexity	Deliverability
OPERATIONAL	Transport on demand (bus or car)			
	Redesigning the bus layout			
	Intermodal parking facilities			
	Dematerialisation of services			
SPECIFIC	Combining service and good delivery with passenger transport			
	More funds for pilot transport projects			
	Workplaces as strategic partners			
GEN.	More support for rural areas			
	Beyond administrative borders			

LEGEND				
Priority	High	Medium-high	Medium-low	Low
Complexity	Low	Medium-low	Medium-high	High
Deliverability	High	Medium-high	Medium-low	Low

Comparative analysis and recommendations for EU non-metropolitan regions

As mentioned in the previous paragraphs, one of the goals of the URRUC project was to provide recommendations non only for the case studies, but also for those EU non-metropolitan regions with similar characteristics and challenges to the four stakeholders' territories.

To this aim, the challenges and recommendations for the four case studies were compared and clustered into a smaller set of recommendations, based on the affinity among recommendations made by different case studies. Table 5 is a synoptic representation of the recommendations made for the case studies, highlighting their priority for each case. It sets the ground for the definition of recommendations for EU non-metropolitan regions, as a result of the inductive-deductive approach described above.

As far as alternatives to the private car are concerned, recommended alternatives were picked among the 11 possible solutions that were previously defined[1]. Similarly, the non-material and digital solutions that were recommended refer to three common clusters that are the same for all the case studies (digital platforms, mobility management and dematerialization of services). For such recommendations the synoptic representation shows the recurrence and priority in each of the case studies. A more varied frame emerged from the structural interventions (which are very context-dependent and differ in each case study) and specific and general recommendations. Hence, such recommendations were clustered: the 16 specific recommendations that emerged from the case studies were reduced to 7 clusters, and the 14 general recommendations were reduced to 5 (Table 5).

Table 5. Synoptic representation of the recommendations for the case studies

	Recommendation	Marina Alta	Scarborough	V. Arroscia	Västerbotten
OPERATIONAL	Bus on demand / call cars				
	Village minibus				
	Feeder				
	Shuttle van				
	Car and ride sharing				
	Social transport				
	Service delivery				
	Digital platforms				
	Mobility management				
	Dematerialisation of services				
	Structural interventions				
SPECIFIC	Careful analysis of users' needs				
	Targeted policies (various users)				
	Strengthen PT-friendly culture				
	Mixed use of transport services				
	Strengthen local skills and roles				
	More funds for transport				

[1] Namely: bus on demand, car clubs, car sharing, feeder, ride-sharing, service delivery, shuttle van, social transport, taxis and shared taxicabs, village minibus.

	projects				
	More importance to tourism				
GENERAL	Governance (horizontal, vertical)				
	Flexibility (rules and processes)				
	Compact urban development				
	Reverse marginalisation				
	Bridge the digital divide				
LEGEND					
Priority		High	Medium-high	Medium-low	Low

Recommendations listed in Table 5, which are fully described in Annex VIII of the final report of the URRUC project (ESPON and Coventry University, forthcoming-c), provide an insight on similarities and peculiarities of the four case studies, as well as a list of suggestions for EU non-metropolitan regions facing issues of urban-rural connectivity.

Conclusion

The proposed contribution presented the results of the project ESPON URRUC, aiming at developing recommendations towards better accessibility and connectivity in four non-metropolitan regions in Europe and, more in general, in all territories, sharing similar characteristics to those under scrutiny in the project.

It did so by explaining the methodology adopted by the project to develop these guidelines and recommendations, i.e. a preliminary policy toolkit that should help local public authorities in formulating decisions on the matter. Rather than resembling quantitative decision support systems and models, the proposed toolkit focuses on the interaction between stakeholders and on the joint identification of operational conditions and specific and general challenges and frame, and often constrain, urban-rural connectivity issues. On this basis, it guides stakeholders in the process of "weighting" the various potential solutions vis-à-vis the identified conditions and challenges, in so doing allowing them to assess their priority and complexity, and eventually their deliverability.

Whereas the proposed list of suggestions deriving from the application of the toolkit to a territory is far from being exhaustive, its objective is to stimulate policy and decision makers in EU non-metropolitan regions to think in innovative terms about transport and connectivity challenges and potentials that characterise their territories.

The toolkit helped stakeholders to realize that before designing operational solutions, it is necessary to act on the underlying preconditions for improving accessibility of rural areas. Issues of governance, legislation and sociocultural aspects revealed to be strong barriers, that would thwart any attempt to provide alternative services. Hence, before trying to provide alternative services it is necessary to reflect on such preconditions.

As mentioned above, the policy toolkit presented in this paper is to be considered as a preliminary work, which has been tested only in the four case-study areas. Dialogue with the stakeholders helped to identify possible improvements, and more research is needed, i.e. to consolidate the weight assignment system, to test the toolbox in other territorial contexts and to refine the methodology accordingly.

Acknowledgements

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‘Sticky Flows’ and ‘Productive Frictions’: Untangling the Mechanisms of Street Urbanism

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Abstract: Streets are the ultimate ‘places of movement.’ Adopting a mobility perspective on street urbanism, this paper analyzes how the interaction of movement, places, and people explains the range of activities and socioeconomic opportunities supported by the streets of Ho Chi Minh City (Vietnam). The context is one of a tangible transition from motorbike to car mobility. This paper aims at identifying mobility-specific mechanisms through which a mobility transition brings about socio-spatial change. Mixed methods served to analyze data collected through participant observations, video recordings of street life, and interviews with street users. The results show a consubstantial relationship between today’s dominant motorbike mobility and vibrant street activity. In contrast, car mobility is negatively correlated with street life. Motorbike mobility is characterized as a ‘sticky flow’ – low speed, thickness, and propensity to seep in and out of the curb. It is argued that such flow is conducive to ‘productive frictions’ between movement and the built environment. By connecting people on the move and people in places, these frictions play a significant role in the production of streets as integrative spaces of opportunities. The mobility transition in HCMC is one towards fewer and fewer points of productive frictions in the urban space.

Keywords: Mobility, Street Urbanism, Ho Chi Minh City

Introduction

Ho Chi Minh City (HCMC), the economic engine of Vietnam, has a rather unique *‘transportation signature,’* or *‘mobility image*:*’* there are about as many motorbikes sharing the road (8.5 million) as there are people living in the city (H.K. Kim, 2017). On average, every household owns two of these light, small, and quite affordable vehicles[1] that provide the flexibility of a bicycle coupled with the comfort of motorized transportation (Truitt, 2008). The fact that the vast majority of the population (83% in 2014) relies on this transportation mode for all mobility needs (JICA, 2016) gives the city’s streets and other public spaces a rather fast pulse, an active feel, that some may describe as loud and relentless. The mobility image of the city was radically different less than three decades ago, when the picture of any busy street or intersection would include many more bicycles than motorbikes. Like other Asian cities, most trips were non-motorized at the time (Replogle, 1992: Tiwari, 2002), the main reason

[1] The typical vehicle is either a semi-automatic motorbike or an automatic scooter. The engine capacity usually is either 110 or 125 cc.

being that years of war and restrictions under communist rule had left the population unable to afford anything else.

As for the city of tomorrow, there are signs indicating a possible transition towards either cars, transit, or both, as the dominant forms of mobility. After three decades of market economy, the emergent middle class has been increasingly tempted with the comfort, safety, and symbolic status they can now afford through automobile ownership (A. Hansen, 2017; Thu, 2016; Tuan, 2015). The number of private cars remains low compared to motorbikes. In 2017, there were one million cars registered in the city (H. K. Kim, 2017). Automobile ownership is growing at an alarming rate (15% per year since 2014 according to Hansen, 2017), which significantly contributes to traffic fatalities, pollution, and congestion. Cars now fill up entire lanes in certain places at peak hour, they generally occupy a disproportionate share of road space, forcing motorbikes to squeeze in the leftover road space. Meanwhile, public policies have been paving the way for more cars on the roads; the local government is considering a complete ban on motorbikes in the city center by 2030. The rationale is that motorbikes should soon become a thing of the past. By then, public transit should have become a viable alternative for the carless. This is assuming that the rail transit network continues to expand at a faster pace than the first metro line, supposedly about to open in 2020, but nearly one decade behind schedule. Nevertheless, whether it is towards the car, transit, or both, what societal changes will the shift away from motorbike mobility entail?

Minute observations of street urbanism dynamics, of the micro social and spatial arrangements unfolding on the streets, can help anticipate the larger societal transformations led by a mobility transition. The street is where mobility problematics meet public sphere challenges. The objective is to first gain an understanding of the ways in which present mobility practices explain everyday social interactions, and long-term social integration, or lack thereof. I do so in HCMC drawing on five months of fieldwork, including participant observations, systematic video recordings of street life, in-depth interviews with urban dwellers about their mobility practices, with informal street vendors and conventional store owners about their business activities. I develop a theoretical framework that elaborates on Henri Lefebvre's theory of the social production of space. I adopt an ecological approach to the street environment in order to grapple with the complex interactions between its two major functions, as traffic corridor and public space.

I argue that the nature of movement through urban space influences both short-term social interactions on the streets and long-term socioeconomic integration in the city. In HCMC today, I first highlight some significant correlations between mobility practices and street activity. Then I shed light on the ways in which the dominant motorbike flow, an offspring of bicycle mobility, explains the vibrant street life typical of HCMC's public spaces. I qualify motorbike traffic as a *'sticky flow'* because of its propensity to irrigate the banks of the roadbed. Furthermore, I demonstrate that a mechanism of *'productive friction'* between such sticky flow and the built environment produces both social interactions on the streets and economic opportunities to live off the connection to the street. At the core of the lived space of urban mobility, productive frictions bring together people 'on the move' and people 'in places'. The mobility transition from motorbikes to cars in the case of HCMC for example can then be interpreted as a shift towards a less sticky flow traversing the urban space, therefore leading to fewer opportunities for productive frictions, in other words to a growing disconnect between people's trajectories, both literally as they move in the city, and figuratively as they proceed in life.

Literature Review

1) 'Mobility Transition' Research Agenda and 'New Mobilities' Paradigm

In a recent effort to theorize 'mobility transitions', Temenos, Nikolaeva, Schwanen et al. (2017) define the concept as a process, a shift from one 'particular moment of assembled technologies, infrastructures, societies, and economies' to another. They ask: 'What kind of societal changes will this entail?' Geels' (2002) multi-level perspective on socio-technical transformations has driven the mobility transition research agenda. The multi-level perspective is concerned with the interactions between technology, industrial innovation, market mechanisms, policy, culture, and civil society. The normative imperative of environmental sustainability has been the primary motivation for the multi-level framework. As a result, existing studies applied in the transportation sector focus on transitions away from automobile dependence, towards low- to no-carbon societies, in places like the Netherlands or the United Kingdom (Geels, 2012). The 'Mobility Transition' research agenda has yet to embrace the question of the societal changes entailed by transitions that occur in reverse, away from sustainability, towards automobile dependence. Most countries of the developing world are experiencing such transitions (e.g. Kenworthy, 2011). Globally, the total vehicle stock has been projected to grow from 800 million in 2002 to over 2 billion units in 2030, with the bulk of the increase taking place in emerging economies; China's increase will have been nearly twentyfold for example (Dargay, Gately and Sommer, 2007). To complicate the matter, several transitions may be occurring concomitantly in such contexts, towards both sustainable and carbon-based mobilities (Jones, 2016), like it is the case in Vietnam, against a backdrop of rapid urban and economic development. Yet, little is known about non-Western mobilities in general, Asian mobilities in particular (Cresswell, 2016), and none of the existing studies adopt a new mobilities perspective (e.g. Cervero, 2013; Cervero & Golub, 2007; Mateo-Babiano & Ieda, 2007; 2009).

The 'new mobilities' paradigm, on which the 'mobility transition' research agenda draws substantively, has marked a mobile turn in the social sciences (Sheller & Urry, 2006). It followed on earlier work concerned with the structuring effect of the automobile on societies (Sheller & Urry, 2000; Urry, 2000). Mobility is considered meaningful, as opposed to being thought of as an abstract line between two points on a map, a derived demand from the need to reach destinations, as it is usually the case in transportation research. It is conceived as an 'entanglement of movement, representation, and practice' (Cresswell, 2010). Mobility is a sensual and social experience, and therefore should be considered from the perspective of the people on the move, not that of the locations in which movement lands. The 'new mobilities' paradigm therefore advances a mobile ontology to explore social phenomena, arguing that after the spatial turn of the 1980s, as initiated by Soja (1980) in particular, the social sciences have remained static and location-based in their way of addressing dynamics of exclusion. In her latest book *Mobility Justice*, Sheller (2018) makes the case that by focusing on the spatial distribution of transportation resources, costs, and opportunities, studies on destination accessibility and environmental justice have failed to consider the injustices rooted in uneven mobilities. Mobilities are uneven at all levels, and all levels are interconnected, from everyday bodily moves constrained by individual capabilities, gender, sexual and racial circumstances, to cross-country migrations bound by international relations and climate change. Sheller demonstrates how a mobile ontology helps explain power dynamics in the contemporary world. Nevertheless, the sustained effort to supersede a spatial perspective in mobility research has led to a situation where *places* now tend to be overlooked. It seems important to bring the focus back on the social production of 'places of movement' (Sheller & Urry,

2006) as originally conceived in mobility research, as part of a dynamic relationship between movement, space, and people (Cresswell 2006; 2016).

2) Street Urbanism from a Mobility Perspective

Urban streets are the ultimate 'places of movement.' Yet, scholars interested in street urbanism have been most concerned about its function as public space than its other defining feature as the stage of mobility. Public space is civic by nature, it is the physical space of the abstract notions of civility and public realm. It is 'the common ground […] that binds a community' through a common sense of belonging, not only to a place, but also to a group (Carr, Francis, Rivlin, & Stone, 1992). Streets have been posited as the 'quintessential public space' (Mehta, 2013)—Kostof went as far as to claim '[t]he only legitimacy of the street is as public space. Without it, there is no city' (Kostof & Castillo, 1992, p. 194). Sidewalks, a contested space, are the 'most important and the most overlooked public space' (Kim, 2015). Regulating sidewalk uses is an exclusive practice, it is a way of controlling who has access to public space (Blomley, 2007). In their study of the homeless of New York whose livelihood depends on sidewalk access, Duneier and Carter's (1999) depicted the sidewalk as a space that 'reveals today's urban life in all its complexity: its vitality, its conflicts between class and race, and its surprising opportunities for empathy among strangers.' Both in the global North and in the global South, the act of vending on sidewalks is instrumental to migrants' social and economic integration in the city (Bell & Loukaitou-Sideris, 2014; Donovan, 2008; Eidse, Turner, & Oswin, 2016; A. M. Kim, 2015). The major difference is regulation. Western streets are known for being more regulated than Asian streets for example, where the culture of the street has often been depicted as one of great social and economic diversity, where the space is used for private, public, and domestic uses alike: vending, meeting, squatting, gossiping, eating, exercising, and so forth (Edensor, 1998; Drummond, 2000; Kim, 2015; Mateo-Babiano, 2009; Mateo-Babiano & Ieda, 2010).

However, the modernization of transportation infrastructure might be signing the "death of the street" (Holston, 1989), by systematically giving priority to traffic flows over public life. Focusing on their function as infrastructure (Ehrenfeucht & Loukaitou-Sideris, 2010), modern planning practices aim at regulating and controlling the streets in ways that bring order (Scott, 1998) to a complex, seemingly 'messy' environment (Hou & Chalana, 2016), in ways that clarify the blurry boundaries between public and private space, between movement and non-movement. Such efforts are occurring in HCMC, as attested by repeated sidewalk clearing campaigns justified by a need to give sidewalks back to pedestrians, street widening projects and parking investments motivated by a need to tackle congestion (Gibert, 2018; Nguyen et al., 2015). The death of HCMC's street may be around the corner. Harms (2009) has already documented the retreat of street life into airconditioned private spaces in what used to be an active public space filled with people sitting outside coffee shops. The paradox is that if civic life as it unfolds in public space where to slowly disintegrate, it would be in the name of a 'civilizing process' (Harms, 2009).

HCMC has long been known for its vibrant street life. Streets and sidewalks have been described as an extension of people's living space—their house or their store—and characterized by a blurry boundary between public and private uses (Drummond, 2000; Mateo-Babiano and Ieda, 2007). Like other Asian cities such as Bandung, Bangkok or Manila, non-movement has precedence over movement on HCMC's sidewalks (Mateo-Babiano, 2010). At any time of the day people will be eating, exercising, praying, selling or buying goods on the sidewalks. On the streets she surveyed in HCMC, Kim (2015,

p. 103) found that most of the sidewalk space that is not reserved for pedestrian movement is used for motorbike parking (42%), followed by merchandise spillover from conventional stores (26%), leisure (13%), outdoor sitting from restaurants and informal food vendors (12%), and other uses such as motorbike taxis and services. The extensive network of narrow streets and alleys is another indigenous feature of HCMC. The city shares many built environment characteristics with other places of the developing world, including a high density, and a mostly non-gridded and poorly hierarchized street network (Cervero, 2013). Alleyways serve the densest neighborhoods in the city (more than 80% of the urban population lives in the maze of alleyways) and are used alternatively for access to private residences, as people's back kitchen, outdoor business, or other private activities, or for socializing. Totaling to the city's largest public space (85% of the street network), narrow alleyways are being progressively upgraded and modernized to give priority to traffic over other uses (Gibert, 2018). In sum, urban scholars have thoroughly documented the richness of HCMC's street life, but have internalized a dichotomy between the two functions of the streets, as spaces of mobility on the one hand and spaces of activity on the other.

More generally, the normative idea that streets should be 'for the people,' and not 'for cars,' is at the core of western-based discourses on street design and urbanism, sustainable mobility, and accessibility (Cervero, Guerra, and Al, 2017; Jacobs, 1958; Tiwari, 2017; Wallström, 2007). Such premise has crystallized an antagonism between motorized traffic and street life, between private mobility and inclusive public spaces. On the contrary, non-motorized transportation and public transit are commonly associated with more vibrant urbanisms (e.g. Calthorpe, 1993; Ewing et al., 2013; Mehta, 2008). Pedestrian counts are typically used as a proxy for measuring street life and the vibrancy of public spaces (Gehl & Svarre, 2013; Whyte, 1980). Over the last decade a growing number of studies has explored the relationships between streetscape characteristics and pedestrian activity (e.g. Boarnet et al., 2011; Ewing & Handy, 2009; Ewing, 2016; McDonald et al., 2018), and have typically found a positive and significant relationship between street activity and walkability. In many regards, HCMC appears as a counterexample. A city that is not particularly walkable, in part due to the weather (hot and humid year round), in part because the sidewalks are so busy, where only 1% of the population typically travels on foot as a result, where transit is on the way but not developed yet, and where 83% of all trips use a private motorized transportation mode (JICA, 2016), still supports a particularly rich, vibrant, and active street life. This apparently idiosyncratic case, and yet similar to many other cities of the developing world, suggests that urban design scholars may want to pay more attention to the ways in which different forms of mobility contribute to shaping and preserving the street as 'quintessential public space.'

Conceptual Framework and Research Questions

I propose to look at HCMC's streets as 'places of movement,' from an ecological perspective. By focusing on Asian street spaces known for a blurry boundary between movement and non-movement, I bring to the fore a core idea of the 'new mobilities' paradigm, according to which there is no substantial difference between travel and activities. 'Activities occur while on the move' thus producing and reproducing places (Sheller & Urry, 2006). A similar idea was previously developed by French transportation planner Georges Amar (1993) in his article promoting an ecological approach to transportation systems. He argued that there is a consubstantial relationship between movement and the built environment, that the type of movement traversing space informs the diversity of land uses and social encounters, and reciprocally. He proposed a typology of 'urban transportation ecologies' based

on the extent to which movement 'adheres' (sticks) to the built environment. Typically, walking is the type of movement with the highest level of *adhérence*, whereas airplane travel only 'lands' in 'places' but is otherwise disconnected from the built environment. It is the level of 'adherence' that makes the difference between a street and a highway. In practice, Amar made land use and transportation planners responsible for organizing human movement and encounters as one system, as opposed to a system of connections between locations. Borrowing from natural ecology, he defined the planning goal as a 'climax' of optimal diversity of movements associated with an optimal diversity of human encounters.

Henri Lefebvre's (1974) spatial production theory inspires a framework to analyze urban transportation ecologies as the 'lived space of urban mobility', in relation with broader process of socio-spatial change. Lefebvre defined space in general, and the urban space in particular, as both socially produced and means of social reproduction, through dialectical relationships between the *conceived space* of planners and technocrats, the order they impose through abstract signs and codes (p. 43); the *perceived space* or dominated space that people experience through the senses without contesting it, the stage of all moves and activities, such as the movements between work, private life, and leisure (p. 48); and the *lived space* that users, artists, and philosophers appropriate through resistance to or contestations of dominant representations of space (conceived space). In this paper, I draw on Lefebvre's socio-spatial theory to analyze the dialectical relationships between the lived space and the conceived space of urban mobility. I focus in particular on the everyday tactics through which people appropriate and at times contest an imposed order through urban design and planning regulation of the street space. I relate this dialectic as it unfolds in everyday life to its equivalent at the level of broader processes of socio-technical transformations. The mobility transition is conceived as dialectical relationship between planners' conceptions of movement in the city of tomorrow, and people's lived experience of the transition.

Therefore, adopting an ecological perspective on HCMC's streets, I propose to explore how the interaction of movement, people, and places, influence not only street life and public interactions, but also socio-spatial transformations. More specifically, this paper addresses the three following research questions:

- In HCMC. to what extent does street activity depend on the nature of transportation flows traversing the street space?
- What are the mechanisms explaining the relationship between transportation flows and street activity?
- How do these mechanisms inform the socio-spatial transformations that the mobility transition brings about?

Methods

1) Data collection

I answer these questions using a range of quantitative and qualitative methods, drawing on data collected during five months of fieldwork (August-December 2018). In addition to participant observations of street life, I conducted 32 structured interviews in Vietnamese with people of different socioeconomic backgrounds about their mobility practices and life trajectories; 36 non-structured interviews with street vendors and conventional retailers; and 200 systematic recordings of traffic flows

(traffic videos) and street activity (side videos) on 19 different street segments. More information about the data collection protocol is provided in Appendix 1.

2) Measurements

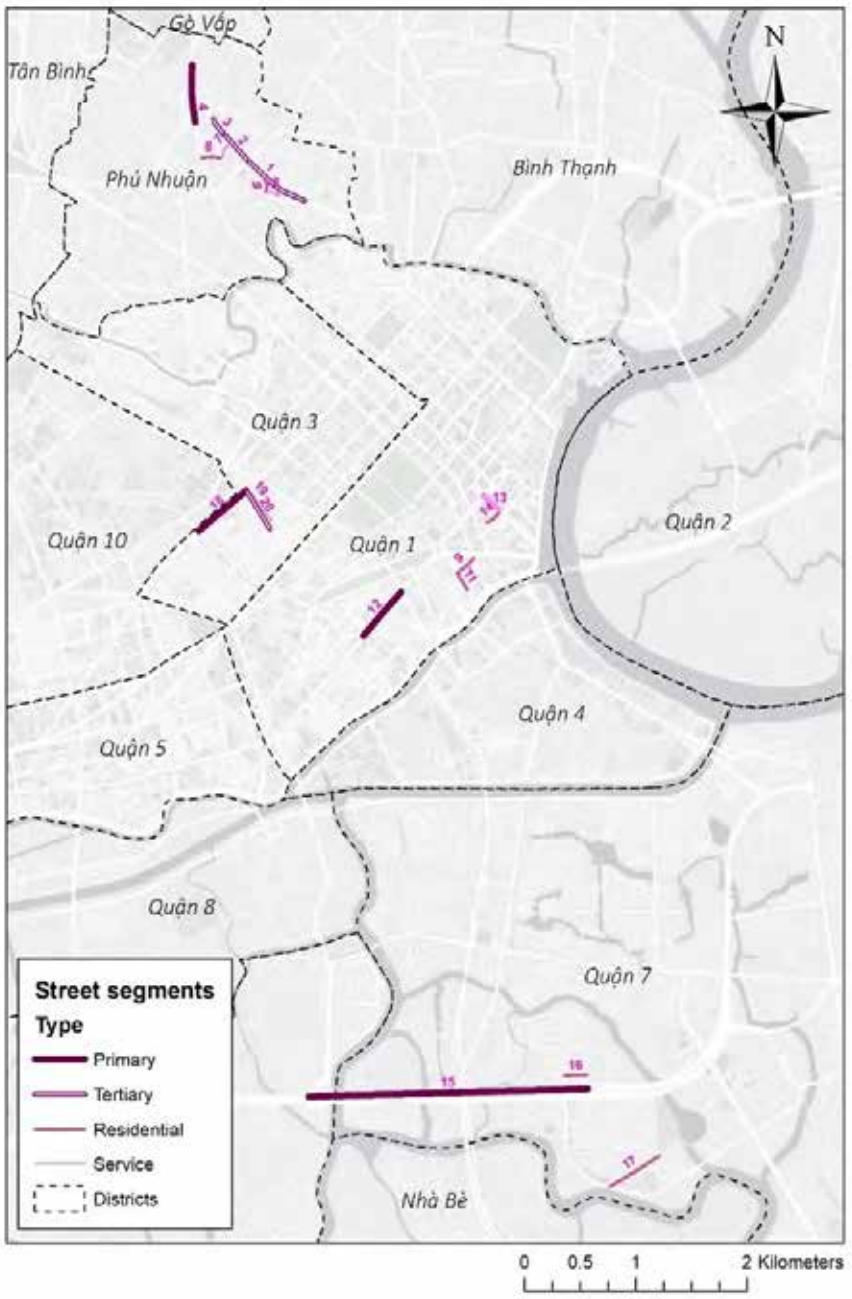
The map in Figure 1 shows the 19 streets on which observations were made. On the map, the streets are classified as per OpenStreetMap typology, but another classification was used for the analysis. Type '1+1' corresponds to two-way streets with one lane in each direction; 'Type 2+2' to streets with two lanes in each direction; 'One-way' streets, 'Market' and 'Alleyways' are self-explanatory; 'Segregated' streets have hard medians separating different traffic flows (typically, cars and trucks do not have access to outside lanes). The unit of observation is a 'street segment,' each observation including the ground-floor of the buildings, the sidewalk in front, and the traffic lanes between curb and median. In other words, when a two-way street was observed on both sides, each side counted as one observation. Segregated streets led to two observations per side (one for the inside lane[s], and one for the outside lane[s] with adjacent sidewalk and property line). An exception was made for alleyways, where properties on both sides and traffic in both directions were counted as part of the same observation. Pedestrian street Nguyễn Huệ was excluded from the analysis conducted in this paper, as well as Hẻm 440 Nguyễn Kiệm as it did not fall in any of the categories described above.[2] All street segments in District 3 were missing the 12:00PM observations. A total of 163 observations were included in the analysis (see Table 1).

With the support of a Vietnamese research assistant, a methodology was developed to count and classify all the street uses present on the video recordings. The same research assistant was responsible for all the counting, first under the supervision of the lead researcher, then alone, in order to avoid inter-rater reliability issues. The 5-step counting methodology is described in detail in Appendix 2.

Table 1 – Frequency of street observations by district and by type

Street type	**District 1**		**District 3**		**District 7**		**Phu Nhuan**		**Total**	
	Streets	*Obs*	Streets	*Obs*	Streets	*Obs*	Streets	*Obs*	Streets	*Obs*
1+1	2	*24*	1	*10*	2	*18*	1	*12*	**6**	***64***
2+2	0	*0*	0	*0*	0	*0*	1	*12*	**1**	***12***
Alleyways	0	*0*	1	*5*	0	*0*	3	*18*	**4**	***23***
Market	0	*0*	0	*0*	0	*0*	1	*6*	**1**	***6***
One-way	0	*0*	1	*10*	0	*0*	1	*12*	**2**	***22***
Segregated (inside)	1	*12*	0	*0*	1	*6*	0	*0*	**2**	***18***
Segregated (outside)	-	*12*	0	*0*	-	*6*	0	*0*	**-**	***18***
Total	**3**	***48***	**3**	***25***	**3**	***30***	**7**	***60***	**16**	***163***

[2] It is an alleyway in the city's nomenclature but it is too large and too busy to fall in the same category as other alleyways, but too residential to be considered with other '1+1' streets.



NAMES
1. Phan Xích Long (1)
2. Phan Xích Long (2)
3. Chợ Nguyễn Đình Chiểu
4. Nguyễn Kiệm
5. Hẻm 257 Phan Xích Long (1)
6. Hẻm 293 Phan Xích Long (1)
7. Hẻm 419 Phan Xích Long (2)
8. Hẻm 440 Nguyễn Kiệm
9. Nguyễn Thái Bình
11. Phó Đức Chính
12. Trần Hưng Đạo
13. Nguyễn Huệ
14. Tôn Thất Thiệp
15. Nguyễn Văn Linh
16. Đường số 6
17. Tôn Dật Tiên
18. Điện Biên Phủ
19. Nguyễn Thượng Hiền
20. Hẻm 419 Điện Biên Phủ

TYPES
1. Type 2+2
2. Type 1+1
3. Market
4. One-way
5. Alleyway
6. Alleyway
7. Alleyway
8. Unknown
9. Type 1+1
11. Type 1+1
12. Segregated
13. Pedestrian
14. Type 1+1
15. Segregated
16. Type 1+1
17. Type 1+1
18. One-way
19. Type 1+1
20. Alleyway

Figure 1 – Surveyed Street Segments

3) Analysis

The development of the measurement strategy led to a typology of street uses along the spectrum from movement to activity, and the definition of corresponding variables. The video data was used to calculate some descriptive statistics by type of street and by district. Several *t*-tests were ran to compare the statistical significance of the difference in means of key variables between a type of streets and the whole sample for example (one-way *t*-tests) or between two measurements of one construct (paired *t*-tests). Similar statistical analyses were conducted while focusing on one type of streets only (Type '1+1) as a way to control for the type of street and tease out the neighborhood effect. Using this sub-sample

of observations, correlation coefficients were calculated between a selection of built environment-, mobility-, and activity- variables. The interview data on mobility practices served to further explain the relationships identified quantitatively between mobility and activity variables. Photographs of street activity and the interview data from street vendors and retailers mostly served triangulation purposes to ensure the validity of the results.

4) Limitations

The measurement strategy has some limitations. Due to resource constraints, both side and traffic videos were recorded by the same person in most cases, not simultaneously but consecutively (traffic video immediately after the side video). This means a risk of double counting, as a person sitting on the sidewalk at the time of the side video recording could have been counted as stationary, but then also on the move on the traffic video if she happened to leave in the meantime and pass in front of the camera. Another limitation is that the gender of street users was not recorded in the people's counts, which prevents any gender interpretation of the results. Finally, when building the database, the traffic counts were converted into motorbike-equivalent units using Cao and Sano's (2012) conversion rates, which were estimated based on traffic observations in Hanoi (Vietnam),[3] but the article did not include a conversion rate for trucks. The bus rate was applied, which is an approximation.

The proposed analytical methods have some limitations as well. First of all, the statistical methods proposed for analyzing the data are quite rudimentary at this stage, focusing mostly on the means of all variables. Further analyses will consider more elaborate modeling techniques (e.g. Poisson regression models), but additional control variables will be needed, relative to the built environment in particular (e.g. population density, sidewalk width). Second, most variables included in the analysis are count variables, which means that correlation coefficients are probably biased due to skewed distributions of the data. Third, there is no elaboration on observed variations between different times of the day. Finally, the video data includes a significant amount of qualitative data that is not analyzed in this paper.

Results

1) Typology of Street Uses

Street uses were classified along a spectrum from movement to activity. Strictly about movement are all the traffic variables, as they correspond to counts of people and vehicles on the move. A sub-set of mobility practices was classified as 'non-compliant tactics.' These include practices such as driving the wrong way, riding on the sidewalk, and walking on the traffic lanes. At the other end of the spectrum are street activity variables that are strictly about static uses. These include variables such as the number of open commercial locations, people hanging out in public space, street vendors. The total count of street vendors was broken down into three categories, including vendors on the sidewalks, vendors on lanes, and motorbike taxis *(xe om)* or cyclos waiting for customers (those on the move were counted as 'motorbike' traffic for motorbike taxis, and 'other' for cyclos). Finally, there is a subset of variables that are neither strictly about movement nor strictly about activity, or both at the same time. Such *'mobility-activity' variables involve mobility means that are temporarily static*. In the case of HCMC,

[3] Car = 3.4 MEU; Bus = 10.5 MEU; Minibus = 8.3 MEU; Bicycle = 1.4 MEU (Cao & Sano; 2012)

typical mobility-activity variables include motorbikes parked on the sidewalks, motorbikes or cars parked in traffic lanes, and *'motobuyers.'* The act of '*motobuying'* designates a common practice in Vietnamese cities where a motorbike rider pauses movement for a short amount of time (less than five minutes in general), puts one foot down on the ground, and without stepping down of the vehicle, makes a purchase to take away from a street vendor, which can be either formal or informal (see Figure 2). In what follows, 'mobility-activity' variables fall under the broader category of street activity.

Figure 2 – 'Motobuyers' purchasing drinks from a street vendor (left) and from a store (right)

2) General Description of Streets, Flows, and Activity

a. Built environment

Most recordings were made on commercial streets and boulevards. On average, the sampled street segments were lined with 15.33 locations per 100 meters. A large majority were commercial locations (68%), followed by housing (21%). The share of commercial locations approached or even exceeded 80% along two-way streets of type '1+1' and '2+2', and along the outside lanes of segregated streets. The share of ground-level housing locations was small on these commercial streets (less than 10%). However, the ratios were inversed in alleyways, where the majority of ground-floor locations were used for housing (76%), followed by commercial (18%). On all types of streets, very few locations were classified as institutional, mixed-use buildings, or parking lots (less than 2% in each category). Finally, the selected street segments were mostly continuous blocks. A negligible share of all locations consisted of intersecting streets (0.3%). A relatively larger share (5%) were entrances of alleyways, but such block discontinuities were nearly inevitable given the density of the network of alleyways in HCMC. See Appendix 3 for a summary of built environment characteristics by type of street.

b. Street flows by type of street segment

Against this backdrop, the transportation flow of all surveyed street segments was largely dominated by motorbikes (see Table 2). A major share of all traffic counts (71%) were motorbikes driving on the lanes. The share approached 90% of all counts on '2+2' streets and on the inside lanes of segregated streets. Only in the market was it lower than average in the market (64%).

Table 2 – Means of movement variables by type of streets

	All	1+1	'2+2'	Alley	One-way	Seg. Outside	Seg. Inside	Market
Traffic counts (/ 5 min)								
Total counts	153,96	76,73	259,58	45,43	508,38	22,94	326,17	113,83
% Motorbikes in lanes	71,0%	73,4%	88,1%	77,2%	76,8%	24,8%	86,4%	64,1%
% Cars in lanes	11,2%	12,7%	7,8%	0,9%	13,0%	26,5%	7,9%	0,9%
% Bikes in lanes	1,9%	2,3%	0,9%	4,1%	0,3%	0,7%	0,7%	3,7%
% Ebikes in lanes	0,2%	0,1%	0,3%	0,1%	0,5%	0,3%	0,2%	0,3%
% Buses in lanes	0,3%	0,4%	0,0%	0,0%	0,3%	0,6%	0,7%	0,0%
% Trucks in lanes	0,9%	0,6%	0,8%	0,0%	1,4%	0,4%	3,6%	0,0%
% Others in lanes	0,4%	0,4%	0,4%	0,7%	0,3%	0,2%	0,3%	0,9%
% Pedestrians on sidewalks	4,7%	4,1%	0,8%	0,0%	1,3%	24,5%	0,0%	0,0%
Sub-total compliant uses	*90,6%*	*94,0%*	*99,1%*	*82,9%*	*93,7%*	*78,0%*	*99,9%*	*69,9%*
% Motorbikes wrong way	3,0%	1,8%	0,1%	0,0%	5,5%	14,6%	0,0%	0,0%
% Car wrong way	0,0%	0,1%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
% Bikes wrong way	0,4%	0,2%	0,1%	0,0%	0,2%	2,3%	0,0%	0,0%
% Motorbikes on sidewalks	0,5%	0,4%	0,4%	0,0%	0,1%	2,5%	0,0%	0,0%
% Bikes on sidewalks	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
% Ebikes on sidewalks	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
% Pestrians in lanes	5,4%	3,4%	0,2%	17,1%	0,5%	2,6%	0,1%	30,1%
Sub-total non-compliant tactics	*9,4%*	*6,0%*	*0,9%*	*17,1%*	*6,3%*	*22,0%*	*0,1%*	*30,1%*
Modal shares (MEU)								
Total MEU (/ 5 min)	196,18	93,24	319,00	41,14	630,17	33,21	497,62	70,03
% Motorbikes MEU	67,9%	62,3%	71,9%	90,2%	61,7%	65,6%	58,0%	87,7%
% Car MEU	22,1%	29,2%	20,9%	3,0%	26,5%	28,1%	18,1%	3,7%
% Bike MEU	2,7%	2,4%	1,1%	6,7%	0,3%	2,3%	0,7%	8,2%
% Ebike MEU	0,2%	0,1%	0,3%	0,1%	0,4%	0,5%	0,2%	0,4%
% Bus MEU	2,0%	2,4%	0,0%	0,0%	2,5%	1,8%	4,9%	0,0%
% Truck MEU	5,0%	3,5%	5,9%	0,0%	8,6%	1,7%	18,1%	0,0%

In terms of modal share, cars represented the second largest share of all traffic counts (11%). Unsurprisingly, the car share was almost negligible in narrow alleyways (less than 1%). The share was equally low in the market, which was not accessible to cars either, not because of width but due to the market activity itself. When converted into MEU, the average car share on all surveyed street segments (22%) turned out to be twice as large as that measured in terms of traffic counts (11%). The results of a paired *t*-test indicated that, at the .05 critical level of statistical significance, the mean MEU car share was significantly higher than that measured as counts, $t(155) = 12.51$, $p = .00$. The difference between the two measurements was of particular importance for '1+1' streets. Compared to all streets, the mean share of cars as proportion of all counts was not significantly different, as shown by the result of a one-way *t*-test, $t(62) = 0.95$, $p = 0.17$. However, the difference in means was significant when car shares were calculated as MEU, $t(62) = 2.55$, $p = .01$. In other words, although the share of cars out of all

moving objects was not particularly higher on this type of streets, the share of road space cars occupied was significantly higher, relative to other transportation modes.

In third and fourth positions in the modal split came the shares of pedestrians walking on the sidewalks (5% of all traffic counts), and that of bicycles riding in lanes (2%). After segregated streets, which had an exceptional share of pedestrians (26%, see below), '1+1' streets appeared to support relatively more pedestrian traffic (4%) than any other type of streets. Naturally, the share of pedestrians walking on sidewalks was null on street segments that did not have a sidewalk, i.e. on alleyways and on the inside lanes of segregated streets. As for bicycle traffic, alleyways and the market were supporting a relatively larger bicycle share than average (4%).

The outside lane(s) of segregated streets appeared to be an exception when looking at the average modal shares. The recorded motorbike share was much smaller than average (25%). The car share was quite high numerically (27%), but the difference in means was not significant at the specified alpha level. Finally, a rather large share of all traffic counts were pedestrians walking on the sidewalk (25%). This most likely due to the fact that one of the street segments of this type—Tran Hung Dao—was located in the heart of the backpacker district of HCMC. On that street, pedestrian counts mostly included tourists, who are generally more likely to walk on the streets than their local users.

People and vehicles engaged in non-compliant mobility tactics represented a total of 9% of all traffic counts. The most common of these tactics consisted in walking in the lanes (7% of all traffic counts). A particularly large share of moving users were counted as such in the market (30%), where sidewalks were too busy to be discernable, and in alleyways (17%) where, if any, sidewalks were not continuous and extremely narrow. The second most common tactic was to ride a motorbike the wrong way (3%). This practice was significantly more prevalent on the outside lanes of segregated streets, where motorbikes driving the wrong way represented 15% of all traffic counts, $t(17) = 3.66$, $p = .00$. The share was numerically higher than average on one-way streets as well (5%), but the difference was not statistically significant. Non-compliant uses were almost inexistent on streets of type '2+2' and on the inside lanes of segregated streets (less than 1%).

c. Street activity by type of street segment

Of all locations recorded along the surveyed street segments, an average of 8.19 per 100 meters of property line were formal commercial locations that were open to customers at 3:00 PM (Table 3). Streets of type '1+1' were the most active type of commercial streets along this variable ($M = 10.81$) and segregated streets the least ($M = 6.02$). Alleyways had even fewer stores open at 3:00 PM ($M = 3.62$), given the large majority of housing locations (see above).

A 'mobility-activity' variable, 'motorbikes parked on sidewalks' outnumbered all other measurements of street activity. All street observations considered, there were nearly 20 parked motorbikes per 100 meters of street segment. The mean number of parked motorbikes was the highest on the sidewalks of segregated streets ($M = 26.57$), followed by '1+1' streets ($M = 25.61$), and '2+2' streets ($M = 23.67$). Of all commercial streets, one-way streets had the fewest motorbikes parked on their sidewalks ($M = 10.64$). In addition, some motorbikes were counted as parked in the traffic lanes. For reasons mentioned above, this practice was most common in alleyways ($M = 5.63$) and in the market ($M = 6.14$), but

motorbike parking in traffic lanes also occurred on '1+1' streets (M = 3.42). In comparison to motorbikes, the average number of parked cars was very small on all streets (M = 1.22).

Table 3 – Means of activity variables by type of street

	All	1+1	2+2	Alley	One-way	Seg. Outside	Seg. Inside	Market
Commercial open at 3:00PM	8,19	10,81	8,25	3,62	9,19	6,02	-	-
Motorbikes parked on sidewalks	19,83	25,61	23,67	1,55	10,64	26,57	-	0,00
Cars parked (street parking)	1,22	2,15	1,12	0,29	0,26	0,43	-	0,00
Total street vendors	2,29	2,41	1,13	0,99	0,98	0,73	-	17,54
- Street vendors on sidewalks	2,07	2,32	0,78	0,25	0,89	0,63	-	17,54
- Street vendors on lane	0,19	0,09	0,19	0,74	0,00	0,10	-	0,00
- Xe om (and cyclo)	0,03	0,01	0,16	0,00	0,09	0,00	-	0,00
People on sidewalks (not walking)	9,27	13,43	9,07	3,97	3,78	7,62	-	0,11
People on lane (not walking)	2,30	0,86	0,80	2,51	0,35	0,86	-	30,81
Motobuyers	0,53	0,35	0,35	0,57	0,22	0,00	-	5,48
Motorbikes parked on lane	3,04	3,42	0,91	5,63	0,91	1,19	-	6,14

The average number (M = 9.27) of people sitting or standing on the sidewalks (not walking) was about half that of parked motorbikes. Moreover, some people were doing the same in the traffic lanes (M = 2.30). Streets of type '1+1' were the most active of all streets along the former variable as well (M = 13.43). Segregated and '2+2' streets were closer to average, whereas the mean was much lower along one-way streets (M = 3.78).

The mean number of street vendors was higher on '1+1' streets (M = 2.41) than almost any other type of street. All streets considered, the mean number of vendors (M = 2.29) included a majority installed on the sidewalks (M = 2.07), few vendors in the traffic lanes (M = 0.19), and very few motorbike taxi drivers or cyclos (M = 0.03). There were no street vendors in the lanes of one-way streets. The market constituted an exception with a much higher number of street vendors (M = 17.54), and also a greater mean number of 'motobuyers' (M = 5.48) than average (M = 0.53). Nevertheless, 'motobuyers' were recorded every 200 meters on average in alleyways (M = 0.57), and every 300 meters approximately on ''1+1'' and '2+2' streets.

3) Street Flow and Street Activity in a 'Modern' Environment

The results presented in this section aim to tease out the Phu My Hung (District 7) effect, where the selected streets were planned according to an ideal of modern city life. The analysis builds on a subset of data (N = 64) that includes only observations made on Type '1+1' streets. This is a way to 'control' for the variations due to street type, while focusing on streets that have appeared so far to be the most active, and where the car effect can be expected to be most tangible. Moreover, '1+1' streets are the only ones for which the distribution of observations enabled a comparison between neighborhood environments. A striking figure when comparing the street flow variables (see Appendix 4) was the very low mean number of all traffic counts on the '1+1' streets surveyed in District 7 (M = 13.94) compared to the average for all such streets (M = 76.73). The motorbike share as proportion of traffic counts (M = 56%) was also much lower than average (M = 73%), and the difference in means was

statistically significant, $t(17) = -3.13$, $p = .00$. In contrast, the car share ($M = 24\%$) was twice as large as average and the difference in means was also statistically significant, $t(17) = 2.64$, $p = .01$. The contrast was even larger with the car share measured in MEU ($M = 49\%$). Streets of District 7 were the only one where the mean car share ($M = 49\%$) was larger than the mean motorbike share ($M = 45\%$). However, neither the mean share of pedestrians on the sidewalks nor that of bicycles riding in lanes were significantly different from those measured on similar streets in more typical districts.

Most street activity variables involving people on the streets had lower means than average on '1+1' streets of District 7. It was the case for the number of commercial locations open at 3:00PM ($M = 7.23$ as opposed to $M = 10.81$); the number of street vendors ($M = .15$ as opposed to $M = 2.40$); the number of people sitting or standing on the sidewalks ($M = 7.50$ as opposed to $M = 13.43$) or in the traffic lanes ($M = .43$ as opposed to $M = .86$); and the number of 'motobuyers' ($M = .06$ as opposed to $M = .34$). The mean numbers of motorbikes parked either on sidewalks or in the lanes were smaller than average. In contrast, the mean number of cars parked next to the curb ($M = 4.51$) was higher than in any other districts.

4) Correlations between Street Flows and Street Activity

Continuing the analysis using the small dataset ('1+1' streets only), this section highlights some correlations between street activity, built environment, and street flow variables (Table 4). The number of sidewalk vendors was more strongly correlated with the number of ground-floor housing locations ($r = 0.50$, $p < .05$) than with that of open commercial locations ($r = 0.31$, $p < .05$). As for the number of street vendors located in the lanes, there was a positive, yet not significant, relationship with the number of housing locations, but no correlation with the number of open stores. The number of motorbikes parked on the sidewalks, however, was strongly and positively correlated with the number of open stores ($r = 0.60$, $p < .05$).

The number of people hanging out (sitting or standing) on the sidewalks was strongly, positively, and significantly correlated with the number of sidewalk vendors ($r = 0.66$, $p < .05$). Similarly, it was strongly correlated with the number of motorbikes parked on the sidewalks ($r = 0.60$, $p < .05$). However, the relationship with the number of open stores was weak and non-significant. The number of *'motobuyers'* was positively correlated with the number of vendors in the lanes ($r = 0.45$, $p < .05$), and that of people in the lanes ($r = 0.38$, $p < .05$). However, the relationship with the number of sidewalk vendors was weak and not significant. It was weak as well, but significant, with the number of open stores ($r = 0.30$, $p < .05$).

P*edestrian traffic* appeared strongly and positively correlated with the number of sidewalk vendors ($r = 0.63$, $p < .05$) and with the number of people hanging out on sidewalks ($r = 0.75$, $p < .05$). Although quite weak and not statistically significant, the relationship between the *motorbike share* and the number of street vendors was positive, both with those on sidewalks and those in the lanes ($r = 0.19$ and $r = 0.20$, respectively, $p > .05$). On the contrary, the *car share* (in MEU) was negatively correlated with the number of street vendors. The relationship was statistically significant with the number of sidewalk vendors ($r = -0.31$, $p < .05$). The signs were negative for all correlations between car share and street activity variables. The relationships between other modal shares and street activity were not statistically significant. Similarly, there were no significant correlations between non-compliant mobility tactics and street activity variables.

Table 4 – Correlation matrix of built environment, street activity, and mobility variables

	Built environment		*Street activity*					*Mobility tactics*			*Parking*	
	1	2	3	4	5	6	7	8	9	10	11	12
Built environment												
1 Stores open	1.0000											
2 Housing (/ 100m)	0.4189*	1.0000										
Street activity												
3 Vendors on sidewalks	0.3092*	0.5031*	1.0000									
4 People on sidewalks	0.2326	0.2379	0.6597*	1.0000								
5 People on lane	-0.0200	0.1229	0.2800*	0.0529	1.0000							
6 Vendors on lane	0.0586	0.1993	0.2737*	0.0215	0.419*	1.0000						
7 Motobuyers	0.2991*	0.3948*	0.2093	-0.0940	0.3838*	0.4450*	1.0000					
Mobility Tactics												
8 Motorbikes wrong way	-0.0238	-0.1243	0.1447	0.2335	0.2236	0.1107	0.0343	1.0000				
9 Bikes wrong way	-0.1196	0.0137	0.0231	0.0611	0.0079	0.0368	-0.1527	0.0837	1.0000			
10 Motos driving on sidewalk	0.1577	-0.1081	0.0399	0.0758	-0.1072	-0.0997	-0.1299	0.1682	0.2378	1.0000		
Parking												
11 Motos parked sidewalk	0.6009*	0.1073	0.3713*	0.5961*	-0.0694	-0.1003	-0.1515	0.0730	0.0718	0.3336*	1.0000	
12 Cars parked	-0.1185	-0.3405*	-0.0673	0.2583*	-0.1650	0.0286	-0.2711*	0.0001	-0.1389	-0.0633	0.1623	1.0000
Modal Shares												
13 Pedestrians (traffic)	0.1430	0.2175	0.6269*	0.7458*	-0.0315	-0.0846	-0.1980	0.0232	0.0962	-0.0065	0.5370*	0.1174
14 MEU Motorbike share	0.2297	0.5367*	0.1901	-0.0018	0.2200	0.1983	0.4140*	-0.0068	-0.0292	-0.0358	-0.0723	-0.4785*
15 MEU Car share	-0.2565*	-0.6053*	-0.3146*	-0.0459	-0.2175	-0.2076	-0.4133*	0.0997	0.0699	-0.0085	0.0650	0.4951*
16 MEU Bike share	-0.0329	0.1397	0.0716	-0.1133	0.0876	0.2205	0.0750	-0.0588	-0.0370	-0.1706	-0.2369	0.0791
17 MEU Ebike share	0.3147*	0.2426	0.0406	-0.1858	0.1234	0.0082	0.0557	0.0097	-0.0882	-0.1217	0.0391	-0.1908
18 MEU Bus share	-0.0781	-0.1096	0.2362	0.0759	-0.0507	-0.1687	-0.1373	-0.0757	-0.0243	0.0708	-0.0576	-0.0119
19 MEU Truck share	0.0704	0.0488	0.0704	0.1350	-0.0719	-0.0084	-0.0407	-0.1575	-0.0588	0.1624	0.1916	0.0523

5) On the Relationships between Everyday Uses of the Streets

The next series of results draws on qualitative data in order to explain the differences in means and correlations highlighted so far. The overall maneuverability of the motorbike seems to provide a crucial explanation for the observed associations between motorbike mobility and street activity. Parking on the sidewalks (or in the traffic lane next to the curb) is the typical preliminary step before entering a store, sitting down at the terrace of a café, or having a noodle soup from a street vendor, hence the strong correlations with commercial activity and street vending. Such parking habit is made possible by the small size, light weight, and little encumbrance of the motorbike (Truitt, 2008), coupled with the fact that the curb is purposely designed as a 45-degree ramp for motorbikes (and bicycles) to step up and down between the roadbed and the sidewalk. Furthermore, the maneuverability of the motorbike is also what makes the act of 'motobuying' possible. When reflecting on their travel diary the day prior of the interview, most motorbike users seemed to conceive such practices neither as full stops nor as complete activities. For example, one respondent started the section of the interview about his activities the day before as follows:

> Interviewer*: 'Let's now talk about the places you went to yesterday'*
> Respondent (a motorbike user): *'Oh, I didn't go anywhere. I only went to work in the morning, and then back home.'*
> Interviewer*: 'On your way to work, did you stop anywhere?'*
> Respondent*: 'No, I didn't stop anywhere'*
> Interviewer*: 'Did you buy anything?'*
> Respondent*: 'Yes, I bought breakfast.'*
> Interviewer: *'How did this happen?'*

While in most places around the world window-shopping on a commercial street gives pedestrians the possibility to make spontaneous stops and purchase decisions; 'sidewalk-shopping' and 'motobuying' are the equivalent for motorbike users in Vietnamese cities. Most respondents who typically commute by motorbike reported such practices being part of their everyday routine. They would 'motobuy' to buy breakfast in particular.[4] A respondent explained: *'[As I drive,] I look. I see what options there are. If I see something I want [to eat], I buy it.'* The transportation mode people use, and whether they make a full stop or not, are decisions they also make on the go. Another respondent described how she has different mobility means associated to different breakfast options (and breakfast places):

> *'There is pho near the apartment building where I live. [If I feel like eating pho], I just walk out of the building and go. Banh gio [a steam rice cake wrapped in banana leave], I buy on the way. Banh cuon [rice paper steamed raviolis], it's also on the way. For vegetarian food [she is vegetarian 10 days a month for religious reasons], it has to be inside a restaurant. So I park.'*

[4] Vietnamese people tend to have quite elaborate breakfasts that they typically do not cook at home. *Pho*, the famous Vietnamese beef noodle soup, is a breakfast favorite for example. It takes eight hours to simmer a flavorful broth and it cannot be cooked in small quantities.

There is in fact a strong co-dependence between street vending, and motorbike mobility. The correlation coefficient was not significant in earlier analysis for reasons most likely related to the fact that all streets had a very large share of motorbike traffic, with very little variation from one observation to another (no effect to pick up). The co-dependence between motorbike mobility and street vending is as real as the one between pedestrian traffic and street vending. Both relationships are most apparent when observing street vendors' tactics as they seek to 'catch' customers. All street vendors interviewed for this study reported that the vast majority of customers reached either by motorbike, or on foot. Street vendors appeared to use different location tactics depending on the type of traffic flow they want to catch. Those who primarily target pedestrians sit low near the ground, facing the sidewalk, and possibly turning their back to traffic, as in vignettes 1 and 2 below (Figure 3). Vignette 3 shows a typical stall targeting 'motorbuyers.' The vendor (not-visible on the picture) is standing behind a stall facing traffic, and the merchandise is at eye level for people on motorbikes. In this case, the stall is in the traffic lane of a narrow alleyway. Finally, vignette 4 shows a specific case where a watch vendor has positioned his stall at ground-level, on the sidewalk, not to catch pedestrians but motorbike users in a particular situation, when they wait at the traffic light (light not visible on the picture). Many formal businesses use similar tactics as informal street vendors to catch the motorbike flow in particular. Some conventionnel cafés for example position a cart similar to the one shown in Vignette 3 right next to the curb in order to catch sell to 'motorbuyers' in additional to seated customers.

Figure 3 – Four street vending location tactics by type of flow

In contrast, car mobility goes against street activity because of its lack of flexibility. Current motorbike users who said they were considering shifting to the car in the near future were asked to reflect on all

the stops they had made the day before (including the quick ones they would not have considered stops outside the interview), and whether these would have been possible had they been going by car. Typically, the first answer would be *'Yes, why not?'* but, admitting they had never thought about this question, they would then correct themselves: *'No, I guess not.'*:

> '*There is nowhere to park near the market [where the interviewee had purchased ingredients from four different sellers the day before, in 'motobuying mode']. I will have to buy everything from Coop.Mart [a supermarket]. There is underground parking.'*

Current automobilists confirmed that their range of options was constrained by their mobility. They almost never buy anything anymore from a street vendor, rarely stop for a coffee on the sidewalk. While it seemed to be a matter of choice for one of the interviewed car users, all others said it was by constraint, because of limited parking options, coupled with the impossibility to stop spontaneously like motorbikes do without seriously disrupting traffic. Nevertheless, they accept the tradeoffs as compared to driving a motorbike, they enjoy being sheltered from the surrounding environment, being protected from the dust, the heat, the rain, and the exhaust fumes, and knowing their children are safer in case of an accident.

Knowing that they cannot catch it, street vendors avoid contact with the automobile flow. This is most evident when observing one-way streets, where traffic regulation requires that motorbikes drive on the right lane(s), cars and other larger vehicles on the left lane(s). Typically, street vendors will be concentrated on the right side of the street. As a robustness check, this hypothesis was tested comparing the counts of street vendors on both sides of the one-way streets included in the sample (Nguyen Kiem and Dien Bien Phu). The result of a *t*-test showed a significant statistical difference for Nguyen Kiem. The result was not significant for Dien Bien Phu, but the surveyed street segment had large hospitals on the left side, which attract street vendors. A left-side street vendor selling *chào* [rice porridge] confirmed that she very never has cars stopping by, and rarely has customers reaching by motorbikes. The vast majority of her customers are relatives of hospital patients who walk out of the hospital to buy lunch for themselves and the patient.

Findings

Two complementary concepts have been identified to further explain the consubstantial relationship between transportation flows and social interactions in HCMC's streets: the 'stickiness' of the motorbike flow and resulting 'productive frictions.'

1) 'Sticky Flows'

Borrowing from Amar's (1993) ecological perspective on transportation flows and the built environment, first of all HCMC's motorbike traffic can qualified as particularly 'sticky.' As per Amar's definition of *adhérence*, the flow is integrated in the built environment. It has its own content and space, it enables spontaneous stops and a number of activities while on the move, it opens up possibilities of improvisations and detours. A high-level *adhérence,* or stickiness, is high, is longitudinal: there is an uninterrupted relationship between movement and the built environment, a consubstantial relationship between movement and what it leads to. On the contrary, when the adherence is punctual, the movement 'sticks' to the built environment only at origins and destinations but it disconnected otherwise. The observations made in this paper invite to qualify motorbike mobility as a 'sticky flow.' Furthermore,

the case of motorbike mobility enabled to identify some mobility-related technicalities to further conceptualized **'sticky flows:' a rather low speed, a certain thickness (or density of users on the move), a propensity to seep through the banks of the road bed, to overflow the built environment, typically the sidewalks, and the direct contact between its participants and the environment through the senses.** Based on this definition—low speed, thickness, propensity to infiltrate, and direct environmental perceptions—pedestrian mobility definitely ranks highest on the stickiness ladder, whereas car mobility falls to the bottom rung.

2) 'Productive Frictions'

Moreover, this study proposes a complementary concept, that of 'productive frictions,' to explain how 'sticky flows' relate to a density and diversity of human interactions in the built environment. The mechanical notion of 'friction' is one of the components in Cresswell's mobility definition. The friction is conceived here as socially produced, and as critical to the production and reproduction of the 'lived space of urban mobility.' Permitted by the resistance of a sticky flow as it traverses the built environment, **'productive frictions' are the interactions between street users 'on the move' and street users 'in place,' thus producing opportunities for social interactions. They necessitate a temporary inversion of movement and non-movement—only when movement pauses do places become activated.** In the case of HCMC, the sticky flow relentlessly rubbing against the banks of the roadbed creates opportunities for strangers and semi-strangers with different socioeconomic backgrounds to remain in constant interaction with each other. They would hardly every meet otherwise. The 'productive frictions' highlighted here are at the core of the symbiotic relationship that exists between motorbike mobility and street activity (Piazzoni and Jamme. Forthcoming 2020). They play a critical role in shaping HCMC's streets as the vibrant public spaces they are. Moreover, they participate in the production of a fertile ground of socio-economic opportunities on the banks of the streets, as sidewalks present possibilities to live off the connection to the street.

3) Mobility Transition and the Social Production of Space

In a rapidly changing context like HCMC, the concept of 'productive frictions' enables to anticipate the socio-spatial transformations that the on-going mobility transition brings about. On the one hand, evidence from Phu My Hung (District 7) and from current car users suggest that HCMC's street spaces will undergo a radical transformation if car mobility is to supersede motorbike mobility. The explanation being the consecutive loss of frictions points in the system of movement. On the other hand, HCMC's streets and sidewalks may remain a vibrant public space if the mobility transition were to turn predominantly towards sustainable mobilities: walking and biking coupled with mass transit. Non-motorized mobilities are even 'stickier' than motorbike mobility in fact, so at least as conducive to the 'productive frictions' and the production of places in the urban space.

These foreseeable consequences associated with different modalities of the mobility transition are not groundbreaking: cars have caused the 'death of the street' in other modernizing cities of the developing world, while car-oriented cities in the Global North know that promoting non-motorized mobilities is key to activating the streets. Nevertheless, the contribution here is an explanation for these assumed processes, a theoretical underpinning to substantiate urban discourses that have internalized a dichotomy between motorized traffic and public sphere. The mechanism that almost inexorably links car mobility and the 'death of the street' can be described as follows: a non-sticky flow becomes the

dominant form of mobility, therefore contact between people on the move and people in places becomes more and more punctual, movement through space loses its spatial production function, the density and diversity of human interactions dwindle, social disintegration ensues. On the contrary, promoting non-motorized mobilities is re-injecting some stickiness in the system, creating friction points.

Conclusion and Discussion

This paper built on a case study of HCMC's street urbanism, where the street network can be thought of as an endless drive-through that people on the move traverse with unlimited options and opportunities to take part in street life. Formal or informal, most street vending places are 'third places' as defined by Oldenburg (1999): places than enable people to stay in touch, to support each other, to develop a sense of belonging to a place and to a group.

I highlighted two mechanisms that help understand how spatial transformations of street urbanisms relate to broader processes of social change led by a mobility transition. The level of 'stickiness' of movement that traverses the urban space informs the possibilities for 'productive frictions' between people, movement, and places, thus shaping opportunities for everyday interactions and long-term opportunities for integration.

Based on this premise, the issue in practice becomes a matter of arranging human movement in the city in ways that care for a diversity of levels of friction in the transportation system, knowing that all forms of mobilities have their own level of friction. The two concepts advanced here invite to planners and urban designers to work with the complexities of multi-modal environments. In places like HCMC that are highly-multi-modal, the goal should not be to simplify the mobility landscape, by banning one form of mobility to force another one through for example; simplifying, one way or another, only leads to creating discontinuities in an existing system of movement. The loss of friction points is a social cost associated with a mobility transition, one that impact societies even more directly than social costs commonly considered: congestion, pollution, and traffic fatalities. Ultimately, as Manuel Castells put it (Castells, 1989, p. 353): *'What we must prevent at all costs is the development of the one-sided logic of the space of flows while we keep up a pretense that the social balance of our cities has been maintained.'*

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Appendices

Appendix 1 – Data Collection Protocol

Interviews: The interviews about individual mobility practices lasted about one hour and included five sections. First, interviewees answered question about their past and present personal circumstances (age, family size, job, income, education, housing situation, and so forth), and their projects, expectations and preferences in these regards. Second, they described their past, present, and anticipated mobility means. The third section aimed at revealing the relationship between everyday mobility practices and urban activities. Following the template of a typical travel survey, interviewees first described their trips and activities the previous day. Then they were asked whether these activities would have been possible with the mobility means they had in the past and those they anticipate (or hope) to have in the future. They also spoke more generally about things they commonly do, especially leisure activities, and associated mobility means. The fourth section aimed at revealing perceptions and meanings attached to different streets. Finally, open-ended opinion questions addressed three major policies likely to transform the urban space in HCMC: the metro project, the ban on motorbikes by 2030, and the sidewalk clearing campaigns. The interview guide was approved by the Institutional Review Board of the University of Southern California. Eligible participants were 18 years or older and had lived in HCMC for at least one year. The final sample 32 of participants included a diversity of profiles in terms of common transportation mode (moto, electric bicycle, bicycle, walking, car, motorbike taxi, and bus), age, gender, and income, but was not representative of HCMC's population.

Video recordings: The video recordings were conducted on 19 streets located in different urban environments, including typical districts characterized by a dense network of alleyways (Phu Nhuan and District 3), the historical and institutional center (District 1) planned according to a grid pattern during the colonization era, and the Phu My Hung neighborhood (District 7) was planned and developed in the last two decades in ways supposed to offer the comfort of modern life to those who can afford it (Harms, 2012; 2016; Kim, 2008). Several types of streets were included, ranging from narrow alleyways to large boulevards. With the exception of alleyways, which by definition cut through residential neighborhoods, all selected streets were lined with 3- to 6-story mixed-use buildings typical of HCMC's urbanism, with stores on the ground floor and additional commercial or residential space in the upper floors. Using an action camera, each street was filmed six times over the course of one day (at about 6:30 AM, 9:30 AM, 12:30 PM, 3:30 PM, 6:30 PM, and 10:30 PM). First, a tracking shot was used to record 'side videos' of the sidewalk and background properties, by following the curb either on foot or on the back of a motorbike; second, a static shot was used to record 5-minute 'traffic videos' (motorized and pedestrian). All videos were recorded in November, during the dry season, so the weather was quite similar from one day to another (approximately 30°C in the afternoon, no rain). Finally, the waiting times between recordings were used for participant observations of street life, photographs, and short interviews with vendors and retailers. Thirty-six interviews were conducted, including 25 with informal street vendors.

Appendix 2: Counting Methodology (Measurements using Video Data)

For each street segment, the methodology included the following steps:

- Step 1: Using the 6:30 AM video, list all activities in anchor 'locations' along the property line. Each location was attributed a location number, a name (e.g. the store's name), a type (e.g. store, house, alleyway, parking lot, institutional use) and a short description.
- Step 2: Using the same video, add to the list all activities happening in front of anchor locations. For example, the screenshot in the Figure below shows a street vendor in front of location #3. This vendor was recorded under the same location number (#3), the type was 'sidewalk vendor,' and the description said, 'lottery ticket seller.'
- Step 3: Using the same video, indicate whether the listed activities are 'active' (open) or not at the time of observation.
- Step 4: Count the number of stationary people and parked vehicles (by type) in front of each location. People (or vehicles) on the sidewalk were counted in another category than people (or vehicles) in the traffic lanes, provided that the distinction could be made. Pedestrians on the move were excluded.
- Step 5: Using the 6:30 AM traffic video, count the traffic exited the shot by transportation mode. Each pedestrian was counted as one in the pedestrian traffic category. For vehicular traffic (motorbikes, cars, trucks, buses, bicycles, e-bikes), each vehicle was counted as one in respective categories.
- Step 5: Repeat steps 2-5 for all other videos recorded on the same segment (other times of the day).

Appendix 3: Built environment characteristics of selected street segments by type

	All	1+1	2+2	Alley	One-way	Seg. Outside	Seg. Inside	Market
Built environment								
Length (m)	514	269	612	203	521	1170	1170	152
Sidewalk	0,71	1,00	1,00	0,00	1,00	1,00	0,00	0,00
Lanes	1,47	1,00	2,00	1,00	1,73	1,33	3,33	1,00
Locations (/ 100m)	15,33	15,51	13,64	33,34	14,93	8,61	0,00	
% Commercial	68,2%	80,5%	76,7%	17,8%	72,1%	78,7%	-	-
% Housing	20,8%	10,4%	6,6%	75,7%	12,7%	6,8%	-	-
% Institutional buildings	1,7%	1,9%	1,5%	1,0%	2,2%	1,4%	-	-
% Mixed-use building	0,3%	0,3%	1,3%	0,0%	0,0%	0,6%	-	-
% Alleys	4,8%	4,9%	7,2%	1,4%	7,6%	3,5%	-	-
% Streets	0,3%	0,0%	0,6%	0,0%	0,0%	1,9%	-	-
% Parking lots	0,1%	0,1%	0,0%	0,0%	0,0%	0,6%	-	-
% Other	3,9%	2,0%	6,2%	4,1%	5,4%	7,1%	-	-

Appendix 4: Built environment characteristics of selected street segments of '1+1' streets by district

	All districts	District 1	District 3	District 7	Phu Nhuan
Built environment					
Length (m)	269	179	386	304	300
Sidewalk	1.00	1.00	1.00	1.00	1.00
Lanes	1.00	1.00	1.00	1.00	1.00
Locations (/ 100m)	15.51	13.67	25.91	9.88	19.00
% Commercial	80.5%	85.8%	83.0%	82.9%	64.0%
% Housing	10.4%	12.4%	14.0%	1.3%	17.3%
% Institutional buildings	1.9%	2.8%	0.7%	0.0%	3.6%
% Mixed-use building	0.3%	0.5%	0.0%	0.0%	0.5%
% Alleys	4.9%	5.0%	0.5%	3.5%	10.5%
% Streets	0.0%	0.0%	0.0%	0.0%	0.0%
% Parking lots	0.1%	0.0%	0.5%	0.0%	0.0%
% Other	1.9%	-6.6%	1.3%	12.3%	4.1%

Appendix 5: Street flows and activity on '1+1' streets, by district

	All	District 1	District 3	District 7	Phu Nhuan
Traffic counts (/ 5 min)					
Total counts	76.73	88.71	119.00	13.94	111.75
% Motorbikes in lanes	73.4%	73.6%	92.9%	55.8%	85.1%
% Cars in lanes	12.7%	13.1%	3.4%	23.5%	2.9%
% Bikes in lanes	2.3%	1.2%	1.5%	3.5%	3.2%
% Ebikes in lanes	0.1%	0.0%	0.5%	0.0%	0.3%
% Buses in lanes	0.4%	0.7%	0.0%	0.3%	0.0%
% Trucks in lanes	0.6%	0.9%	0.4%	0.4%	0.3%
% Others in lanes	0.4%	0.1%	0.5%	0.6%	0.6%
% Pedestrians on sidewalks	4.1%	7.2%	0.0%	3.3%	2.4%
Sub-total compliant uses	*94.0%*	*96.8%*	*99.2%*	*87.3%*	*94.8%*
% Motorbikes wrong way	1.8%	0.7%	0.0%	5.0%	0.7%
% Car wrong way	0.1%	0.2%	0.0%	0.0%	0.0%
% Bikes wrong way	0.2%	0.3%	0.0%	0.3%	0.0%
% Motorbikes on sidewalks	0.4%	0.7%	0.0%	0.4%	0.4%
% Bikes on sidewalks	0.0%	0.0%	0.0%	0.0%	0.0%
% Ebikes on sidewalks	0.0%	0.0%	0.0%	0.0%	0.0%
% Pestrians in lanes	3.4%	1.4%	0.8%	7.0%	4.2%
Sub-total non-compliant tactics	*6.0%*	*3.2%*	*0.8%*	*12.7%*	*5.2%*
Modal shares (MEU)					
Total MEU (/ 5 min)	93.24	121.45	132.69	19.69	114.30
% Motorbikes MEU	62.3%	56.1%	84.9%	45.2%	83.4%
% Car MEU	29.2%	31.8%	9.9%	48.8%	9.3%
% Bike MEU	2.4%	1.2%	1.9%	2.9%	4.5%
% Ebike MEU	0.1%	0.0%	0.4%	0.0%	0.3%
% Bus MEU	2.4%	5.3%	0.0%	1.4%	0.0%
% Truck MEU	3.5%	5.6%	2.9%	1.7%	2.5%
Street activity counts (/ 100m)					
Commercial locations open at 3 :00PM	10.81	10.72	17.48	7.23	9.66
Motorbikes parked on sidewalks	25.61	34.44	22.98	19.90	18.72
Cars parked (street parking)	2.15	2.16	0.23	4.51	0.17
Total street vendors	2.41	3.61	1.79	0.15	3.92
- Street vendors on sidewalks	2.32	3.61	1.71	0.07	3.61
- Street vendors on lane	0.09	0.00	0.08	0.08	0.28
- Xe om (and cyclo)	0.01	0.00	0.00	0.00	0.03
People on sidewalks (not walking)	13.43	21.96	5.36	7.50	12.00
People on lane (not walking)	0.86	0.84	1.53	0.43	1.03
Motobuyers	0.35	0.02	1.14	0.06	0.78
Motorbikes parked on lane	3.42	1.67	5.70	5.92	1.25

Parking Pattern and Influencing Factors of Dockless Public Bicycle: Case Study from Nanshan Shenzhen

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Abstract: The last-mile problem has been the hot focus question in the field of urban planning for a long time. In recent years, booming dockless public bicycle system in China provides new solution of this problem. However, large number of dockless public bicycles have occupied large amount of public space and disturbed people's daily life. To support dockless bicycle system efficiently, it's urgent to understand the parking modes of dockless public bicycle and their impacts on public space use. Using big data from the OFO BSS in Shenzhen, demographic data, building environments and the location of points of interest. This study defines the "parking density" and "parking duration" of sharing bicycles to analyze the parking characteristics. We take Nanshan district in Shenzhen city as a representative case, and divides Nanshan area into a 500m*500m grid, counts the number of bicycles parked in each grid. The factors affect dockless public bicycles are grouped into four main categories: transportation, land-use/build environment, population-job and meteorological data. We summarized four parking modes and a logit regress model was applied to explore the relation between parking pattern and open space. Based on the results of the model, we discussed the management of public bicycles in Shenzhen and made some suggestions.

Keywords: Dockless bicycle sharing system; Parking mode; public space

1. Introduction

Public bike system (PBS) also called a bicycle sharing system (BSS), which was born in 1965 in Europe has been developed for three generations. The third-generation system included electronically-locking racks or bike locks, telecommunication systems, smart cards and fobs, mobile phone access, and onboard computers (Demaio, 2009). The concept of PBS/BSS is simple: A user arrives at a station, takes a bike, uses it for a while and then returns it to another station. It is economical, eco-friendly, healthy, ultra-low carbon emissions and more equitable, has increasingly received attention in the last decade and have rapidly emerged in many cities all over the world. A characteristic differentiating bike sharing systems from other non-motorized systems is that they do not necessitate ownership of bikes and therefore facilitate increased complementarity between biking and transit. Bicycle-sharing systems free the user from the need to secure their bicycles avoiding bicycle theft issues. At the same time, the decision to make a trip can be made in a short time frame providing an instantaneously accessible alternative for a one-way or a round trip. Generally, many studies referred to the docked system, which need several fixed stations with docks in each station used to store bicycles and finish rent and return operations. The dockless system, also considered as the fourth-

generation system, based on the mobile app and GPS, which eliminates stations and docks. Passengers can easily pick up and drop off bikes anywhere using their cell phone.

This system is quite spread nowadays in China through enterprises as OFO and Mobike since early 2016. Majority of bike-sharing schemes contains fewer bicycles compared with a dockless sharing bicycle. Many available bicycles and no restrictions on parked locations may result in different characteristics of public bicycles using and their influencing factors from dock system. Dockless public bike system brings new experiences and conveniences as well as some problems: (1) the emergence of huge number of dockless public bicycles means that more parking space needs to be set up in the public space of the city. This is bringing challenges to urban planning and urban management. (2) meanwhile, the feature of "drop off bikes anywhere" will result in a lack of certain constraints on the user's parking behavior. The user's parking location may disturb or affect the daily activities of city residents such as parking bicycles on the pavement. (3) For areas where many bicycles are parked, if the demand and supply do not match, it will result in a waste of bicycle resources and urban space resources.

However, few studies focused on the dockless parking system which needed to be deeply discussed. This paper selected Shenzhen, one of Chinese fastest urbanizing city, as a representative Metropolis case, and explored dockless bicycles by OFO bike sharing system. OFO bicycle-sharing system was launched in Shenzhen in December 2016 with more than 2200,00 bicycles. This paper mainly studies the inactivity of the dockless public bike system. Four issues are discussed: (1) How to measure the parking of dockless public bicycles? (2) what are parking modes of dockless public bicycles? (3) What's the relationship between parking modes and built environment? (4) how to manage public space to support efficient dockless parking?

2. Literature review

2.1 The systems perspective of sharing bike research

Sharing bike involved in many areas of research and it is broadly based on two perspectives: user perspective and systems perspective (Faghih-Imani and Eluru, 2015). In this study, we only focus on systems perspective.

2.1.2 The systems perspective

System perspective research can be divided into three categories.

(1) **Based on the practical usage, a number of studies focus to deal with bike sharing rebalancing problem, using intelligent algorithms**. In bike sharing system, the lack of resources is one of the major issues: a user can arrive at a station that has no bike available or wants to return her bike at a station with no empty spot. Fricker and Gast (2016) propose a stochastic model of a homogeneous bike-sharing system to study the effect of users' random choices on the number of problematic stations and compute the rate at which bikes must be redistributed by trucks to ensure a given quality of service. You, Lee and Hsieh (2017) provide an integrated model for the problems of fleet sizing, empty-resource repositioning and vehicle routing for bike transfer in multiple-station systems. O'Mahony (2015) tackle rebalancing the system during rush-hour, developing novel methods for optimizing rebalancing resources and formulate an optimization problem whose goal is to produce a

series of truck routes to get the system as balanced as possible during the overnight shift. Chen, et al. (2015) address the layout planning of public bicycle system within the attracted scope of a metro station. and locations of service stations and the optimal route options for the implement of redistributing strategy. Lozano, et al. (2018) proposes a multi-agent model that provides visualization and prediction tools for bike sharing systems.

(2) **Explore the spatial and temporal patterns of bike use over the time of day, using data mining and visualization techniques.** Whereas the aim of clustering is to identify mobility patterns in BSS usage by partitioning the stations into different clusters having a similar usage. Wong and Cheng (2015) presents the insights of imbalanced public bicycle distributions through the analysis of spatiotemporal activity patterns of bike stations. the clustering algorithm is used to analyze how station activity patterns are geographically distributed in the city based on their usage patterns and explore how these activity patterns relate to underlying cultural and spatial characteristics of Taipei City. Temporal and spatiotemporal patterns among bike stations of Barcelona bike sharing system were explored by Froehlich et al.(2008). Numerous researches also used a hierarchical clustering method to generate clusters and investigate usage patterns geographically distributed in the city to understand the impact of the inhomogeneity of the city on the long-run activity of stations (Vogel and Mattfeld, 2011, Lathia, et al., 2012). Brien et al.(2014) proposed a classification of bike-shares, based on the geographical footprint and diurnal, day-of-week and spatial variations in occupancy rates. Etienne and Latifa (2014) present one such automatic algorithm based on a new statistical model which will automatically cluster BSS stations according to their usage profile. Zhou (2015) investigated the spatiotemporal biking pattern in Chicago by analyzing massive BSS data from July to December in 2013 and 2014， constructed bike flow similarity graph and used a fast greedy algorithm to detect spatial communities of biking flows.

(3)**Thirdly, study on demand estimation and corresponding methodology.** These studies examine the influence of BSS infrastructure, transportation network infrastructure, land use and urban form, meteorological data, and temporal characteristics on BSS usage. This is the most relevant reference for this research. Faghih-Imani et al.(2014) collect station-level occupancy data from two cities and transform station occupancy snapshot data into station level customer arrivals and departures to perform our analysis. develop a mixed linear model to estimate the influence of bicycle infrastructure, socio-demographic characteristics and land-use characteristics on customer arrivals and departures. In the work of Krykewycz, et al.(2010) various demographic, land use, and infrastructure factors understood to be favorable for bike share usage were spatially analyzed to define a primary market area. El-Assiet al.(2017) investigate the effects of weather, socio-economic and demographic factors, as well as land use and the built environment on bicycle share ridership, a regression analysis was performed on three different levels. Hampshire and Marla(2012) explaining the factors affecting the bike sharing trip generation and attraction. Using usage data from bike sharing systems in Barcelona and Seville, 9 census level demographic data, and the location of points of interest, employ a panel regression model to produce consistent estimates of trip generation and attraction factors in the presence of unobserved spatial and temporal variables. Zhang et al.(2017) employed a multiple linear regression model to examine the influence of built environment variables on trip demand as well as on the ratio of demand to supply at bike stations in China. Faghih-Imani et al.(2014) investigated factors affecting bicycle share demand at the station level using real-time ridership data. The results showed that stations close to major roads had lower trip activities compared to stations that were situated

around minor roads and bicycle lanes. A number of land use and built environment variables, temporal characteristics and weather variables such as temperature were investigated. Maurer(2011) used a pair-wise suitability analysis to understand the effects of variables such as job density, household income, and alternative commuters on public bicycle share ridership to propose the locations of bicycle stations in Sacramento, California. Gebhart and Noland(2014) used real-time ridership data for Capital Bikeshare in Washington D.C. to investigate the impact of weather variables and proximity of bike share stations to metro stations on ridership levels. Buck and Buehler (2012) investigated the influence of bicycle infrastructure, population density, land use mix around stations, and the number of households without a car using bicycle share systems using ridership data from Capital Bikeshare. Wang et al.(2012) evaluated the effect of socio-demographic, land use, built environment and transportation infrastructure variables on bicycle share ridership. Rixey (2013) explored the influence of socio-demographic characteristics such as education, income, and employment and population density on monthly ridership data from three United States.

Most studies focused on the factors affecting the use of public bicycles and the scheduling methods between stations. Since the shared bicycle does not have a centralized station, the starting and ending position of the vehicle is only related to the user's personal travel destination, so the impact of the built-up area on the shared bicycle usage will change. In addition, because the shared bicycle does not have a fixed site, but is dispersed in the city, the network formed by it is extremely complicated; and its more fluid characteristics also makes it difficult to monitor the number of vehicles in real time. In addition, there are significant differences in the number of vehicles used between different regions. Based on the above characteristics of shared bicycles, the original site-based data analysis method and the small network-based global optimization scheduling strategy are difficult to apply to the current shared bicycle.

Therefore, combined with the current use of public bicycles without dock, this paper will focus on the relationship between the parking characteristics of the dockless public bicycles and the built environment.Explore the parking mode of dockless public bicycles under the influence of different built environment factors, and then coordinate the relationship between urban public space and dockless public bicycles, rationally plan bicycle parking facilities, and promote green travel to provide relevant suggestions.

3. Data sources and method

3.1 Data source

3.1.1 The data of bike status

OFO is one of the biggest companies operating dockless bike-sharing systems in China, with a market share of about 50%. OFO bike is equipped with GPS to provide useful, accurate trip data. OFO began operating in Shenzhen in December 2016 with more than 20,000 bicycles in September 2017.This study takes Nanshan district which is one of the city centers of Shenzhen as case study. Nanshan has a high accessible road traffic network with subway and bus system cover the whole area. The climate in Nanshan is also pleasant, so it is very suitable for short-distance travel by bicycle. In order to describe spatial distribution of the dockless public bicycle and compare the parking characteristics between different areas, this study divided Nanshan district into 500m*500m grids with a total of 823 grids.

Grids with an average 24-hour bike less than 10 were removed. Finally, 500 grids were taken into our analysis (Figure 1).

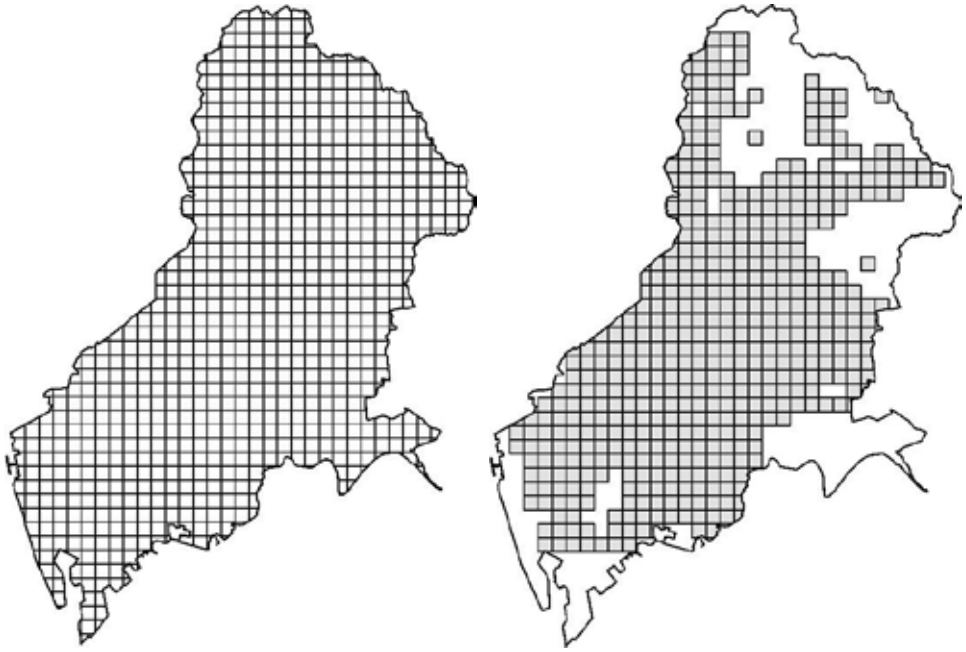


Figure1 the grids of Nanshan District

The raw data were obtained from the OFO website, which contained about 46.5 million pieces of messages including information of trip start time and date, trip end time and date, start location and end location This study scanned the working status of these bicycles every 5 minutes and got records the working day of the fourth week of September 2017. The data content includes the bicycle ID, the time and date when the bicycle starts to be used, and the bicycle position coordinates. There are about 57.6 million bicycle status records in a day. We determined bicycle parking by identifying unmoved positions and corresponding duration during the day by bike's location and time stamp to explore parking mode.

Table 1 *The raw data of OFO using*

Time stamp	**Bike ID**	**GPS signal**	**X**	**Y**
2017-0321T00:13:21	7556118647	1(1-work,2-non-work)	113.884828	22.857536
2017-0321T00:13:21	7556073013	1(1-work,2-non-work)	113.884834	22.857274
…	…	…	…	…
2017-0321T00:27:44	7556146932	1	113.896694	22.458407

3.1.2 The factors of impacting bike parking

These factors are grouped into four main categories: transportation, land-use/build environment, population-job and meteorological data. Detailed indicators are shown in Table 2.

Table 2 The parking variables and influencing factors

Variable	Calculation	unit
Parking variables		
Parking density	Number of public bicycles parked in a grid at a time	num/ per gird
Parking duration	Average of the parking duration of all parked vehicles in a grid	minutes
Independent variables		
Density of fast way	Length of Expressway in a grid	km/km^2
Density of major& secondary road	Length of Major road and secondary road in a grid	km/km^2
Density of minor road	Length of Minor road in a grid	km/km^2
Bus stops	Number of bus stops in a grid	num/ per gird
Subway	Distance to the nearest subway	m
Population	Number of residents in a grid	1000/ per grid
Job	Number of Enterprise POI in a grid.	num/ 1 gird
Mix used	Information entropy	/
Residential land	Percentage of Residential land in a grid	/
Commercial land	Proportion of Commercial land in a grid	/
Educational Land	Proportion of Educational Land in a grid	/
Green Land	Percentage of Green Land in a grid	/
Building density	Number of building in a grid	num/ per gird
Service facility density	Number of shop and restaurant in a grid	num/ per gird
Altitude	Average altitude of a grid area	m

The parking density of a grid is the parking number of dockless public bicycle in a certain period. We first calculated parking number of each hour, then the average number of 24 hours is the parking density of a grid. The parking duration refers to the time interval value of a single dockless public bicycle from the time of stopping to the next use. The parking duration of a grid is the average of the parking duration of all parked vehicles in a certain period.

The land use mixing degree is to first calculate the area proportion of each type of land use in the grid, and then calculate by the following formula (1):

$$MixUsed = -\frac{\left(\sum_{i=1}^{N} p_i \ln p_i\right)}{\ln N} \qquad (1)$$

p_i——the percentage of i land type；

N——the number of all land types.

The data of subway comes from the website (http://www.szmc.net) of Shenzhen Metro Group Co., Ltd. The road net and bus data are provided by Shenzhen Urban Transport Planning Center. The information of population, job and land use is supplied by the Shenzhen Urban Planning Bureau and the Urban Planning and Design Institute of Shenzhen. We use points of interest (POI) data from BAIDU (see www.baidu.com).The terrain data of Shenzhen comes from google map.

3.2 Statistical analysis

First, we calculate the parking density and parking duration of each grid. According to these two attributes, we use the cross-classification method to divide the grid parking type. In this way, each grid corresponds to a parking mode, and then the built environment indicators of each grid are calculated. The multinomial Logit regression model is used to analyze the influencing factors of parking mode and the parking mode preferences in different built environments.

4. Results

4.1Statistical characteristics

4.1.1 Parking density

62 thousands dockless public bicycles had been parked in Nanshan district for more than 10 minutes, and on average, 49 thousand bicycles parked per hour, which occupied 7.3 ha public space. By grid analysis, the parking density was around 100 bicycles per grid per day, and the maximum number of bicycles in one grid was 575.

Figure 2 shows an uneven spatial distribution of parking density of dockless public bicycles in Nanshan. Obviously, the bicycles were unevenly distributed. The central area had a significant higher density than others because these are the main functional areas of people's daily life, such as living, employment, leisure, transportation, etc. The low-density areas were mainly close to less-developed area, mountain and other bicycle ban zones such as parks and waterfront.

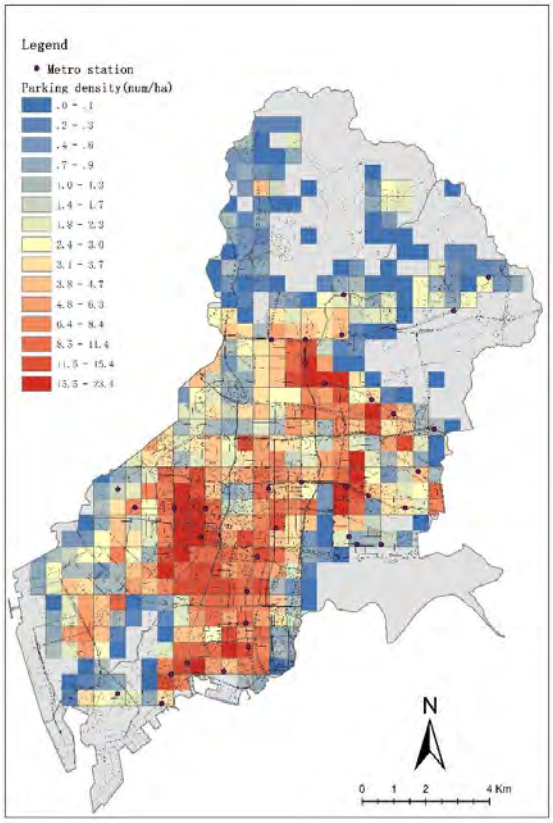


Figure 2 The spatial distribution of parking density of dockless public bicycles in Nanshan

3.1.2 Parking duration

The average parking duration of bicycles was 341 min per time, which meant bicycles were used around every 6 hours. The parking durations of around 10 thousand bicycles were more than 1420 min, which continuously occupied public space whole day. Figure 3 shows the spatial distribution of parking duration of dockless public bicycles in Nanshan. Grids in the center area of Nanshan had a significant shorter parking duration and peripheral grids had a longer parking duration. The short-term parking of grids was mainly in high-tech employment center, universities and commercial centers. These areas are mostly with good location, a large number of enterprises, well-constructed urban roads and mixed land use. In addition, the grid with subway station in has a high probability to be a short-term parking place. The grids with long-term parking were mostly in the suburb areas. The destinations of one-way riding such as Shenzhen-Hong Kong port area also caused long-term parking. By comparing the spatial distribution characteristics of parking density, it can be found that the area with a long parking period generally belongs to the area with a lower parking density.

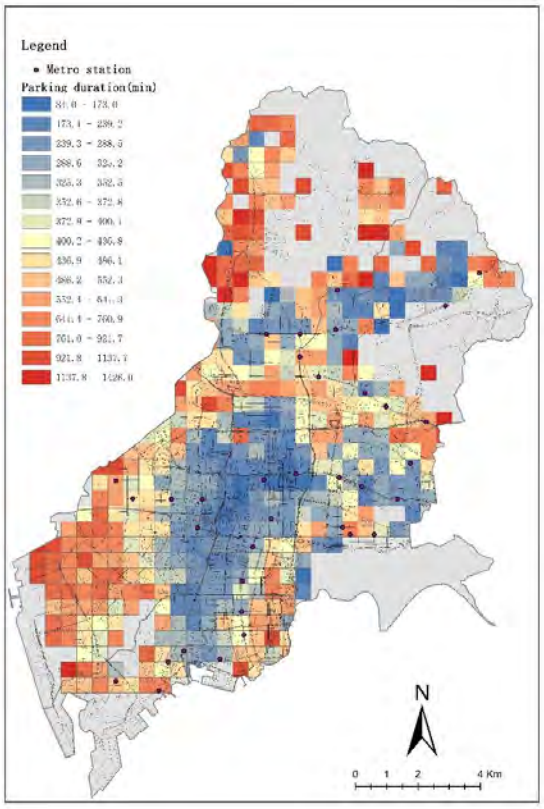


Figure 3 The spatial distribution of parking duration of dockless public bicycles in Nanshan

3.1.3 Parking patterns by Cross-classification

Figure 4 is a scatter plot of parking density and parking duration, in which X-axis is the parking density, and the origin is the average value of parking density and parking duration. Obviously, parking duration is negatively correlated with parking density. Four quadrants represented different parking characteristics of dockless public bicycles: （1）The grid in the first quadrant had high parking density and long-term parking and we called it **High-High(HH)** parking mode, which meant bicycles were static and dense stacked. （2）The grid in the second quadrant had low parking density and long-term parking. We named it **Low-High (LH)** parking mode, in which the bicycles were not many and inactive. (3) The grid in the third quadrant was the **Low-Low (LL**) parking mode which meant there were a few bicycles but efficiently used. (4) At last, the grid in the fourth quadrant with high parking density and short parking was **High-Low (HL)** parking mode, which was the most active mode.

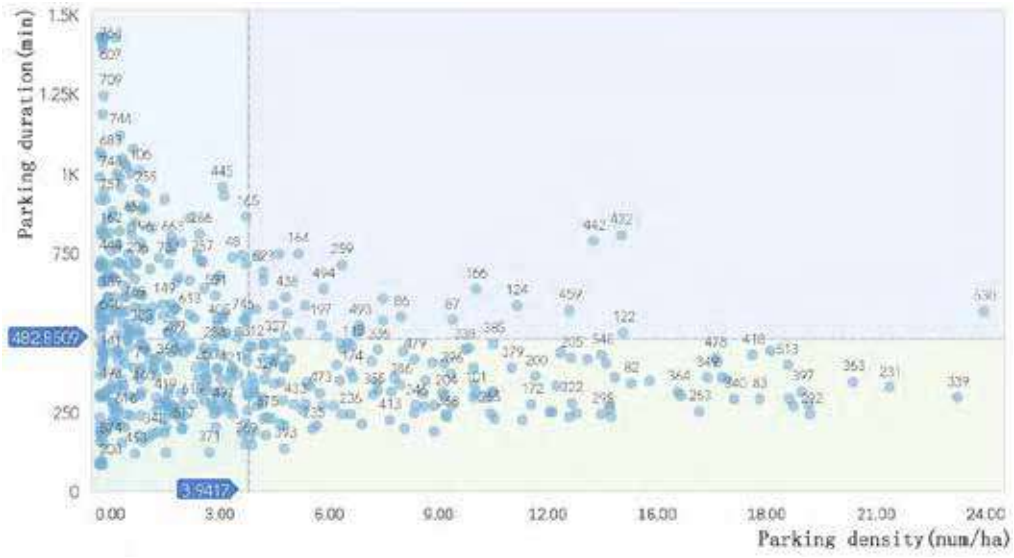
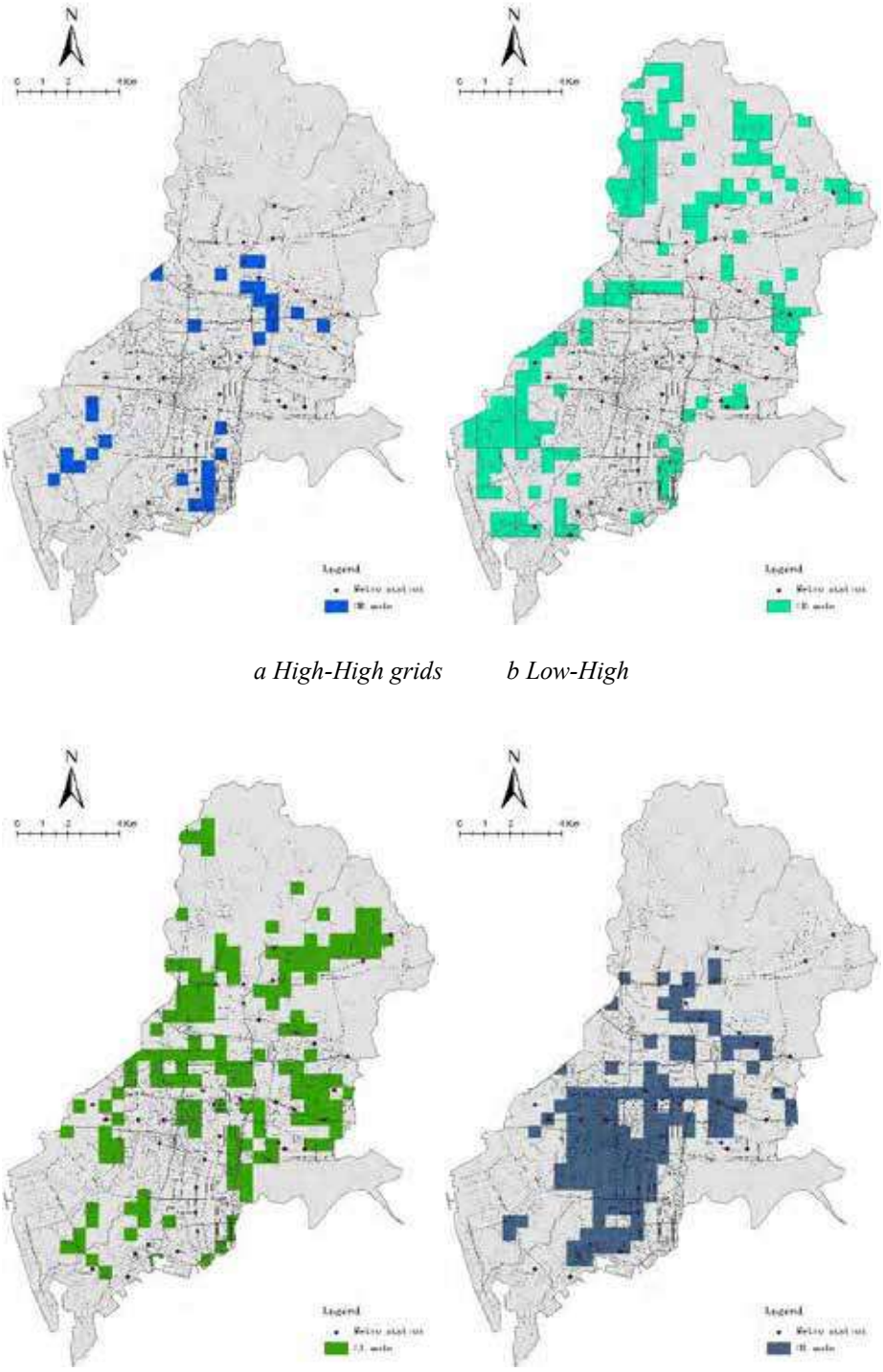


Figure 4 The scatter plot of parking density and parking duration

3.1.4 The spatial distributions of four parking modes

By categorizing the grids by 4 parking modes, the distribution of each parking mode were shown in Figure 5. Among all grids, HH mode accounted for 6%, LH mode had 34%, LL mode accounted for 32% and the left 28% was HL mode.

Table 3 shows the average value of built environment variables for each parking modes. Grids of HH mode had the highest density of fast way and grids of HL had the highest density of all other road types. LH mode grids had the poorest public transportation service (less bus stops and far away from metro station). HL mode was with the highest population and job density, and the LH mode was with the lowest ones. In terms of land use, HL mode had the highest mix use degree, residential land and proportion of commercial land. LL mode had the highest educational facilities and green land. The HL mode also had the highest service facility density followed by LL mode.



a High-High grids *b Low-High*

c Low-Low *d High-Low*

Figure 5 The spatial distribution of four dockless public bicycles parking mode in Nanshan

Table3 Statistical characteristics of built environment of four parking modes

Built environment variables	HH	LH	LL	HL
Density of fast way	32.91	14.25	20.06	22.97
Density of major & secondary road	46.10	15.49	27.22	51.01
Density of minor road	62.48	43.65	58.01	79.30

Bus stops	2.52	0.77	1.95	3.90
Subway	1222.15	2019.12	1226.13	672.47
Population	53.61	33.80	61.86	317.91
Job	0.48	0.34	1.08	2.80
Mix use	0.50	0.39	0.45	0.54
Residential land	0.02	0.02	0.02	0.07
Commercial land	0.03	0.02	0.05	0.06
Educational Land	0.02	0.01	0.09	0.05
Green Land	0.03	0.03	0.05	0.03
Building density	0.10	0.06	0.12	0.21
Service facility density	0.28	0.05	0.35	1.75
Altitude	12.95	35.64	28.02	16.23
Number of grids	31	167	162	140

4.2 The influencing factor of parking mode

A logistic regression model was applied to explore the built environment impacts on parking mode. The LH mode area had low artificial built environment and high altitude which was obviously far away from people's daily life. The number of dockless public bicycle in this area was small. Although the parking duration was long, this would not be a problem to occupy public place. We took LH as the compared group. The results are listed in table 4. The model's likelihood ratio is statistically significant at 0.01 level and the pseudo R square is 0.418.

Table4 Multinomial Logit Estimates Results of Built Environment Factors

	HH			LL			HL		
	B	Sig	Exp(B)	B	Sig	Exp(B)	B	Sig	Exp(B)
Intercept	-0.907	0.156		1.999	0.000		-0.007	0.990	
Density of fast way	**0.422**	**0.022**	1.525	0.242	0.093	1.274	**0.571**	**0.001**	1.770
Density of major & secondary road	**0.505**	**0.019**	1.657	0.239	0.165	1.270	**0.669**	**0.001**	1.953
Density of minor road	0.074	0.755	1.077	0.192	0.185	1.211	0.398	0.058	1.489
Bus stops	**0.606**	**0.041**	1.833	0.135	0.566	1.145	0.173	0.519	1.188
Subway	-0.572	0.067	0.564	**-0.605**	**0.000**	0.546	**-1.531**	**0.000**	0.216
Population	-0.573	0.405	0.564	0.054	0.883	1.055	**1.148**	**0.006**	3.152
Job	-0.112	0.892	0.894	**1.409**	**0.004**	4.093	**1.694**	**0.001**	5.441
Mix use	0.161	0.560	1.174	**-0.355**	**0.029**	0.701	0.066	0.800	1.068
Residential land	0.115	0.776	1.122	-0.381	0.128	0.683	-0.391	0.240	0.677
Commercial land	-0.198	0.561	0.820	0.310	0.059	1.363	0.215	0.298	1.240
Educational Land	0.832	0.187	2.299	**1.468**	**0.002**	4.339	**1.315**	**0.009**	3.724
Green Land	0.029	0.911	1.029	0.196	0.080	1.217	0.299	0.152	1.348
Building density	0.504	0.199	1.655	0.320	0.177	1.377	**0.850**	**0.014**	2.339
Service facility density	**2.462**	**0.033**	11.727	**2.428**	**0.016**	11.336	**2.836**	**0.006**	17.048
Altitude	**-1.851**	**0.002**	0.157	0.033	0.799	1.034	**-2.187**	**0.000**	0.112

（1）Results show that compared with LH parking mode, HH parking mode is with denser high-class roads (fast road, primary and secondary roads), probably because of spatial segregation of bike lanes by high-class roads. Grids with denser bus stops have positive impact on being a HH mode, since bike plus subway is not competitive than bus in these areas. Meanwhile, area with more shops and restaurants are the easier to be HH mode than LH mode. In addition, with the lower the altitude, public bicycles are easily stacked to increase the parking density and parking duration. Therefore, we can infer that it is easy to form a HH parking mode when those areas are separated, bus-oriented, lower and with lots of shops, where the attraction demands are **one-way demands**, .to restrain bicycle flows out of the areas. As a result, bicycles in this area stack and cause long-term parking, strongly occupied public space and disturbed people's outdoor activities.

（2）Close to subway station, dense job opportunities, lots of educational land and shops, less mixed land use indicate those special zones such as universities and independent high-tech parks, and form LL parking mode. These regions are normally independent managed, with big scale and closely interrelated, where the demands of dockless public bicycles are limited, clear, stable and continuous, therefore the use of dockless public bicycles is very efficient and the parking duration is short. The public bicycles in this area have less exchange with other areas. LL parking mode is self-sufficient, with the least occupation of public space comparing with other 3 modes.

（3）High-grade urban roads, closer to the subway station, high population density, high density of jobs, high density of shopping and restaurants, and relatively lower the altitude have a significant impact on the HL parking mode. Areas with the combination of the above characteristics will tend to be the core area of people's daily activities and have strong and aggregate demands to use bicycles. To meet the demands, bicycle operators often set up excessive bicycles to serve people at any time. Due to the large travel demand, the dockless public bicycles are used at high frequencies, resulting in a high density, low duration parking feature. At the same time, the bicycles in the area exchange frequently with the bicycles in the surrounding area. In HL mode areas, bicycles are most active, and besides parking space, the turnover space, bike lane and other facilities are urgently needed.

4.3 Suggestions for public space governance to adapt dockless public bicycles

Comparing the parking demand of public space, first, the two parking modes of LH and LL have little impacts on the occupation of public space. For the LH parking mode, a small number of public bicycles are parked in the area for a long time, which is not conducive to the maintenance of public bicycles. Bicycle maintenance and parking spots can be combined to design as part of a public space service facility. For area with LL parking mode, it is necessary to pay attention to changes in land use or transportation facilities in the area, which will cause changes in the demand for public bicycles. Some public space can be reserved as a potential bicycle parking slot. Secondly, HH parking mode and HL parking mode have high pressure on public open space. On the one hand, a multi-level parking facility system can be constructed, combining a centralized and decentralized layout. In areas where public open space is limited, multistory parking can be used. On the other hand, bicycles with less use is a waste of public open space and it is reasonable to control the scale of the dockless public bicycles. In addition, for the HH parking mode area, the considerable bike lane design is necessary to encourage bicycle flow and to overcoming those obstructions from slope and one-way destination.

Besides, the dispatch management of dockless public bicycle is an also important optional strategy for reducing public open space pressure. Dispatch management strategies can be divided into active dispatching and passive dispatching. Active dispatching encourages cyclists to ride public bicycles in the HH area to other areas in need by setting incentives for operators; and passive dispatching is to transport dockless public bicycles from HH area to the demand area by full-time dispatchers and vehicles. This involves vehicle route and bicycles redistribution problem.

In terms of urban spatial management strategy, some public open place should adopt a limited open management strategy for dockless public bicycles, allowing a certain number of dockless public bicycles to enter, which not only does not create pressure on the spatial environment in the region, but also meets people's cycling needs. In some important areas, such as the area within 10m around the entrance and exit of subway station, a no-parking area for public bicycles is set up to prevent public bicycles from occupying safe evacuation space.

5. Conclusions

This paper took Nanshan District in Shenzhen city as a representative case, to analyze the parking characteristics of dockless public bicycles by "parking density" and "parking duration".

For the "parking density" and "parking duration" of sharing bicycles in Nanshan, the short-term parking of grids are mainly high-tech employment centers, universities and commercial entertainment areas. The areas with long-term parking are mostly in the suburb areas close to mountain or construction site. the central area has a significant higher density than others. Based on cross classification, we presented four parking modes, and applied a logistic regression model to explore built environment impacts on parking modes.

The results show that spatial isolation, public transportation, urban centralization, functional zone and attitude all significantly influence the parking modes and cause uneven spatial distribution and uneven uses of dockless bicycles, and cause serious occupation of public space. To improve the efficiency of bicycle parking and reduce the useless occupation, considerable bike lane system to encourage bicycle’s flow, compact parking facilities to save space, dispatch management to improve efficiency, diverse policies to ease the burden of public space are all necessary strategies.

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Track 13: Planning for accessibility and sustainable mobilities

"Imagining the future of my neighbourhood": Residents' perceptions of sustainable mobility and regeneration around metro stations in the city of Thessaloniki

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Abstract: New development around public transport stations has long been seen as the main alternative to low-density urban sprawl and car dependent land use patterns. Less attention has been given, however, to involving local residents in the public discussion about the potential of public transport infrastructure for sustainable regeneration of their neighbourhoods. The present paper presents an experiment undertaken to seek out how local residents would actually conceive the future of their neighbourhood and its potential for sustainable regeneration based on the metro which is under construction in the city of Thessaloniki. The experiment focused on two metro stations under construction in two different neighbourhoods in terms of their socio-spatial characteristics. After a questionnaire survey to residents and businesses, two interactive workshops were held on the day of the nearby open market, one in each station. The survey and workshops operated as knowledge production for both sides: the local residents that were helped to envisage the metro as a future challenge and the research team that had to incorporate their expectations into an ongoing pilot urban project. The paper highlights the potential of the use of qualitative methods in the research and planning of sustainable mobility and neighbourhood regeneration.

Keywords: Transit-oriented neighbourhood regeneration; sustainable urban mobility; residents' perceptions; Thessaloniki metro

1. Introduction

Public transport has long been seen as the backbone of the transition to urban sustainability whereas new development around public transport stations has been proposed as the main alternative to low-density urban sprawl and car dependent land use patterns (Cervero, 2015, Curtis *et al*. 2009, Papagiannakis *et al*., 2017). Coupling public transport investments and urban development mainly through mixed use development around public transport stations, what is mostly known in the literature as a Transit-Oriented Development (TOD), is one of the more widely accepted policies seen as the undisputed path to achieving efficient and sustainable urban development forms.

As urban areas are continuously experiencing transformations of slow or more rapid paces, urban development characteristics and dynamics, mobility and accessibility patterns and in general a city's spatial geography are all components which are interconnected in a complex way (Naaes, 2006). In places where new public transport services are provided in existing, compact, mixed-use areas which have been classified by some writers as high-density TODs (Thomas *et al.*, 2018), such transport investments not only transform neighbourhood identity but also reshape the lives of residents, in some cases by forcing the most vulnerable to leave (Chapple and

Loukaitou Sideris, 2019). Therefore, it is crucial to study patterns and changes that occur at a local scale and identify potential strategies that enhance local identity and the sense of space from a resident's perspective.

Among the main objectives of a TOD is to increase the quality of life of the local community inhabitants given that a TOD contributes to increased transport alternatives in congested urban areas, to the reduction of energy consumption and air pollution, to increased safety for pedestrians and cyclists and to the reduction of road accidents (Parker *et al*., 2002) and consequently to more vibrant communities. Yet, policies that advocate a TOD pattern have given less attention to involving residents in the discussion about the potential of public transport infrastructure for a sustainable regeneration of their own neighbourhoods. It is worth noting here that recent research has shown the impact of compactness within a wider range of urban form typologies and found that the higher the density, the higher the neighbourhood satisfaction due to the main important components of the compact city that is public transport, accessibility to city centre and land use mix (Mouratidis, 2017).

Neighbourhood regeneration strategies are strongly associated to sustainable community development and to the overall sustainability of the cities as it combines multiple social, economic, environmental and institutional objectives (Kafkalas *et al*., 2015). Additionally, these strategies promote compact forms of development in existing urban areas, while reducing the need for suburban development. The demand for prosperity along with the request for open-endedness and constant re-interpretation of urban places, more important when it concerns small urban spaces, have led to changes in the approaches of local scale planning, aiming to reconsider the quality of public space (Aravot, 2002, Whyte 1980). A subsequent practice of urban regeneration, especially at the neighbourhood level, is the placemaking approach, as this approach is based on working with the local community through participatory forms of planning involving residents and employees in the intervention areas (Laven *et al*., 2016). In this way, social and economic productivity, and physical improvements are considered more successfully implemented in an area. Promoting local involvement through placemaking policies contributes to the redesign of dominant uses of specific public spaces, such as streets, changing them from simple transport corridors to significant spaces for human activity. Thus, their regeneration as a public space of shared nature, in other words as "shared spaces" (Clarke, 2006, Grey and Siddal, 2012), addresses basic objectives of neighbourhood regeneration such as good connectivity, safety and preservation of social cohesion. Such approaches and tools improve the integration of urban and transport planning by focusing on the implementation of measures that enhance accessibility and quality of the public realm giving priority to local community and vulnerable users.

Thessaloniki is a typical Mediterranean city with high densities and a characteristic mixed-use pattern throughout its main compact area (Yiannakou, 2013). Since 2008, a metro transport system is under construction passing though the most densely and mixed-use parts of the inner city. Thessaloniki Metro has been for years a politically controversial mega-project as financial and other critical obstacles, especially major archaeological findings, led to a very slow pace of its construction. Degradation images and closures of many businesses in the surrounding areas have dominated the perception of local residents for this mega-project, almost exclusively conceived as a problem within the city's heart and less as a potential of upgrading the local quality of life.

Taking into consideration this dominant image of the residents regarding the metro under construction, the paper presents an experiment undertaken to seek out how local residents would actually conceive the future of their neighbourhood and its potential for sustainable regeneration based on the metro which is under construction in the city of Thessaloniki. The experiment focused on two new metro stations (currently under construction) in two different neighbourhoods of the city. For the needs of the study, a questionnaire survey to residents and businesses was initially undertaken followed by two interactive workshops that were held on the day of the nearby open market, one in each station. A profile of the study areas and the methodology followed is presented in the second section while the third section analyses the findings and discusses the main results of both the survey and the workshops.

2. A profile of the study areas and the methodology of the case study

For the purpose of the case study, two different neighbourhoods were selected within the dense compact area of Thessaloniki with different, however, socio-spatial characteristics: the first one (Patrikiou Station study area) is located within the older, typically residential, inner part of Thessaloniki, a former middle class area which has been gradually deprived over the last decades; the second one (Kalamaria Station study area) is located in one of the main municipal centres of Thessaloniki, a typical middle class area in the compact city.

a. Study area of Patrikiou Station

The study area of Patrikiou Station (Figure 1), located in the east part of the Municipality of Thessaloniki, the central and largest municipality of the city, is a typical compact and high density residential inner-city area. Densities in the area range between 600 and 700 inhabitants per Ha, with buildings up to 5 floors and mainly of an age of 40-50 years old. At a ground floor level, most uses consist of multiple retail outlets, freelancers, services and utilities which serve daily needs of local residents. A considerable number of the ground floor outlets are closed, without any use, which is partly due to the economic crisis of the country since 2010. Within walking distance of less than 10-minute walk of the metro station under construction, there are facilities of leisure, sports and green areas with the most significant one the Mina Patrikiou park, a neighbourhood park and one of its most characteristic public spaces. The study area is located within the wider zone of influence of nearby coastal zone of the city, known as Nea Paralia, which offers recreation facilities and activities for the residents of the entire east and south east part of the compact city. The study area is crossed by two main roads of the city (Vasilissis Olgas and Delphon), one of which functions as a major arterial and entrance to the city and the second as one of its minor arterials. In terms of the mobility characteristics, the proximity of the area to public transport services (bus lines) is quite satisfactory. However, it lacks an integrated pedestrian and biking network.

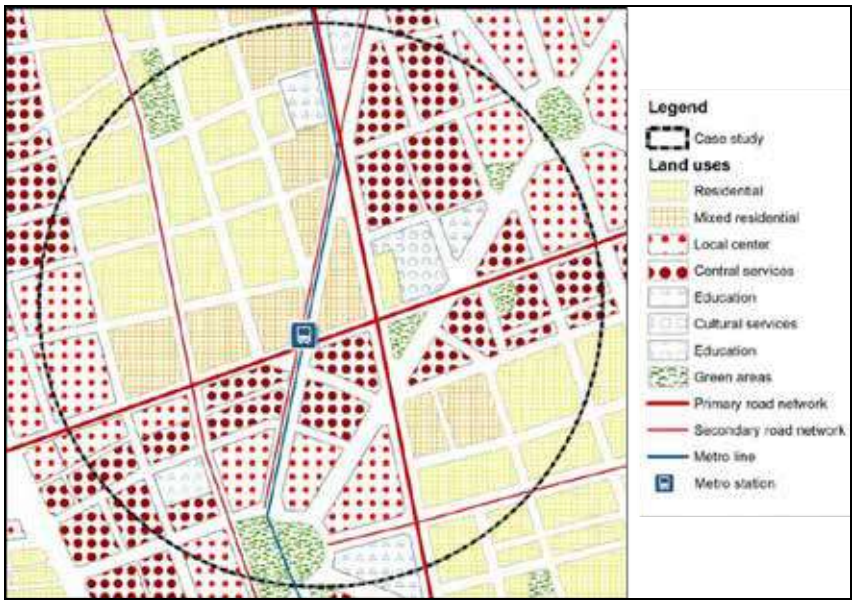

Figure 1: Land uses in Patrikiou Station study area

b. Study area of Kalamaria Station

The study area of Kalamaria Station (Figure 2) is located in the centre of the Municipality of Kalamaria, situated in the south east compact area of Thessaloniki. This study area is also distinguished by mixed uses of a local centre nature that are developed along a pedestrian zone as well as other main streets of the area. The area is compact with rather lower densities ranging between 120 to 270 inhabitants per Ha, with buildings of 4-5 floors and mainly of an age of 20-40 years old. The immediate zone of influence of the metro station bears common urban characteristics with those of Patrikiou Station area. At a ground floor level, there are multiple commercial and recreational uses as well as education, care and cultural services all developing along the main road axis (Metamorphoseos, Aigaiou and Pontou). In the case of Kalamaria Station study area, there is a much smaller number of closed stores without use comparing with that of Patrikiou Station, along with a greater number of residential ground floor uses and parking lots. Regarding the mobility characteristics, the area is also characterized by satisfying accessibility and proximity to public transport (bus lines). Despite the long length pedestrianized streets of Metamorphoseos and Kominon, the wider area lacks an integrated pedestrian and biking network.

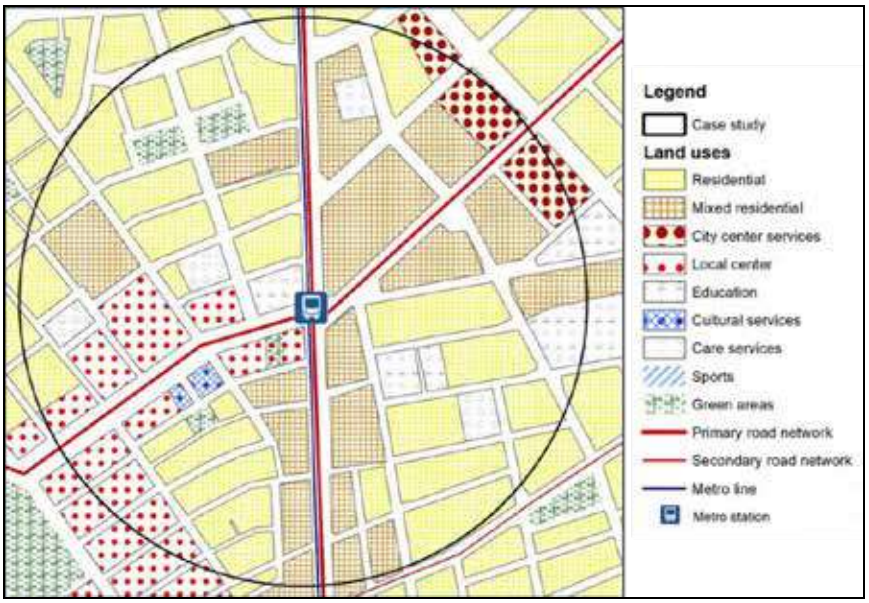

Figure 2: Land uses in Kalamaria Station study area

c. Methodology

The methodology of the present case study included the following three steps: 1) An analysis of the two study areas based on field recording and mapping of their critical urban and mobility characteristics. 2) A questionnaire survey in order to understand the main characteristics of the users of the study areas, to evaluate these areas based on the respondents' perceptions about the local problems and to record their views and expectations regarding the potential of upgrading the neighbourhood around the future metro stations. The questionnaire survey was held in the first week of December 2017 and was addressed to a sample of 180 people (90 questionnaires in each study area) who work, live and visit the two study areas. The questionnaires were conducted in public places, retail and leisure stores of the study areas. 3) The organization of two participatory workshops, in order to involve people living, working and visiting the study areas in a future neighbourhood regeneration project based on the metro stations.

Regarding the third step, in order to make sure that people would participate in some way or another, both workshops were held as open interactive events organizing the whole event as part of people's regular activity in

their neighbourhoods. Thus, the two workshops were conducted on a day when the weekly open market is held in the study areas. The workshops were promoted with the slogans "Imagining the future of my neighbourhood" and "The Metro in our neighbourhood: I participate, I propose, I make the place where I live" and were carried out in cooperation with the Municipalities of Thessaloniki and Kalamaria and with the support of the company responsible for the construction of the metro project, Attiko Metro SA. The events took place in 6 and 14 June 2018. A total of 150 people took part in the events, 76 and 74 people at Patrikiou and Kalamaria Station areas respectively. During the events, the participants were invited to express their everyday difficulties encountered in their neighbourhood and their perception on how these problems affect the quality of the urban environment, the local economic activities, the identity of the area, the mobility patterns and the housing prices. They were also asked to state their suggestions and expectations for future regeneration interventions envisioning their neighbourhood after the accomplishment of the metro construction.

The study group provided the participants with guidelines for the evaluation of the areas as well as example ideas in order to encourage them to take part in the event. The participatory the process included the use of post-it notes, where participants could write down specific problems as well as their personal ideas for a future regeneration plan. On satellite maps of the study areas the participants could assess specific places that they consider problematic, attractive or prosperous as well as their own proposals for the regeneration of the study areas. In the proposal maps, participants were able to mark up the zones which they prefer to be developed with commercial uses, leisure uses, green areas, as well as the creation of traffic calming or pedestrian streets.

3. Main findings

Table 1 presents the main characteristics of the respondents in the questionnaire survey in both study areas. The findings from the field research as well as the results from the questionnaire survey were mapped (Figures 3 and 4) in order to understand critical issues and correlate them with the results of the participatory workshops.

Table 1: Sample characteristics

Gender	Female	Male					
Patrikiou	52%	48%					
Kalamaria	41%	59%					
Age range	16-24	25-34	35-49	50-64	65+		
Patrikiou	11%	27%	31%	26%	5%		
Kalamaria	36%	18%	23%	14%			
Profession	Free lancer	Retired	Unemployed	Public servant	Private servant	Student	Household
Patrikiou	38.7%	5.6%	5%	37.1%	2%	8.2%	3.4%
Kalamaria	21.4%	10%	2%	11.3%	24.3%	22.9%	8.1%
Annual income (€)	0-5,000	5,000-10,000	10.000-20,000	20.000-40,000			
Patrikiou	53%	36%	8%	3%			
Kalamaria	51%	29%	4%	6%			
Status of Respondents	Residents	People working in the area	People visiting the area				
Patrikiou	56%	35%	9%				
Kalamaria	70%	22%	9%				

Looking into the main findings from Patrikiou Station study area (Table 2, Figure 3), it can be observed that, according to the users, the area is well accessible due to its easy connection to the city centre by public

transport. However, they indicate the lack of an integrated pedestrian and bicycle network. The users think the operation of the metro in the area will allow public transport multimodality, as the area will be served by metro and bus connections. A notable problem for the users is the lack of parking spaces and of an integrated parking management plan for residents and visitors. Real estate prices, which are considered to be ranging at low levels due to the economic crisis, are expected to increase up to 20% with the launch of the metro. Finally, the area was evaluated as having considerable open and free spaces and greenery areas, with the presence of Mina Patrikiou park, in about 5 minutes' walk from the station.

Table 2: A summary of the results of the questionnaire survey

	Evaluation of Patrikiou				Evaluation of Kalamaria			
	Dissatisfied	Partly Satisfied	Satisfied	Very Satisfied	Dissatisfied	Partly Satisfied	Satisfied	Very Satisfied
Degree of satisfaction by public transport	14%	29%	52%	5%	14%	29%	52%	5%
	High		Low		High		Low	
Housing price rates	78%		22%		80%		20%	
Distance from the city center	73%		27%		56%		44%	
	Sufficiency		Absence		Sufficiency		Absence	
Green areas	12%		88%		15%		85%	
Public spaces	20%		80%		46%		64%	
Parking spaces	24%		76%		41%		59%	
Pavement quality	40%		60%		35%		65%	

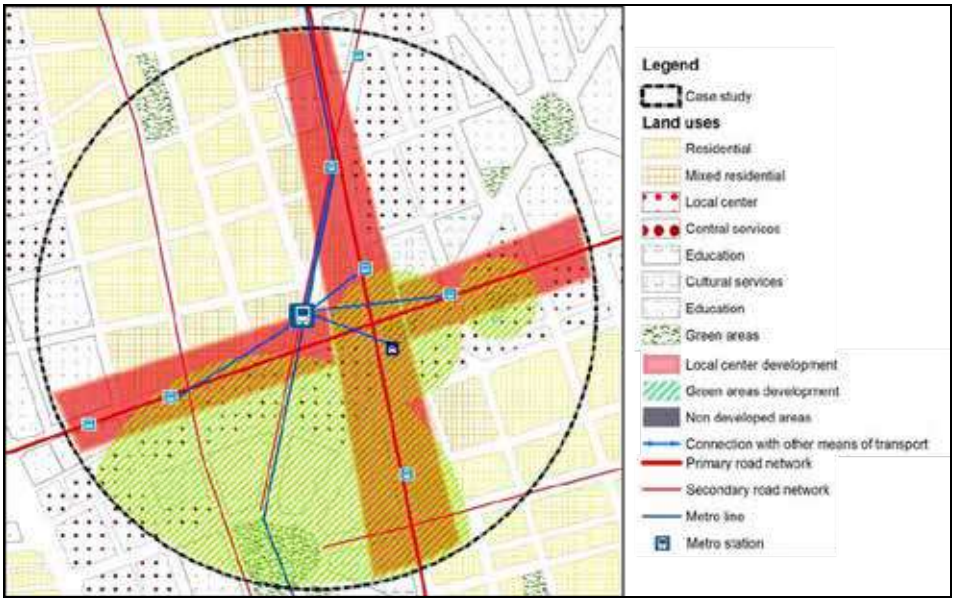

Figure 3: Evaluation map of the Patrikiou Station study area

Regarding the main findings from Kalamaria Station study area, the users find as the most forceful characteristic of the area the main pedestrian street which is the most central and vibrant street of the municipality with

immediate proximity to the station. The connectivity of the area to the centre of Thessaloniki is also considered satisfactory, although the area is in larger distance from the city centre than the Patrikiou Station one. It was also stated that the proximity of the bus stops from the station will enhance public transport intermodality. The users agree that the lack of parking space in the area makes necessary the implementation of a parking management plan. Regarding open space and green areas in the zone of influence of the station, residents and visitors seem to enjoy the operation of the central pedestrian street which functions as the urban centre of the municipality. Housing prices in the area are higher than the ones in Patrikiou Station, however, a decline in the prices during the last years as a result of the financial crisis was also recorded. These prices are expected to change due to the metro operation in the area, with an increase of 20% -25%.

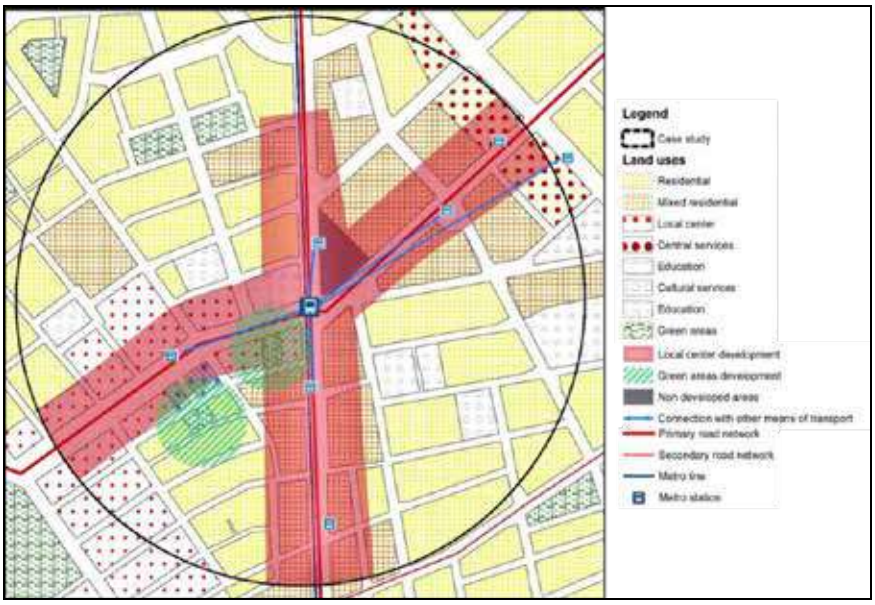

Figure 4: Evaluation map of Kalamaria Station study area

Based on the results underlined from the workshop "The Metro in our neighbourhood", in Patrikiou Station study area the participants noted more or less all the above mentioned problems that were identified in the evaluation based on the questionnaire survey and made the following specific suggestions regarding the regeneration of their neighbourhood and the public realm enhancement:

- Maintenance of the pavements and construction of necessary facilities for people with disabilities
- Establishment of a bicycle network and creation of parking facilities next to the station area
- Implementation of a parking management plan and development of parking spaces also suitable for disabled people
- Redesign of the Mina Patrikiou park with standards oriented to children and disabled people
- Informative signs, either with information about the area and the available public infrastructure and how people could make the best of it
- Protection and enhancement of all open and green areas and more specifically of the Mina Patrikiou park.

As mentioned above, during the event the participants were asked to mark on a map the preferable type of development in the area (commercial, recreational, green uses, traffic calming streets or shared spaces) (Figure

5). The majority of the participants proposed to pedestrianize or implement traffic-calming measures on Solonos street, as well traffic-calming or shared space measures around the Mina Patrikiou park in order to protect children playing in the park during the day. A smaller percentage of participants suggested to pedestrianize or implement traffic-calming measures on Kritis street in order to restore economic vitality in the area. Both these streets function today as collector roads and are congested with parking. Similar suggestions were made for specific local streets aiming to protect children crossing these streets to access their school.

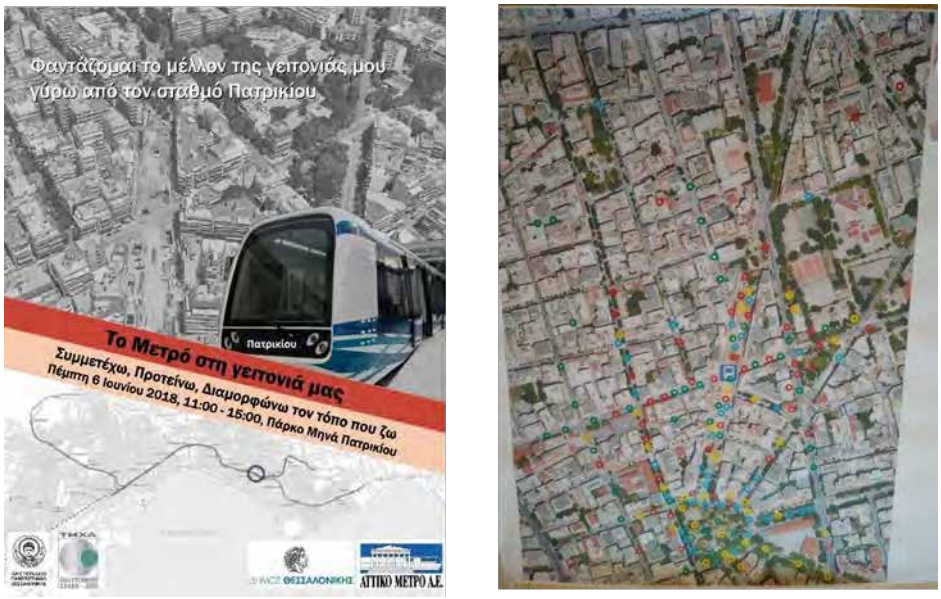

Figure 5: Invitation poster and map with the participants' proposals (Patrikiou Station study area)

Regarding commercial development, the majority of participants stated that greater development of commercial functions after the metro operation should be promoted in the streets Solonos, 25 Martiou and Delphon, as they represent the main arterial or collector roads of the area and they are directly connected with the station. In addition, it was highlighted that Kritis street, the street that trespasses the study area, which has also been stated as downgraded zone with a decrease of commercial stores due to economic crisis in the last years, is expected to be upgraded after the operation of the metro. Considering green areas that should be developed, the participants stressed the lack of greenery mainly on 25 Martiou street as well as on the local streets Chalkidikis, Alexandrias and Christovasili. In addition, they mentioned that the metro will affect positively the aesthetic and environmental enhancement of nearby Mina Patrikiou park, which is and the most popular area during the day.

In the case of Kalamaria Station study area, the results of the workshop "The Metro in our neighbourhood", underlined the following suggestions regarding the regeneration of this neighbourhood and the public realm enhancement:

- Restructuring the mobility patterns of the area oriented to pedestrians, to children and to people with disabilities
- Development of an integrated bicycle network
- Implementation of a parking management plan and parking facilities near the station as well as construction of underground parking infrastructure in connection with the station
- Redesign of an open parking space into a green space with an underground parking
- Playgrounds installation on the parks

The majority of the participants suggested the implementation of traffic-calming measures in Aigaiou and Pontou streets in order to reduce the speed of the vehicle and protect pedestrians. Furthermore, it was suggested to pedestrianize most of the local streets (Soumelas, Vazelonos, Iasonidou, Kyriakidou) which are connected to the main pedestrian street Metamorphoseos, because they have very narrow sidewalks. In the new car free streets, only residents would be allowed to park their vehicles and as a result, the walkability will be improved.

Figure 6: Invitation poster and map with the participants' proposals (Kalamaria Station)

Most participants stated that the greatest development of commercial functions after the operation of the metro will take place on the main arterials Pontou and Aigaiou as well as in the part of Metamorphoseos which is today closed due to metro construction. As they acknowledged, this will arise as result of their proximity with the station. A significant observation for the case study is that most of the participants claimed that the area is full of commercial and leisure stores in the main pedestrianized zone of Metamorphoseos and Komninon streets and therefore there is no need for further development of such land uses in the area. Regarding the development of green areas, the participants stressed the importance of the sustainable upgrade of the outdoor parking area between the streets Chaldias, Karolidou, Kiouptsidou, with the creation of a park and underground parking. Finally, a smaller percentage of participants suggested the redesign of an existing park between the streets of Metamorfoseos, Amisou and Soumela.

4. Discussion and conclusions

Public participation represents a tool whereby the community can express its needs and desires. Incorporating a public participation process regarding new policies or policy changes for sustainable mobility and neighbourhood regeneration, is one step, and perhaps the 'easy' one as the real challenge is 'implementation' (Public Participation and Citizen Engagement, 2015). So, the main purpose of the present paper was in fact to bring experimentally into the broad public the question of the future of their neighborhood in connection to a large transit infrastructure under construction, which for years was creating negative attitudes on behalf of the local residents due to its impacts during the construction stage. This experiment attempted to study whether we can build a broad local support to such big projects through a neighborhood regeneration plan around public transport, in other words through a transit-oriented regeneration, and through that to urge for the implementation of more sustainable forms of development and mobility at the local scale.

Figure 7: Pictures from the two citizen workshops

The overall results of both the questionnaire survey and the workshops indicated that in both study areas a TOD regeneration plan based on the metro station were very welcome by the citizens involved. As a matter of fact, it was notable that the citizens didn't comment at all on the problems and impacts of the construction of the metro.

The most important benefit of applying such a methodology was the interactive education between planners and participants. Planners can educate and inspire participants by explaining the planning guidelines and presenting already successful examples, and therefore participants can express ideas, problems and needs that the planner missed or haven't taken into consideration. In an effective public participation, citizens' involvement can result in better and more informed decisions and thereby, generate durable and sustainable solutions. It goes without question that an authentic public participation requires rethinking the underlying roles of, and relations between the involved parties (King *et al*., 1998) such as the citizens, experts and public authorities. The survey and workshops of the present research operated as knowledge production for both sides: the local residents that were helped to envisage the metro as a future challenge and the research team that had to incorporate their expectations into an ongoing pilot urban project. Public involvement in the present research, through questionnaire surveys and interactive workshops, showed the potential of the use of qualitative methods in the research and planning of sustainable mobility and neighbourhood regeneration. Furthermore, these methods helped to identify different types of citizens and the way they may affect or be affected by decisions taken in the process. Overall, such an approach can enable to integrate local knowledge into urban planning and regeneration policies (Berman, 2017).

Public involvement includes the promise to the public that its contribution will influence decisions in a planning process and thereby represents a way of building trust between local government and citizens. For such an experiment to be useful and effective further elaboration is necessary to draw the attention of the local authorities and encourage the drawing of a neighbourhood plan and the implementation of specific interventions based on placemaking practices and advocating for social, human-scale places. It is also important to ascertain that the citizens' individual ideas will be implemented in some way or another and that closer attention will be paid to their needs and desires. Planning a sustainable neighbourhood based on the citizens' perspective

represents a tool for upgrading public space with an emphasis on human scale. It is a policy of revitalizing public space in cooperation with its users and residents, aiming at the creation of attractive places that will satisfy their needs. A collaboration between residents, planners and decision-makers along with a continuous contact and communication among them can increase the added value and may bring significant positive effects at the local scale as well of large scale public transport investments which usually are evaluated only by their contribution to city and metropolitan scale development.

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How Could the Integration of Land Use and Transport in Planning Practice Contribute Achieving Sustainable Urban Form - By a Case Study Analysis of Kings' Cross and Olympic Legacy in London

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Abstract: This dissertation seeks to analyse how the integrated land-use and transport planning could contribute archiving sustainable urban form. It has been evidenced that there is a close interrelationship existing between land use and transport. Moreover, it is essential to evaluate the effectiveness of planning practice for archiving a more sustainable future from an integrated perspective of land use and transport. London Kings' Cross and Olympic Legacy have been selected as two studying cases, as London can be regarded as an excellent research platform with the well-developed planning system. In general, this study will analyse and explain the contribution of integrated land-use and transport planning for sustainable urban form in three levels. Firstly, the theoretical relationship between sustainable urban form and its influencing factors will be summarised. Then, the primary planning principles will be summed up through the analysis of integrated planning strategies. Finally, the effectiveness of planning practice will be assessed through the case-specific planning policies. The conclusion in various levels will improve the connection between theoretical research and planning practice for achieving sustainable urban form through integrated land-use and transport planning.

Keywords: Sustainable urban form, Integrated land-use transport planning, London King's Cross, London Olympic Legacy

1. Introduction

1.1 Theoretical background and purpose of study

In the 21st century, urban sustainability is regarded as a crucial issue for the development of human society. It is evidenced that the integrated efforts of land-use and transport planning usually have significantly positive impacts on sustainability in an urban context, which is also regarded as the achievement of the sustainable urban form (Mason, 1994). The definition of sustainable development and its relationship to the urban context is a priority to understand the concept of sustainable urban form (SUF). Since the conference of World Commission on Environment and Development (Brundtland, 1987), the universally accepted definition of sustainable development is described as an event which is capable of meeting today's needs without compromising the ability of future generations to meet their own needs. Previous research has revealed that shifts in behaviour and attitudes could significantly affect the acceptance of urban sustainability. Implicitly, manipulating land uses which support potential reductions in transport emissions should be one of the most effective methods of achieving sustainable urban development.

1.2 Research question

The principal aim of this paper seeks to answer the question of how could urban planners and policy-makers promote sustainable development in planning practice from the viewpoint of integrated land-use and transport planning(ILUTP). The interrelationship between sustainable urban form (SUF) and integrated land-use transport planning (ILUTP) will be established to explain how land-use and transport planning could collaboratively contribute to SUF in planning practice.

1.3 Overview of study process and significance of the study

Firstly, main influencing factors in achieving SUF will be critically analysed to explain why the relationship between land use and transport planning is vital in achieving SUF. Secondly, a literature review about the theories of the land-use transport interaction will be discussed to explain the interrelationship between land-use and transport planning system. Strategic planning policies will then be reviewed to classify main planning principles for achieving SUF. According to the analysis of strategic planning policies, case-specific policies of two study cases will be comparatively analysed. Finally, the contribution of ILUTP to achieve SUF will be assessed.

The primary contribution of this research may be to further explore the correlation between land-use planning system and transport planning system for make SUF successful. On the other side, the comparative analysis of case-specific planning policies in two study cases will help to define similar and different focuses on integrated principles in achieving SUF.

2. Literature review and criticism

2.1 Theories about sustainable urban form

It is hard to identify which urban form is most sustainable for development in cities. Williams et al. (2000) argued that certain types of urban forms could be more sustainable in some respects, involving

reduced travel demand and green energy usage, but detrimental in others, perhaps in causing social inequalities. In fact, the concept of sustainability covers a variety of aspects. It is necessary to analyse the connections between urban form and various sustainable features at different geographical scales.

Figure 2.1(a) Egan wheel: Key components of sustainable communities. Source: Mazni et al, (2010)

From the perspective of planning sustainable community, Egan (2004) reviewed a serious of key components in sustainable place making, which involves transport, ecosystem, economy, social equity, housing, governance, public services, and the built environment (Figure 2.1a). However, addressing key sustainable components appropriately in urban development can be challenging due to the complexity of the large cities.

Clearly, sustainability is not just dependent on physical form alone. However, expectations about the magnitude of an urban form's influence on sustainability are significant. Manipulating land uses could be regarded as an effective method of achieving sustainability especially for the sustainable transport systems in urban areas (Williams et al. 2000). Presently, there are two basic types of urban development patterns:

- **Compact city pattern**

The compact city pattern implies intensive land use patterns and a predominantly monocentric urban structure. The high density, the high spatial accessibility, and the high share of non-car travel modes could be expected in the compact city. From the perspective of energy efficiency, the compact city form is recognised as having the most efficient land use and transport systems by the Green Paper on the Urban Environment, which claims European policies on SUF (Brundtland, 1987).

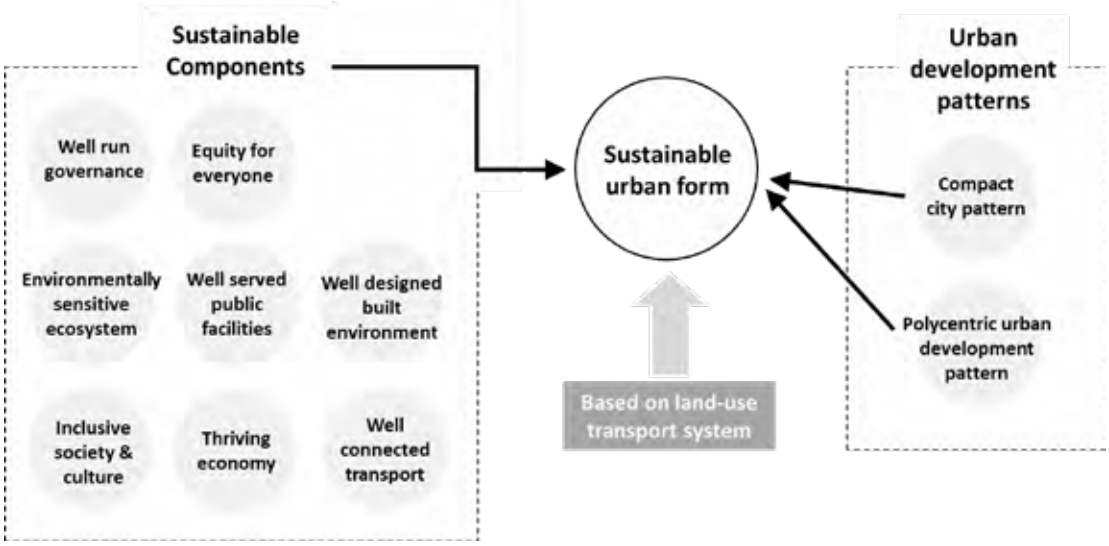
- **Polycentric urban development pattern**

The polycentric urban development pattern pursues a relatively high density around a central core that is surrounded by local employment and business centres. Development is restricted to the central zones adjacent to the sub-centres while a vital role for the central inner city is retained. As a result, high accessibility of primary facilities by non-car mode can be ensured, and more open spaces within the metropolitan area can be preserved (Wegener and Fürst, 2004).

Though a variety of urban development patterns have been proposed as theoretically sustainable urban forms based on sustainable land-use patterns and transport systems, there is not a clear consensus about which type of urban development pattern is preferable for achieving SUF. The different development histories of metropolitan areas, such as London or New York, make the urban development pattern significantly diverse. SUF cannot be designed as a specific type of form affected by the pre-existing historical urban development patterns. For different cities, urban planner and policy-makers will determine different pathways of sustainable development. But there is still a common agreement for urban planners and policy-makers.

From the perspective of transport, SUF could be regarded as a type of urban development pattern which significantly promotes a sustainable travel system regarding the considerable reduction in energy consumption and an increase of the journey efficiency and road safety. In any case, a highly sustainable land-use pattern and transport system can be regarded as the cornerstone for SUF (Figure 2.1b), which is why research on SUF should focus on the interactive relationship between land use and transport.

Figure 2.1(b) The composition aspects of SUF, from the perspective of sustainable components and urban development patterns. Source: Made by author



Meanwhile, there is some practical analysis of SUF including the compact city pattern, urban villages pattern, mixed-use neighbourhood pattern, and the adaptable city pattern. Burton (2000) and Williams (1999) concluded that urban compactness achieved through higher residential density and mix of land use could promote greater public transport usage and social communications in town centres. Newton (1997) discussed some different urban forms beyond the distinction between compact and dispersed city form. He recommended the concept of the urban village located near public transport infrastructure as an ideal form for small-scale towns focusing on reduced travel distance and low-carbon emission.

Masnavi (1998) emphasised the variables of density and mix of uses as key influencing factors in achieving sustainable neighbourhoods, which significantly affect travel behaviour and attitudes of residents regarding travel mode choices, social interaction, and their perceptions of environmental quality. Besides, urban adaptability, which means the ability of different urban forms to adapt over time to the increase of travel need and land-use density is also discussed in the SUF debate. It is evidenced that particular shapes and sizes of urban grid, such as regular grid, adapt well to the urban change in density and travel patterns. (Scoffham and Vale, 1996).

In combination, considerable amounts of research have been conducted revealing the most effective development patterns for a more SUF. The research elements based on land use characteristic have positive impacts on sustainable travel patterns and travel behaviour (Table 2.1a).

Table 2.1(a) Aspects of sustainable development and their impacts

Elements of sustainable development pattern	Possible impacts
High density; *Mix of land uses*	Improve public transport usage with good accessibility to transport facilities; Improve social communications through design of active street space
Small neighbourhood size; *Neighbourhood location around town centres*	Decrease travel distance with commensurate lowering of carbon emission
High density; *Mix of land uses*	Improve travel mode choice, but only if the transport options are provided; Increase social interaction
Regular urban grid which promotes the increase of density; *Small-size block which is easily redeveloped into walking block*	Increase density, easily adapt to changing travel patterns

Besides, Newman and Kenworthy (1999) argued that the compact city development pattern could only have limited impact on sustainable travel behaviour if the travel strategies restricted car usage and improved travel mode choices. It is asserted that proximity to travel destinations did not have a significant influence on travel mode choices without considering travel purpose. Van and Senior (2000) argued that mixed-use and high-quality neighbourhood design with more accessible walking and cycling routes could encourage sustainable mode choices and reduce car dependency for daily shopping needs.

Based on the analysis of planning policy on transport, the relationship between urban form and travel patterns is criticised at the regional scale. Headicar (2003) concluded that the travel patterns are not just related to the size of neighbourhoods. It is suggested that residential density should be strategically considered, for example, in connecting to town centres or employment centres. Stead et al. (2000) speculated that if the location strategies for settlements catered to increased travel demand for work and shopping by offering more sustainable mode choices, then a greater reduction in car use and energy consumption will be achieved at the urban scale.

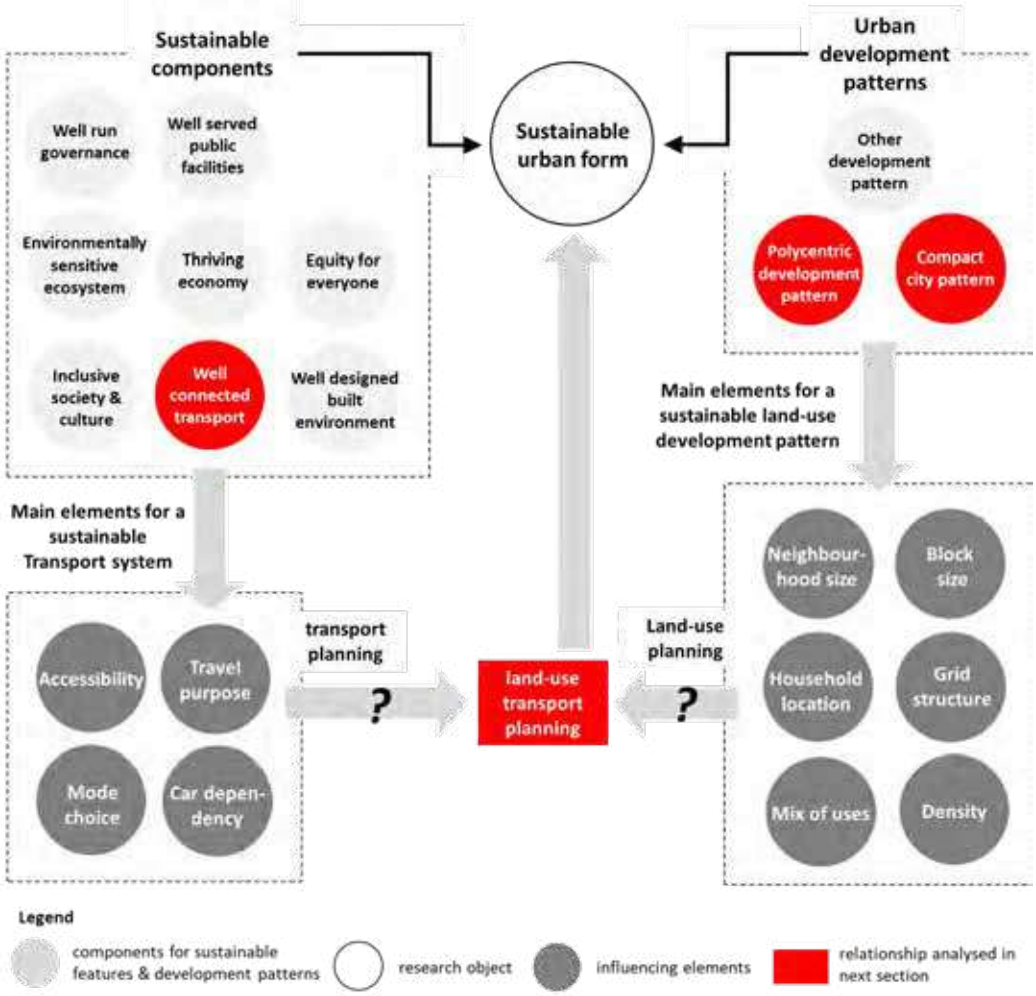
Overall, the main elements of a sustainable transport system have been illustrated (Table 2.1b), among which higher density development, good spatial accessibility to public transport, mixed land use, more travel mode choices, and proactive household location are key, and these elements could have evident influences on sustainable travel patterns and behaviour in achieving more SUF.

Table 2.1(b) Aspects of sustainable transport system and their impacts

Elements of a sustainable transport system	Possible impacts
Reduce car usage; *Create more travel mode choices;* *Focus on travel purpose and distance of work and shopping*	More sustainable mode choices may result, such as walking, cycling and public transport
Increase the mix of land use; *Improve neighbourhood design for cycling and walking*	More sustainable mode choices for travel generated by shopping; Reduce car uses for daily shopping
Large neighbourhood size with good connection with transport infrastructures; *High residential density*	Promote the transport accessibility and attractiveness of public transport
Household locations; *Accessibility of public transport;* *Create more travel mode choices*	Reduce car uses which then reduces energy consumption

In fact, all research discussed previously co-determine the sustainability of urban development patterns and transport patterns (Williams et al. 2000). The interrelationship between transport planning system and land-use planning system need be explored further through the integrated planning view of land use and transport system (Figure 2.1c).

Figure 2.1(c) The potential interrelationship between SUF, land-use planning system and transport planning system. Source: Made by author

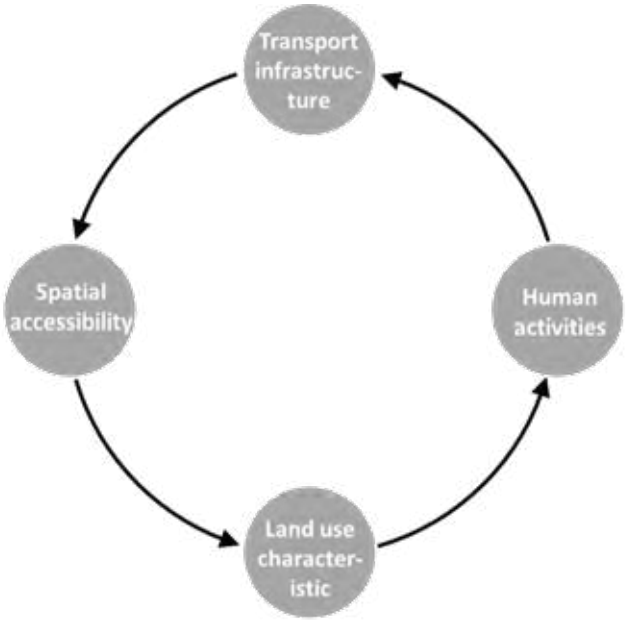


2.2 Theories about the land-use and transport interaction

Theories concerning the interaction between land-use and transport planning system involve technical, behavioural, and strategic dimensions. For example, land use has impacts on travel behaviour. Meanwhile, transport could influence the location behaviour of firms and households. But issues of coordination between land-use and transport planning in different urban contexts are still less well known (Wegener and Fürst, 2004).

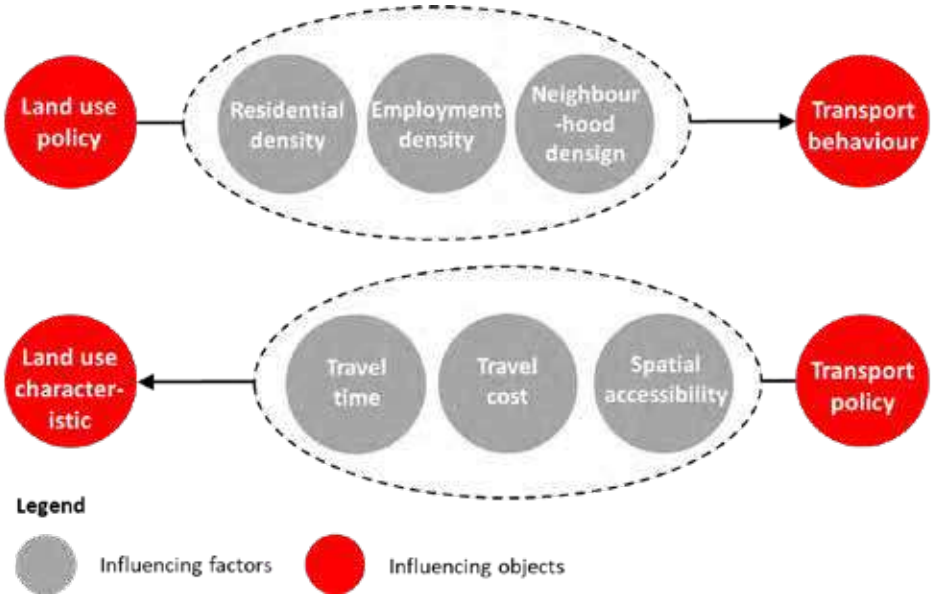
According to the EU research project, 'Transland' which evaluates strategic policies and their impacts on future urban developments in the field of integrated transport and land-use planning, theoretical and conceptual work on the integration of land use and transport has been reviewed. Theories on the two-way interaction are put forward to address the locational and mobility responses, involving households, travellers and firms, to changes in the land use and transport system. It is proposed that land-use and transport planning should be seen as an integrated mechanism, producing the land-use transport feedback cycle (Figure 2.2a). The mechanism in this 'cycle' is based on a set of relationships including the distribution of land uses, human activities, transport infrastructure, and spatial accessibility.

Figure 2.2(a) The land-use/ transport feedback cycle to illustrate the land use/ transport mechanism. Source: Made by author, Wegener and Fürst, (2004).



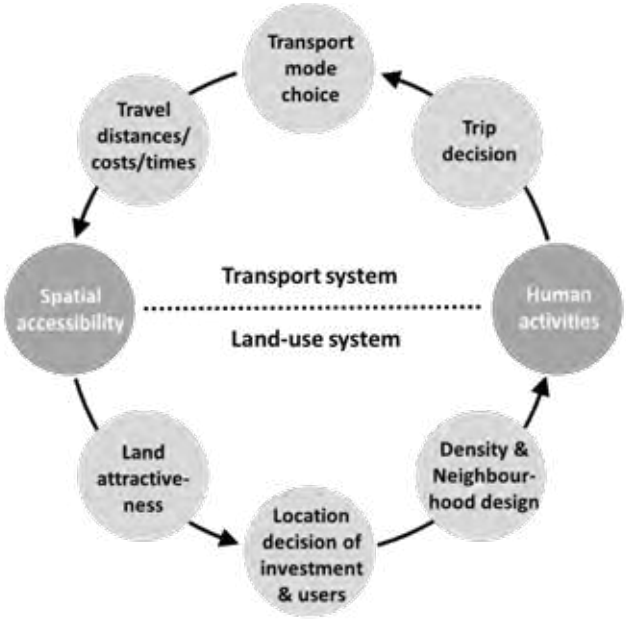
The results of the land-use and transport interaction are expressed concerning expected impacts on urban density, employment density, neighbourhood and open space design, development locations, accessibility, and travel cost/ time (Figure 2.2b). There are two influencing directions in this interactive mechanism, which is the impact of land use policies on transport behaviour and the impacts of transport policies on land use outcomes. It is summarised that the impacts of land use policy on transport behaviour could be reflected through the traffic variables such as trip length, mode choice, and travel cost. Besides, the impacts of transport policy on land use characteristics could be mainly measured by the location decisions reflected in different land-use categories.

Figure 2.2(b) Expected influencing factors within land use/ transport mechanism. Source: Made by author, Wegener and Fürst, (2004).



In general, the current research has explored a two-way interactive paradigm of urban development, which consists of four main elements including the land use system, human activities, the transport system and spatial accessibility. Land-use planning policy is regarded as an important factor to generate travel demands, while transport planning policy has an inevitable influence on the changes in land use because of diverse location decisions of investments in future development. Moreover, changes in land use characteristics will further generate more travel demands and inevitably have impacts on current transport behaviour. Thus, the dynamic relationship between the land use system and the transport system have been established (Figure 2.2c). Based on this interactive relationship, the interrelationship between SUF and the specific influencing factors can be established.

Figure 2.2(c) Dynamic relationship between the land use system and the transport system. Source: Made by author, based on an article by Wegener and Fürst, (2004).



2.3 Strategic policy Review

To guide the susyainable planning practice, a variety of strategic policies have been stated, which adopt the integration of land-use and transport planning, such as Planning Policy Guidance 13[1] (PPG 13), National Planning Policy Framework (NPPF), Sustainability of Land Use & Transport in Outer Neighbourhoods[2] (SOLUTIONS), and Smart Codes[3].

[1] 'PPG 13' aims to deliver the UK government' s objectives for transport development and encourages the integration of planning and transport. (National planning policy framework, 2012).

[2] 'SOLUTIONS' is a research conducted by Engineering and Physical Research Council, which aims to develop a guidance to support the implementation of sustainable land use and transport. (Suburbansolutions.ac.uk, 2017).

[3] 'Smart Codes' is a guidance for smart growth, including multimodal transport, infill development, affordable housing, and other practices in planning regulations (American Planning Association., 2017).

This paper has summarised the major planning objectives from these policies, basically involving the formation of urban form, the promotion of transit-oriented development, the classification of walking and cycling transport system, the improvement of spatial accessibility and safety, the application of traffic and parking management to reduce the usage of private cars (Table 2.3). In addition, the key planning factor has been categorised, which could be regarded as a set of the main influencing factors for making the sustainable development possible.

Table 2.3 Strategic policies for the integrated approach to land-use and transport planning

Framework	Planning objectives	Key factor
PPG 13 & NPPF	Manage the major generators of travel demand in district centres and make them near to the transport interchanges	Developments site locations
	Promote more sustainable mode choices for people and moving freight	Public transport, Walk and cycle
	Promote accessibility to work, shopping, leisure and other services by public transport, walking and cycling	Accessibility of facilities, Work-housing balance
	Reduce the need to travel in urban areas, especially for the reducing of car uses	Travel demand management
	Create safe and secure layouts which minimise conflicts between traffic and cyclists or pedestrians	Walk and cycle, Neighbourhood design
SOLUTIONS	Regulate land use and transport, particularly for the conservation area and the allocation of dwellings and employment	Work-housing balance
	Invest the development of land and transport, for example improving the capacity of existing transport networks and establishing more travel links	Strategic transport network
	Price the use of land and transport, such as the extra travel taxation in central region like the congestion charging zone.	Travel demand management

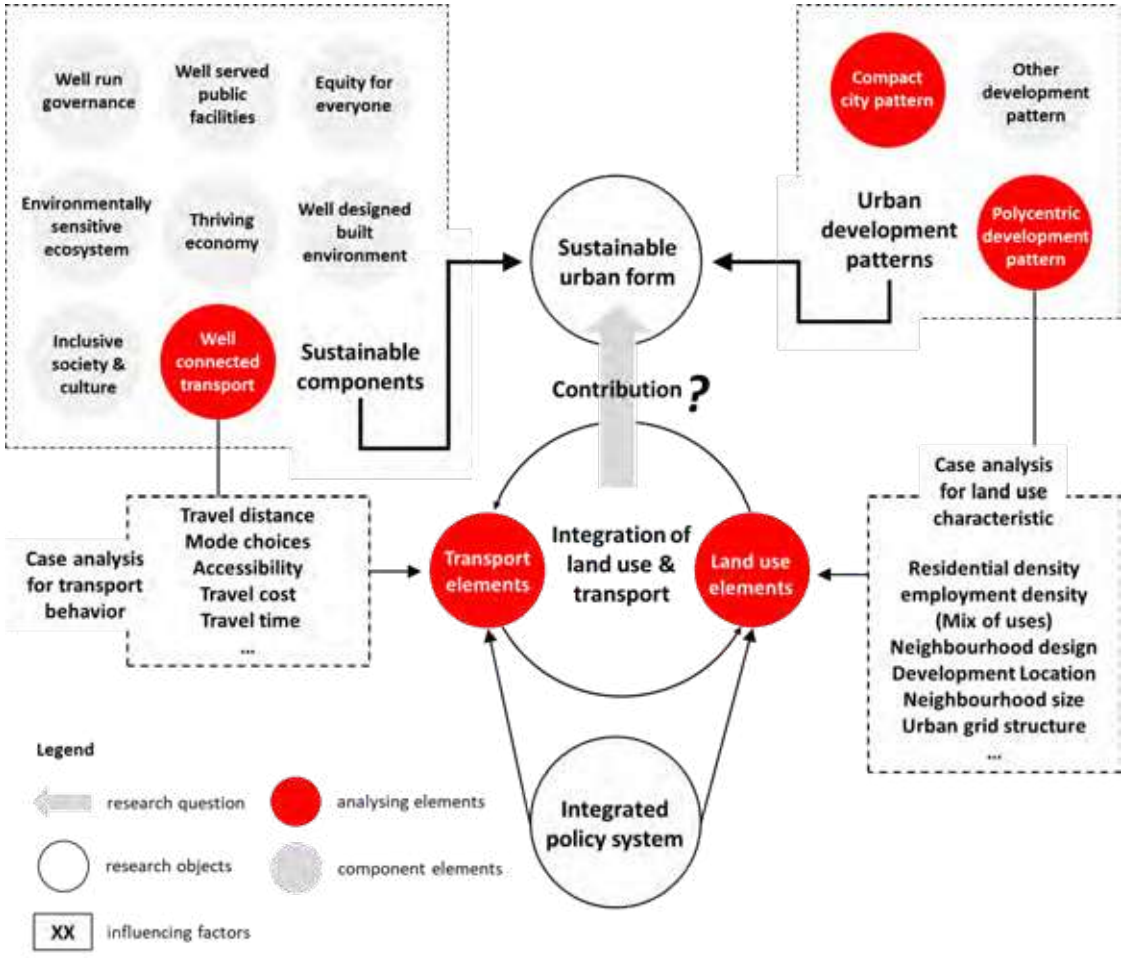
Smart Codes	Accommodate the mixed-use blocks and buildings to stimulate community development and promote the wellbeing of residents	Mix of use, Neighbourhood design
	Provide the appropriate flexibility of live/work units used for commercial and residential development	Work-housing balance
	Develop a high-density, high-intensity and mixed-use employment district centre	Development density Mix of use
	Encourage the development of affordable housing in more accessible areas and increase the community density	Development density, Development site locations
	Protect the transfer right of development for different purposes, such as green spaces preservation, historical district preservation.	Mix of use
	Cluster the residential development and creating the physical active community	Neighbourhood design

2.4 Theoretical framework - interrelationship between sustainable urban form and integrated land-use transport planning

A theoretical framework is established, which shows the expected interrelationship between SUF and its influencing factors (Figure 2.4). More importantly, the interactive mechanism between these factors has been revealed by the land use and transport system relationship. Banister and Givoni (2010) argued that an integrated view of land-use and transport planning could guide them in the direction of more effective measures to achieve SUF. Based on the perspective of an integrated land-use and transport planning system, a sustainable development pattern could be possibility assessed.

Land-use system considered in spatial planning will define particular types of urban forms (i.e. compact, polycentric) which can promote more social interaction, activities and sustainable transport behaviour. Transport system considered in spatial planning could contribute to reducing unnecessary long-distance travel, car use and to guiding more sustainable travel behaviour. More importantly, once more sustainable travel behaviour has been achieved, this will have positive impacts on later land-use investment and development to strengthen its pre-existing sustainable land-use characteristics. Finally, SUF will be accomplished through this dynamic-interactive relationship, especially regarding the aspect of sustainable transport.

Figure 2.4 Interrelationship between sustainable urban form and integrated land-use transport planning. Source: Made by author



3. Methodology for the research process

3.1 Research approach

The approach of this research will mainly focus on the exploratory, qualitative research on the integration of land-use and transport planning to promote the evolution of more SUF through primary principles of planning policy and planning practice instructed by them. The research can be regarded as a collaborative effort to criticise planning guidance on how local planning authorities can contribute in making urban development more sustainable through the integration of land-use and transport planning.

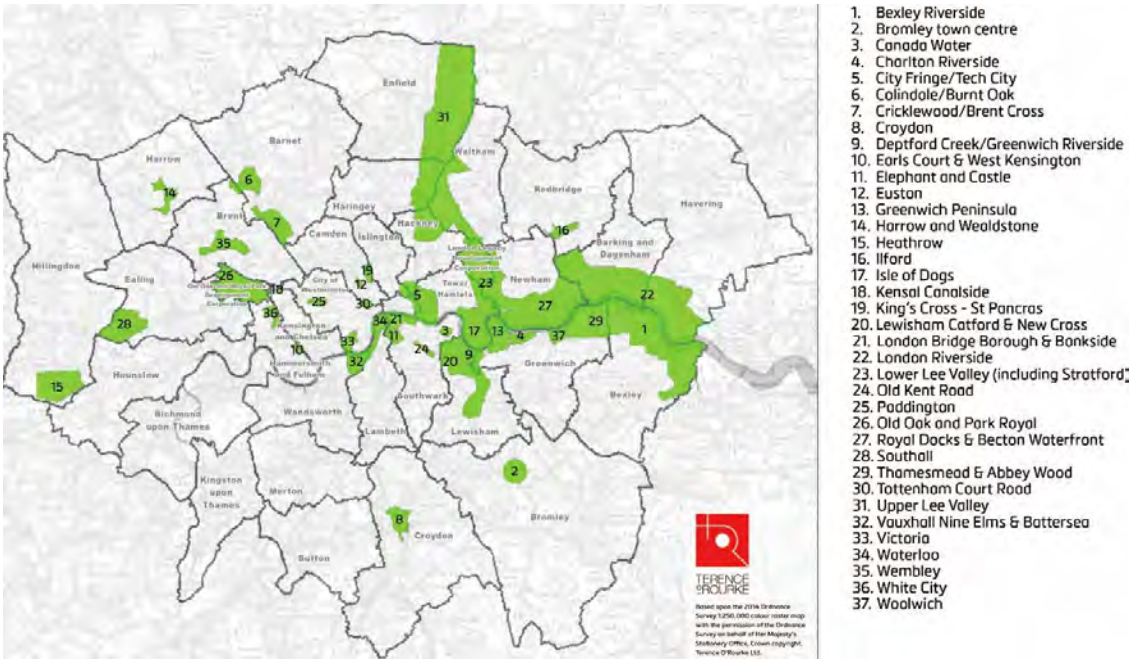
3.1 Research scope

According to the model of urban development pattern, the compact city model and polycentric urban development pattern is commonly recognised as more sustainable growth pattern, which is also mainstream urban development model in most western countries. Cities under the effects of high development density and high-efficiency public transport system such as London, Paris, Barcelona have great potential to be more sustainable through the integrated land-use transport planning. More

importantly, the research should concentrate on a highly-developed city currently experiencing pressures of urban growth.

London is an excellent platform for the analysing the practice of integrated land-use and transport planning because of the large-scale urban intensification and numerous regeneration events. Thousands of new homes and jobs are proposed to create in London's 38 opportunity areas. The delivery of SUF through urban development practices in these opportunity areas will significantly affect the urban sustainability in London (Figure 3.1).

Figure 3.1 The location map of London's 38 Opportunity Areas. Source: Londonfirst.co.uk, (2017)



4. Case study analysis

4.1 Background for Kings' Cross and Olympic Legacy area

The regeneration of King's Cross can be recognised as a transport-led development project, while the urban regeneration in London Legacy district was significantly promoted by the 2012 Olympics and its redevelopment. Though the two cases have different development histories and historical backgrounds (Table 4.1), they have strong similarities in their development objectives.

Table 4.1 Overview of the case study areas

Area	Kings' Cross Opportunity Area (KCOA)	London Legacy Development Corporation area (LLDC)
Developing vision	a vibrant, inclusive, and sustainable redevelopment project with the	a mixed-use development driven by the 2012 Olympics, London's eastern

	significant potential to utilise its excellent transport accessibility	gateway and intersected by the Channel Tunnel Rail Link
Total area	24 hectares (excluding the area of railway stations)	73 hectares (Phase 1, known as 'Stratford City')
Principle Development objective	High spatial accessibility, mixed use (including commercial, retail, education, residential, green spaces), high density (especially compared to traditional residential areas), improvement of transport interchanges, local community involvement.	

In brief, regeneration of Kings' Cross and Olympic Legacy is mainly driven by the massive investment in transport infrastructure and land use development, which contributes to integrated land-use and transport planning more significant (Figure 4.1a, Figure 4.1b). These cases both reflect the strong character of the compact city pattern or polycentric urban development patterns, such as high density of housing and employment, a mix of uses, and high spatial accessibility for public transport. Land use characteristics and transport behaviour in local areas will be substantially changed by these regeneration projects. The two cases have relatively high value for assessing the contribution of integrated land-use and transport planning to develop a more SUF.

Figure 4.1(a) Location and the boundary of Kings' Cross Opportunity Area. Source: Made by author

Figure 4.1(b) Location and the boundary of London Legacy Development Corporation Area. Source: Made by author

4.2 Case-specific policy analysis in Kings' Cross Opportunity Area

Currently, Kings' Cross presents one of the most significant regeneration opportunities in Europe. It is also the largest plot of brownfield land in central London. As a gateway from Europe to London and the UK, St Pancras International and Kings' Cross railway station play vital roles in the urban-regional transportation system.

4.2.1 Spatial accessibility and connectivity in urban-regional scale

Delivering efficient urban-regional transport connection is an integral part of the regeneration objectives (Kings Cross Opportunity Area planning & development brief, 2003). The location of Kings' Cross and two transport interchanges offer significant advantages for the improvement of spatial accessibility and mobility (Figure 4.2.1). The physical boundaries of the regeneration site should be broken down to provide a full connection with the rest of London. It is argued that the area's transport accessibility underpins the potential for high-density development, which is also fully integrated with public transport network (Kings Cross Opportunity Area planning & development brief, 2003).

Figure 4.2.1 The spatial connection of KCOA with central London. Source: *Kings' Cross Central: Urban Design Statement document*

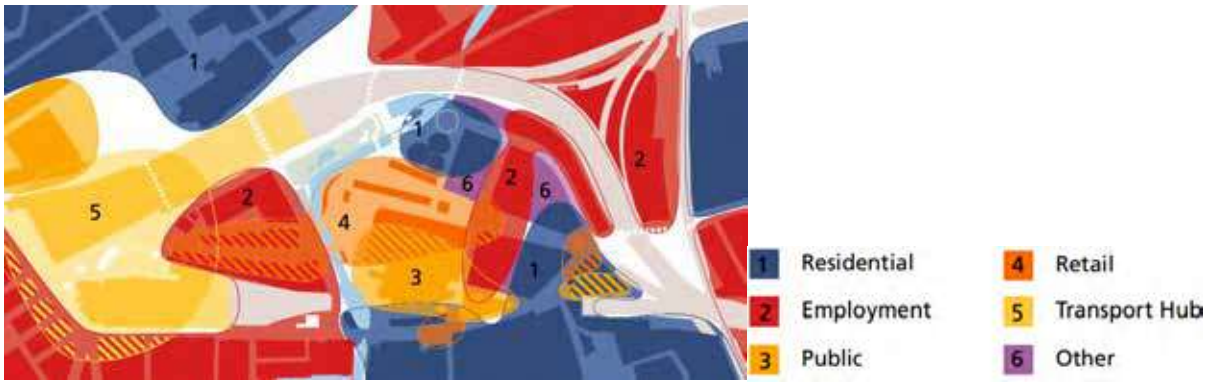
In a word, the planning policy related to spatial accessibility usually focuses on the improvement of transport connectivity within the urban-regional area. For KCOA, two transport interchanges, Kings'

Cross Station and St Pancras International Station including CTRL terminus, are key catalysts to guide the direction of redevelopment. This transportation hub comprised of two railway stations, CTRL terminus and Kings' Cross St Pancras underground station become one of the most crucial transport gateways for central London. Under this developing condition, the form of high-density development will also be considerably promoted by the integrated rail transport system. On the other side, locating at the fringe of Central activities zone (CAZ) and smaller size of regeneration site (around 24 hectares) enhance the demand for developing density and intensity, because of the significant increase in land values.

4.2.2 Social and economic activities in regeneration area

Financial links can be promoted by allocating newly available jobs widely. For social interactions, the focus is on community involvement, which primarily includes making better access to employment and training, improving local people's qualification through education and creating attractive communication environments. High-density mixed use is an effective way to enhance the competitiveness of business, maximise affordable housing provision to meet changing needs and contribute to the vitality of the whole project. Depending on this mixed pattern of land uses with optimised density (Figure 4.2.2), the land-use capability of offices, retail, leisure, education can be increased. The hugely demand of housing and diverse services in central London will be met.

Figure 4.2.2 Strategic land use framework in KCOA. Source: *Kings' Cross Central: Urban Design Statement document*



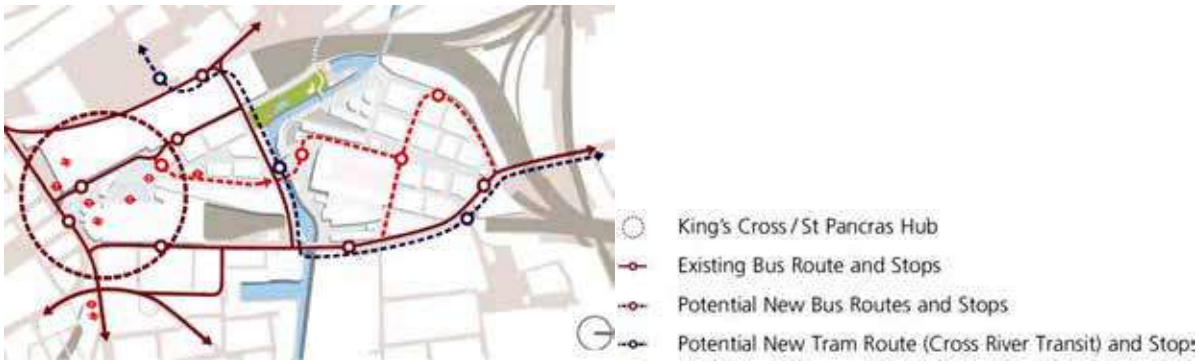
To conclude, the planning policy related to the social-economic activities generally emphasis on the enhancement of local vitality by high density and mixed-use development. The policy requires the commercial development should achieve plot ratios of at least 3:1 wherever there are good transport accessibility and capacity. Moreover, that ratios nearer to 5:1 is recommended to be achieved in highly accessible areas (Queenelizabetholympicpark.co.uk., 2017). To make optimum mixed use of the site, a flexible framework of land use plan is proposed that allows the mix of uses in the north part to be chosen to respond to a changing social-economic climate.

4.2.3 Transport availability for sustainable travel modes

Encouraging more sustainable travel modes by improving the attractiveness of public transport, walking and cycling will have significant impacts on reducing car dependency. To increase the attractiveness of sustainable travel modes in KCOA, new reliable bus routes linking the site with surrounding

communities and Camden town centre should be considered (Figure 4.2.3). The provision of bus priority measures wherever needed to maximise the reliability of existing and new services for jobs, shopping, leisure and other activities. Besides, high-quality pedestrian and cycle links to public transport nodes should be well-designed. For car parking and storages, the provision for car parking is expected at deficient levels. For example, the developer should demonstrate on minimising the traffic generation in the site. The proportion of car-free housing is required to reach at least 75%.

Figure 4.2.3 Public transport system plan in KCOA. Source: *Kings' Cross Central: Urban Design Statement document*



In summary, the planning policy related to promoting the availability of sustainable travel modes builds on the well transit-connection of public transport, walking and cycling. A network of tertiary vehicular routes can minimise most of the car traffic in the centre of the site except for the essential vehicle services such as fire access and deliveries, which will make public realm more quiet and safer for pedestrians . In Kings' Cross, private and public car parking is combined to make the best use of shared facilities, which can also provide for different demands at different times of the day and week (Queenelizabetholympicpark.co.uk., 2017). Also, more cycle parking can improve the attractiveness of cycling travel instead of travel by private car.

4.3 Case-specific policy analysis in London Legacy Development Corporation Area

Different from the regeneration of Kings' Cross, the redevelopment of London Legacy emphasises on a larger-scale site, which covers the area in four London boroughs. After the 2012 London Olympic, the London Legacy Development Corporation was established to promote and deliver physical, social, economic and environmental regeneration of the Olympic Park and its surrounding areas by securing sustainable development and ensuring the smooth transformation of these Olympic venues in the long term (Queenelizabetholympicpark.co.uk., 2017).

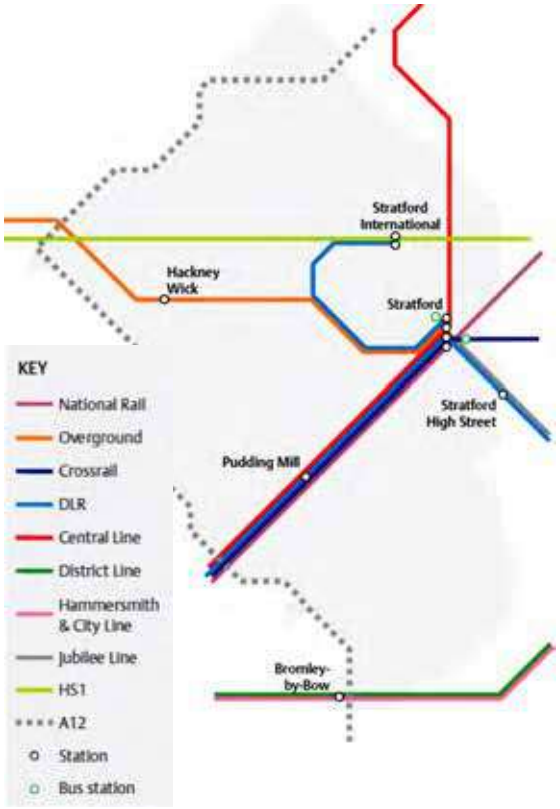
4.3.1 Spatial accessibility and mobility in urban-regional scale

Improving the strategic transport connection and transport infrastructure is considered as the priority to develop business growth, jobs and lifelong learning in Stratford area. The Legacy Corporation area occupies a key strategic location at the meeting point of the London-Stansted-Cambridge-Peterborough Growth Corridor and the Thames Gateway Growth Corridor (Anon, 2017). Strategically, this area is connected to the major business and growth hub of central London, including Canary Wharf and the

Royal Docks (Figure 4.3.1a). The potential of being another London Metropolitan centre improves spatial accessibility more important for the redevelopment after the 2012 Olympics.

Figure 4.3.1(a) Location of LLDC area in London. Source: *A walk around Queen Elizabeth Olympic Park*

Figure 4.3.1(b) Public transport and connectivity in LLDC area. Source: *LLDC Local Plan 2015 to 2031*



In general, the improvement of public transport infrastructures and services at all levels is the cornerstone for delivering the social-economic growth in Stratford area, including the development of international, national, regional and local transport connectivity. The efficient and well-designed stations, including the development of Stratford Station for Stratford City and the 2012 Games, the new stop of Channel Tunnel Rail Link at Stratford International Station, the capacity enhancements of Jubilee Line, Overground and DLR, strengthen the spatial accessibility and mobility of LLDC area (Figure 4.3.1b). Based on that, Stratford becomes one of the best-connected places in London, which attracts substantial investment for the further land redevelopment.

4.3.2 Social and economic activities in regeneration area

Developing a strong local economy and driving the transformation of east London as a new city centre is the vital objective for the regeneration in LLDC area. To reach this target, the economic profile of the area should be strengthened, which depends on providing additional floor spaces in a wide range of sizes, types and forms.

More particular, the local plan about employment clusters will foster a range of job opportunities, and it is also the key to the character and vibrancy of the regeneration site. With the spatial distribution of employment areas and social infrastructures in several hierarchies, the daily social activities can be centralised around the central development area. More social communications can be promoted within the new-designed public spaces. On the other side, a mix of housing types should be provided to create the sustainable neighbourhood and avoid problems that may result from over-concentration of certain size and types of accommodation. It is required that all community planning proposals should reflect identified housing size, building form and tenure requirements.

4.3.3 Transport availability for different travel modes

Managing development and its transport impacts to promote sustainable transport choices and prioritise pedestrians and cyclists is an essential policy to minimise reliance on the private car to ensure that the regeneration of the Legacy area is optimised and more sustainable. The plan aims to lead to dramatic changes in Londoners' behaviour and attitudes to their cars and contribute to decreasing car ownership per household in local communities. In doing so, several specific policies should be considered, such as implementing a locally connected street network that prioritises pedestrians and cyclists as the most important travel modes, followed by public transport and the private car (Figure 4.3.3) (Queenelizabetholympicpark.co.uk., 2017). The amount of new development across its areas, in particular as the town centres and employment clusters, should be related to the transport capacity of existing or planning improvements to transport infrastructures and services.

Figure 4.3.3 Transport prioritises. Source: *LLDC Local Plan 2015 to 2031*

Besides, facilitating local connectivity with the redevelopment of high-quality built environment can significantly strengthen the attractiveness of walking and cycling within the area. It is believed that the improvement of local connectivity is a critical issue for the liveability of this area. Currently, physician barriers such as motorways, railway lines and canals, increase the difficulty for people to move around the area. It is crucial to forming a network of linked walks connecting with adjacent neighbourhoods and town centres throughout the Olympic Park, which will adequately respond to the potential of social activities.

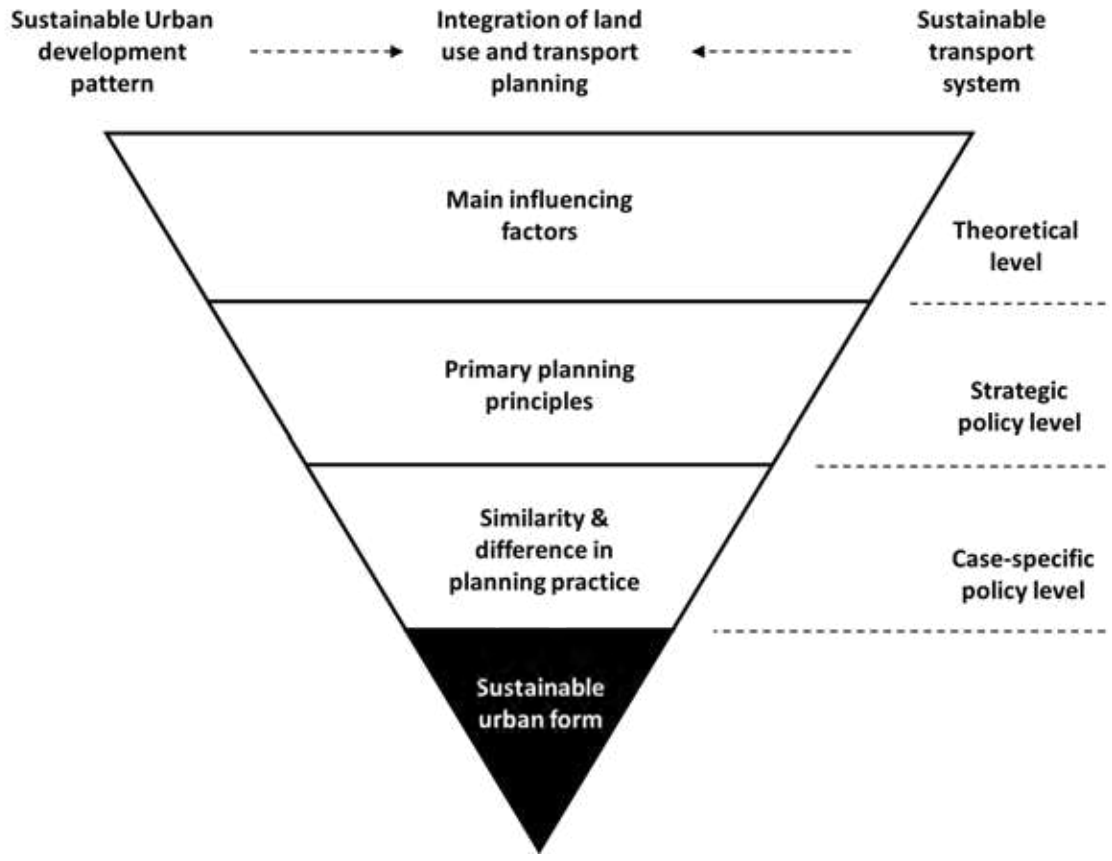
5. Conclusion and recommendation

5.1 Contribution of integrated land-use and transport planning for SUF

It has been evidenced that land use and transport planning are two principal systems in co-determining the sustainable effectiveness of spatial planning in practice. In general, the transport planning policy can be regarded as a kind of 'push' measures to limit the unsustainable travel behaviour, such as long-distance car travel and car dependency. While, the land use planning policy can be considered as a kind of 'pull' measures to indirectly guide more sustainable land-use characteristics, which greatly promote the social-economic vitality in town centres and communities.

This research concludes that the integrated land-use and transport planning consisting of sustainable urban development pattern (i.e. compact city model and polycentric urban development pattern) and sustainable transport system (the most crucial components for sustainable objectives) can significantly contribute to achieving SUF (Figure 5.1).

Figure 5.1 The framework about contribution of ILUTP for achieving SUF at three levels. Source: Made by author



Besides, the complexity of SUF and ILUTP has been revealed. The reason is probably that a various range of influencing factors are involved in the land-use planning and transport planning systems, and they have impacts on co-determining the sustainability of urban development. More complicated, it is difficult to assess the efficiency of each influencing factor on promoting SUF because of the significant

difference in urban areas. However, the contribution of ILUTP for achieving SUF can still be assessed in the western countries with the well-developed planning system, through the analysis of planning strategies and empirical studies. Based on this research, contributions of ILUTP for achieving SUF have been concluded in three respects, involving influencing factors summarised from the literature review, planning principles classified from planning strategies and different planning practice assessed through case-specific policies.

a) Main influencing factors for affecting SUF

Main influencing factors are summarised from land-use and transport planning policy which promote SUF through positively affecting transport behaviour and land-use characteristic in development areas.

The influencing factors related to changing transport behaviour have a 'push' impacts on achieving SUF in the short term, which mainly include the improvement of public transport infrastructures to change people's travel modes, traffic management and minimised parking provision to reduce the use of the car.

The influencing factors related to affecting land-use characteristic usually have a 'pull' impacts on achieving SUF in the longer term, which include strategic development location, accessibility of key facilities, size of development settlement, work-housing balance in local area, a mix of uses in town centre, high development density especially for residents and employments, design for walkable neighbourhood and open streets.

b) Primary planning principles for instructing SUF

To guide planning practice, three primary planning principles have been summarised, include the promotion of spatial accessibility, diverse activity and sustainable transport availability.

Principle-A: Spatial accessibility supported by the improvements of transport infrastructures and transport network connectivity to attract investments and connect the travel origins and destinations much easier;

Principle-B: Diverse activities in town centres and new communities supported by high-density development and mixed land use to create social and economic vitality;

Principle-C: Transport availability for mode choices supported by high-quality design and amenity of public spaces to promote more sustainable travel behaviour.

c) Case-specific planning policies for achieving SUF

The similarity of case-specific policies in planning practice has been assessed and summarised from the case-specific policies as well as the difference (Table 5.1). It is also explored from the case-specific planning policies that the location of regeneration projects may result in somewhat different outcomes in planning practice for achieving SUF.

Table 5.1 Similarity of case-specific planning policies in KCOA and LLDC area

Principles	Similarity of case-specific policies
Principle-A	• Deciding the form of regeneration as high-density and mixed-use development by establishment of integrated transport system at the beginning; • Easily getting more capital investments from related stakeholders to speed up the regeneration process; • Potentially generating vast numbers of inbound and outbound daily trips through the improved transport infrastructure and system;
Principle-B	• Greatly cutting down the travel distance between homes and workplaces by offering relative numbers of new homes and workplaces and keeping work-housing balance locally; • Compulsively providing sufficient proportion of affordable housing in development communities to promote the mix of accommodation, the mix of residents and the mixed use of public spaces;
Principle-C	• Directly reducing car uses through discouraging unnecessary car travels, such as daily light food shopping, leisure activities by working out more strict parking measures; • Indirectly reducing car uses through encouraging more sustainable mode choices by designing more walkable public spaces and street layouts, particularly in new communities;

The development location may affect the development pattern of the project and change the spatial character of the city. Kings' Cross is planned as a viral connection node, and new employment centre in central London as the transportation interchanges have already been here. The project can be treated as an expansion of central London, which significantly strengthens the spatial character of the compact city in central London. While London Legacy is planned as a new urban centre for the great London, which relies on the consistent improvement of transport accessibility since 2012 Olympics. The project can be recognised as a development for a new urban centre, which shapes the spatial character of Great London as a polycentric urban form. In general, the regeneration project in KCOA and LLDC area will both contribute to promoting London as a more sustainable city at regional-district scale.

5.2 Limitation of the research and recommendation for further analysis

The conclusions reflect primary concerns for urban planners and policy-makers toward more SUF from the perspective of ILUTP. The outcomes may not be specific enough to explain the achievement of SUF through influencing factors, primary principles, and case-specific policies, because of the limited time and lack of data. The measures of quantitative analysis focusing on the changes of travel modes, density, and the mix of uses will be greatly helpful to evaluate the correlation between SUF and ILUTP.

d) Shortcoming and failing within this research

One significant limitation is those previous conclusions about achieving SUF aim at assessing the effectiveness of integrated policies in urban regeneration projects. The outcomes of ILUTP have limited influence on the improvement of sustainability in surrounding areas. But the SUF should not just be accomplished through urban renewal projects under the instructions of integrated land-use transport planning, which may lead to creating a 'sustainable island' surrounded by the 'unsustainable sea'. A more ambitious target should be considered, emphasising on how to promote more SUF for the whole city through the integration of land use and transport planning.

e) Further questions arising from the research

It is also claimed that the influencing factors in social respect can also affect the sustainability of urban development, especially having considerable impacts on the sustainable transport system. Stead et al. (2000) once argued that socioeconomic conditions could explain more variation in travel patterns than do land use characteristics. It is believed that the influence of land use could not be as significant as it previously assumed. The socioeconomic component, such as household car ownership, household socioeconomic group and working residents proportion, need to be paid more attention instead of issues of land use or transport.

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Planning for accessibility and sustainable mobilities

Bicycle-Metro Integration for The 'Last Mile' in Shanghai*

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Abstract: Cycling is always considered to be one of the most popular daily traffic tools in cities due to its flexibility, convenience and low cost. Moreover, Bicycle-metro integration is theoretically considered to be an effective solution for improving public transportation efficiency of "last mile" between home and metro station in big cities. However, this proposition has not been fully proved in practice. In recent years, the emerging dockless bike-sharing system makes it possible to examine the spatial integration between flexible bicycle traffic and rail transit. Compared with traditional public bicycle systems with fixed docks, such as New York Citibike, this new bike-sharing system demonstrates the mobility and flexibility of cycling. We randomly sampled the GPS coordinates of 80,000 dockless bikes in Shanghai, which represent the origin and destination points of cycling. We mapped the bicycle traffic on an equal population cartogram of Shanghai to distinguish overall patterns within the center of Shanghai. Results show that most of the high-frequency cycling streets still centre around metro stations. The streets basically present a gradual decline from the metro stations to outlying areas in terms of cycling frequency, which indicates that bicycle-metro integration has already become the basic model for daily transport in Shanghai.

Keywords: Bicycle-metro integration, the 'last mile', dockless bike-sharing system, Shanghai

Introduction

Traffic-oriented development (TOD) is a way to ensure the sustainable development of transportation and urbanization. As a fast, efficient and large-capacity transportation mode, the subway system is the focus of the TOD strategy. However, in the suburbs of the city, the subway stations are sparsely distributed, and their service radius often needs to be extended to more than one mile or even three miles, which seriously reduces the public accessibility of the subway system. In such cases, passengers in the subway system usually enter the station by other means, such as walking, cycling, and taking a bus. This transfer process is described as the last mile issue. Improving accessibility and strengthening the integration of other modes of transportation with subway stations will definitely increase the passenger capacity of the subway system.(Zhao and Li, 2017).

Meanwhile, cycling is always considered to be one of the most popular daily traffic tools in cities due to its flexibility, convenience and low cost (Akar and Clifton, 2009; Parkes et al., 2013). The traditional bicycle sharing system began in the late 1990s and has been extensively researched to date. For bicycle sharing systems in different cities, Pfrommer et al.(2014) determined that the peak usage of working days is between 7 am and 9 am, 4 pm to 6 pm, and the weekend peak is at noon. Ahmed et al.(2010) argue that the shared bicycle system is busier in warmer months, which usually confirms the relationship between weather and private cycling tendencies. A study of bicycle-sharing travel time based on data from Melbourne, Brisbane, and Washington,

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DC Researchers at the University of Minnesota and the University of London determined that this duration was within a narrow band between 16 and 22 minutes(Fishman, Elliot, Simon Washington, and Narelle Haworth., 2014). Another study shows that average users of a particular bicycle sharing service typically travel longer than annual membership (Buck, Darren, et al., 2013). Tao et al.(2013) analyzed the global and space-time modes of traditional public bicycle sharing systems in Nanning, China, and studied the impact of urban patterns on these models. Froehlich et al.(2009) conducted a spatio-temporal analysis of the use of bicycle stations in the shared bicycle system in Barcelona for 13 weeks, applied clustering techniques to identify sharing behaviors between stations, and compared experiments with four prediction models used in nearby stations. result. Some studies have focused on the sustainability of bicycle sharing systems.

Bicycle–metro integration is an effective solution for improving the accessibility of metro systems and facilitating green transportation (Zhao and Li, 2017). In recent years, dockless bike-sharing programmes have been launched in China at an impressive speed. These new common-usage bikes cover almost every street in Chinese big cities, and can be accessed via smartphone (Chinta and Sussan, 2018). Compared with traditional public bicycle systems with fixed docks, such as New York Citibike (Faghih-Imani and Eluru, 2016), this new bike-sharing system demonstrates the mobility and flexibility of cycling. People do not have to depart from or arrive at fixed docking stations; they may enjoy cycling from/to anywhere in the city. This design is effective in solving the 'last mile' problem, which is spreading across hundreds of cities around the world, including San Francisco, Seattle and London, by providing people with the transportation tools between public transport hubs and home.

Data and methods

With a surging number of active users, bicycle sharing is growing rapidly. Shared bicycles are used by more than 32 million users every month on average, reaching a coverage of 8.04% in first-tier cities in China. Currently, GPRS-based smart locks are widely used in the bicycle sharing industry. OFO, as the first and one of the biggest dockless bike-sharing firms in China, provides the bicycle-sharing system with more than 700,000 bikes in Shanghai. This study randomly sampled the GPS coordinates of 80,000 OFO bikes in Shanghai, which represent the origin and destination points of cycling.

Figure 1. Working mechanism of dockless bike-sharing system

Source: https://www.zdnet.com/article/chinese-bike-sharing-company-ofo-arrives-in-seattle/

Navigation in the Google Maps App provide a feasible approach to generate the cycling route from the origin and destination points. Furthermore, in order to eliminate the interference caused by the passing behavior of the research, The 80,000 cycling origin–destination (OD) lines were intercepted into 141,317 cycling directional lines, each with a length of no longer than 500 metres, which is generally considered as the basic service radius of metro stations.

Results and discussion

In order to explore the spatial relationship between rail transit stations and shared bicycle riding behavior, as shown in Figure 2, the shared bicycle riding behavior is divided into five categories: starting, riding, inner, outer and transit. Cycling data. This study mainly focuses on the starting and riding, arrival and riding behaviors around the various rail transit stations, and records the starting, reaching, and internal riding of the 500-meter radius around the rail transit station i as Di. , Ai and Ci.

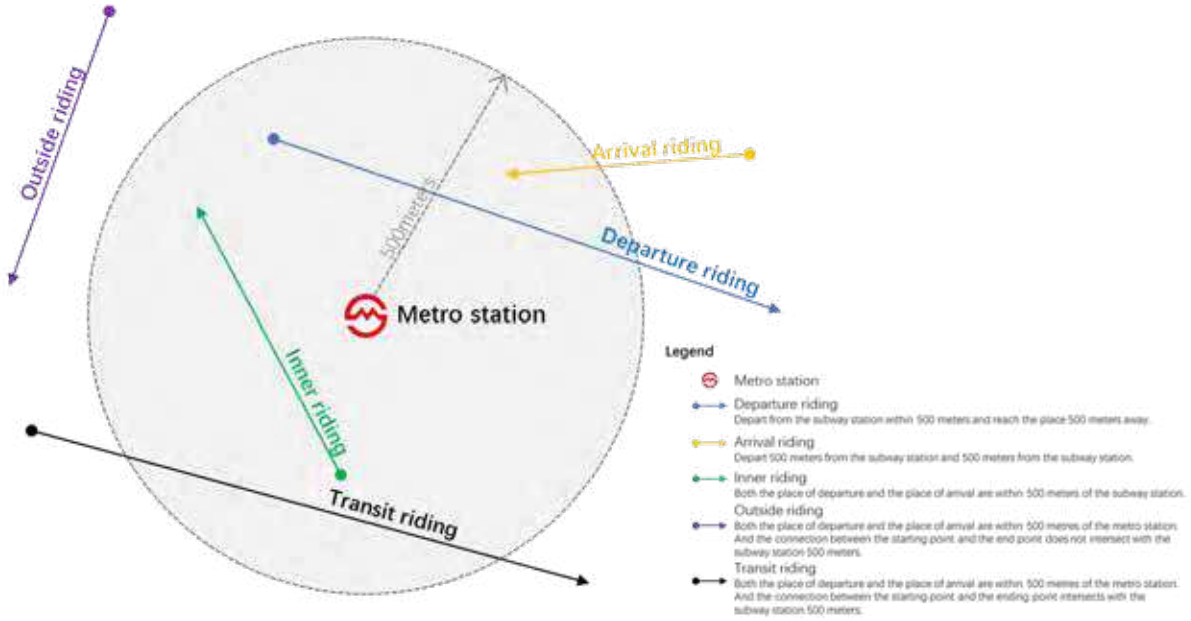

Figure 2. Division of riding behavior based on metro stations

According to the test, the number of riding, arrival, and internal riding around the Shanghai Rail Transit Station were 35,492, 31,646 and 1,245 respectively, and the number of rides related to the 500-meter range of the rail transit station reached 68,383. The ratio is as high as 85.48%, which indicates that there is a great spatial matching relationship between the shared bicycle riding data and the rail transit as a whole.

Shanghai Rail Transit Line 1 was selected as the research object, and Shanghai Rail Transit Line 1 was the first subway in Shanghai. There are 28 stations on Line 1, including 8 interchange stations, running through the Shanghai city from north to south, connecting the city center (People's Square), the city's sub-center (Xujiahui area), the suburban area, and the transportation hub (Shanghai South Railway Station, Shanghai Railway Station) can reflect the spatial connection characteristics of subway and bicycle travel in different locations. After testing, there were a total of 9455 cycling data around the rail transit line 1 site, accounting for 11.82% of the city's data.

Comparing the number of rides within 500 meters of each orbital station, it is found that: 1) the urban center system is clearly reflected: the city center, the sub-center and the commercial center of the district have high riding capacity; 2) the starting distance and the number of arrivals There is a clear positive correlation (the correlation coefficient between the two reaches 0.960), but the starting distance of each station is generally higher than the arrival of the ride (the ratio of the two is 1.26:1); 3) the number of terminal rides is obvious

"Zoom in" phenomenon: the number of rides around Xinzhuang Station and Fujin Road Station is significantly higher than that of Outer Ring Road Station and Youyi West Road Station; 4) There are some gradients in the process of attenuation of the center-suburb ride: such as Hengshan Road - Xujiahui, Tonghe New Village - Hulan Road.

Compared with the starting and the riding, the distribution characteristics of the two are relatively the same, except that the total number of starting and the line density is obviously stronger than that of the riding. Compared with the bicycle to the railing station, people are more It tends to ride from the perimeter of the rail transit site.

Compared with working days and rest days (Table 1), the average daily riding time on working days is 895 times, which is slightly higher than the rest day (858 times), but the riding distance is 1896 meters, which is obviously less than the riding distance of the rest day (2601 meter). At the same time, comparing the total travel time of each time period, it is found that there is a clear "early peak + late peak" double travel peak feature on the working day, while the rest day more reflects the single travel peak feature of "noon peak".

Table 1. Working days and rest days in 500 meters of each station on the rail transit line 1

	Weekdays		weekends	
	Cycling frequency(per day)	Average cycling length(meters)	Cycling frequency(per day)	Average cycling length(meters)
Departure cycling	524	1874	495	2785
Arrival cycling	371	1928	363	2352

We mapped the cycling directional lines of Shanghai (Figure 3) to distinguish overall patterns within the centre of Shanghai. The cycling directional lines are represented clearly as groups of radial lines from/to metro stations. Furthermore, with the help of the bicycle route navigation of Google Maps (www.maps.googleapis.com), each cycling trip was simulated by inputting coordinates of its start point and end point. Each street is assigned the number of starting and ending trips (no longer than 500 metres), which represents the cycling frequency. As is shown in Figure 3, most of the high-frequency cycling streets still centre around metro stations. The streets basically present a gradual decline from the metro stations to outlying areas in terms of cycling frequency, which indicates that bicycle–metro integration has already become the basic model for daily transport in Shanghai.

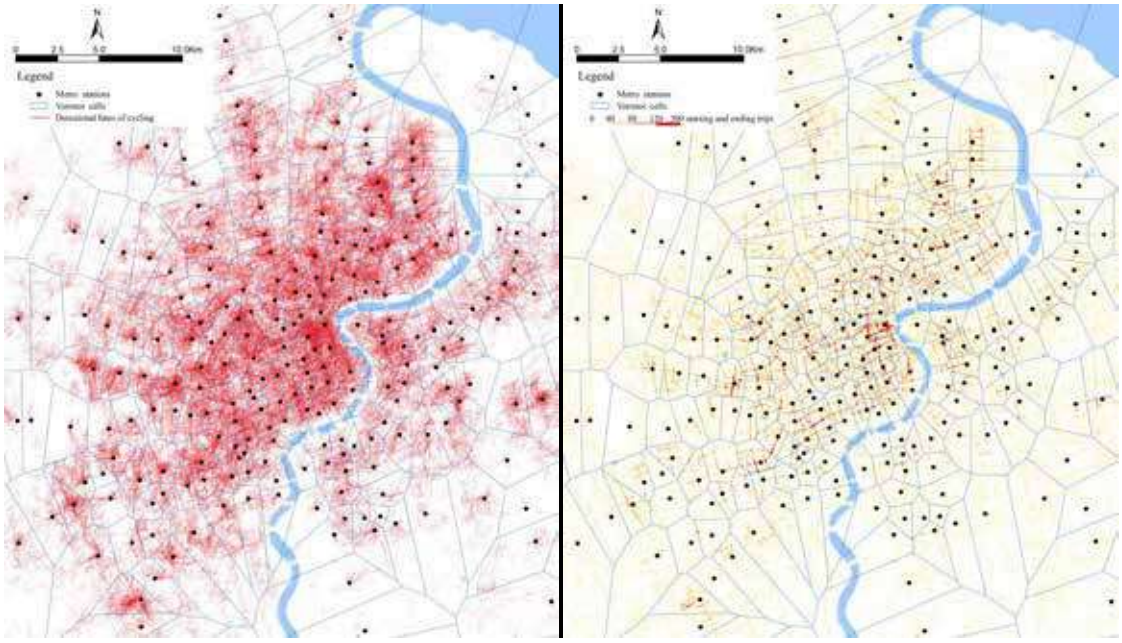

Figure 2. The cycling directional lines and cycling frequency of Shanghai's metro station voronoi diagram

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PA15

Planning, Law and Property Right: in the face of transitions

Right to the city, human rights, and Canadian cities

By Sandeep Agrawal

Right to the city

The idea of the *right to the city*, as conceived by Henri Lefebvre[1], raises questions of how or whether human rights intersect with cities. Can rights be used to implement Lefebvre's notion? In Canada, federal and municipal governments are deploying human rights policies in combination with city planning to realize this right to the city.

A fundamental question here is whether a difference exists between the right to the city and human rights in the city? Much academic debate on Lefebvre's concept encompasses two inter-related principal ideas:

- The city is an *oeuvre*—in which all its citizens participate and make decisions that contribute to the production of urban space
- Spaces are produced by their inhabitants by physically appropriating them—accessing, occupying, and using them in everyday life.

Right to the city resists the power of capital and the state by calling city inhabitants to engage in direct struggle and urban politics to achieve access and occupancy in urban spaces.

Human rights

Human rights are the rights we each possess by virtue of being human, based on our inherent dignity and equal worth *as* human beings. These are the "highest moral rights, [as] they regulate the fundamental structures and practices of political life, and in ordinary circumstances, they take priority over other moral, legal and political claims." This Universal Declaration of Human Rights (UDHR) of 1948 is the foundation of human rights law, inspiring an extensive body of legally-binding human rights laws.

I interpret the *right to the city* as several human rights—rights to expression, religion, life, liberty, equality, housing and property[2] — as they relate to city inhabitants in the form of political engagement, equitable services and the accommodation of diversity. An aspect of city life is the notion of a right to property, [3] but Lefebvre rejects this idea, arguing that it undermines the right to appropriate and inhabit the city. However, he does acknowledge that the right to housing as the right to adequate housing and shelter is a necessary but insufficient condition for the right to the city.

Many planning scholars who resist the prevailing neo-liberal tendencies in planning have embraced Lefebvre's concept, while others point to gaps and disconnects within his ideas and between his concept and human rights. For instance, it critically overlooks practical guidance on what this right to the city entails or how it informs relations between urban dwellers and the state. Even while it significantly resists the privatization and homogeneity of public space, it is more useful as a rhetorical device than a policy-making or legal instrument. The concept remains vague, with undefined terminology: What is a "right"? What is meant by "the city"?

For Lefebvre, the right to the city was a "cry" to initiate a radical struggle against the state and capitalism, but it was not supported by law in any conventional sense. Thus, this concept diverges from codified, legally binding human rights. However, we can still adopt it by relying on current institutional frameworks and invoking moral and legislative policy that affects people, along with their spaces and

places. The judiciary can further facilitate this orientation by interpreting and applying human rights in the state's policies and practices. More recent scholarship[4] interprets Lefebvre's later writing as a potential encouragement to finding a more transformative potential within existing legal rights framework.

Several countries, including Canada and some European nations, as well as the UN, champion the right to the city as part of a broader agenda for human rights.[5] In Canada, both the *Charter* and provincial and territorial human rights legislation provide the basic mechanism and legal framework for this idea. The humane development of inclusive cities depends on these constitutional and quasi-constitutional guarantees and their inherent values[6]. The Canadian *Charter* and human rights legislation provide rights to individuals, but they are increasingly being viewed as "collective rights," such as the rights of Indigenous peoples or persons with disability—the convergence point in the contemporary interpretation of the *Charter* and the right to the city.

Rights are enduring legal protections that are granted to individual citizens by the liberal-democratic state. The state, however, conceives of rights as ends—that is, the struggle is over when a legal right is secured—which is antithetical to Lefebvre's conception of ongoing resistance to capitalism and the state. Fainstein's *Just City*[7] supports political institutions and public policies despite their imperfections. She endorses, instead, reforms through existing political-economic processes and argues against the need for social unrest to achieve justice. The construction of cities makes justice possible for everyone, through "continued pressure on the existing democratic practice." Nonetheless, in neoliberal cities, social equity is largely disregarded in favour of growth.

The Charter and Canadian cities

The *Canadian Charter* delineates the rights and freedoms of people only in relation to government activities, versus human rights legislation, which encompasses both private and public acts. Specifically, *Charter* Section 15 guarantees equality before the law and the right to equal protection and benefit of the law without discrimination based on race, disability, and analogous grounds. Laws (including municipal government bylaws) inconsistent with the Charter may be declared invalid and may lead to the payment of damages or other remedies. Notably, these constitutional guarantees are not absolute. *Charter* Section 1 places "reasonable limits [on rights] prescribed by law as can be demonstrably justified in a free and democratic society."

Interactions between individuals and organizations (for example, between employers or landlords) are governed instead by human rights legislation, like the Alberta Human Rights Act or the Ontario Human Rights Code. Therefore, provincial and territorial human rights agencies deal with discrimination issues based on race, religion, age, or sexual orientation, and thus may vary by region. However, overlaps do occur when an act of government occurs in an employment context or when the federal, provincial, or municipal government provides services, facilities, or accommodations.

Canadian municipalities have made significant progress on the human rights front, enabled by either federal and provincial legislative changes, or due to government responses to court rulings. As well, the federal government now maintains a human rights-based approach to a national housing strategy. Human rights issues in municipalities have also evolved over the last decade, increasing in the last few years.

Two key factors affect planning at the municipal level:

1. Increasing challenges to municipal bylaws based on *Charter* Sections 2 (right to expression, religion, and peaceful assembly), 7 (right to life, liberty, and security) and/or 15 (right to equality) and to court decisions that favour protecting these rights—such as the right of the homeless to erect tents on public properties and improving working conditions of city sex workers.
2. New federal legislation or amendments to existing federal regulations, some emerging from court rulings that protect human and *Charter* rights—such as safe injection site locations, methadone clinics, and cannabis dispensaries.

These two factors have prompted municipalities to review, revise, or even rescind existing bylaws, create new land-use classes, or revise existing zoning bylaws to accommodate new resulting land uses.

Implications

Now more than ever before, human rights are a critical issue at the municipal level. Certainly, new federal legislation now shapes municipal planning in unprecedented ways, such as with the locations of safe injection sites and cannabis dispensaries within the municipal fold. However, these new issues follow perennial ones, like secondary suites, user characteristics, minimum separation distances, and keeping livestock within the city limits. Still, provincial and municipal governments continue to make significant human rights progress, as in these examples[8]:

- Alberta revised its human rights legislation to include age (in relation to the provision of goods, services, accommodation, or facilities), sexual orientation, and gender identity and expression as grounds of discrimination.
- Alberta municipalities amended their bylaws to align them with human rights legislation and the *Charter*: Calgary removed its prohibition on secondary suites in residential areas; Edmonton changed its group homes use-class, and a complete review of a zoning bylaw is currently in progress.
- In 2014, Ontario included human rights in its provincial policy statement, mandating that municipalities ensure their planning and policies adhere to the *Charter* and the province's human rights code.
- Many Ontario municipalities changed the definition of group homes and other supportive housing facilities, as well as the use of minimum separation distances.
- City of Toronto established equity, diversity, and human rights offices.

In closing, I wish to highlight that the Canadian state has taken the lead in guaranteeing its citizens the *right to the city* and all the related rights that attend this. Lefebvre challenged whether this was possible for a state to do. Concomitantly, the Canadian judiciary has further clarified, applied, and even expanded the scope of human rights as they relate to various aspects of city life. According to Qadeer[9], even if rights exist in law, their actual realization depends on the institutionalization of equality in economic, social and cultural matters; entrenched institutional biases and power politics may still prevent any progress made in law. Hence, Lefebvre's perspective remains valid in its emphasis that the *right to the city* is the *ongoing pursuit* for better conditions for city dwellers. This continual struggle appears to yield better results when worked within the existing political and institutional structures.

Sandeep K. Agrawal is a professor and director of the School of Urban and Regional Planning at the University of Alberta. His current research works span a broad range of issues from human rights, multiculturalism, and annexation to housing and homelessness in First Nations communities. He is a co-