Walking and Transit Use Behavior in Walkable Urban Neighborhoods

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ABSTRACT

Urban transportation is one of the most important target sectors for creating more sustainable and livable cities. Many US cities are making huge investments in public transit infrastructure in efforts to lower automobile use, encourage compact development, and curb greenhouse gas emissions. This paper explores how differences in the urban environment impact walking and transit use and how urban residents utilize walking and transit as modes of transportation. I use data from neighborhood mapping, observations, surveys, and interviews to explore these two questions. I find that walking is indeed the main mode of transportation within the urban core of Seattle. In contrast to what mainstream urban planning literature would suggest, residents living in the dense urban core of Seattle do not appear to be transit dependent and continue to drive at higher than expected rates. To help explain this, I explore how the 'theory of urban fabrics' applies to walkability and transit planning. This new emerging theory encourages planners to rediscover how to prioritize different modes of transportation within different parts of the city instead of current trends, which advocate for multimodal and shared streets throughout the city. Evidence indicates that the most walkable neighborhoods are those that have

the least number of conflicts between pedestrians, transit, and automobiles, and that the transit system in Seattle suffers because it is not prioritized over cars in any significant way. This reduces the likelihood that individuals will make the switch to transit over driving, which has important implications for transportation planning policies.

Introduction

Transportation in the United States accounts for just over one quarter of all greenhouse gas emissions (US EPA 2017), making it an obvious target for reducing CO₂ and GHG emissions to combat climate change. Urban planners use two related strategies to reduce per capita driving and thus its contribution to GHG emissions. First is to promote compact urban development and walkable communities. Second is to promote the development and expansion of public transportation. These two strategies aid in achieving a sustainable future and work towards creating livable and vibrant communities.

Many cities are presently pursuing the development of multi-modal transit systems, constructing and expanding light rail transit, expanding bus service and experimenting with bus rapid transit, and modern streetcars. In November 2016, 50 cities across the US voted on a combined \$200 billion in public spending on public transportation, with Los Angeles, Seattle, San Francisco, San Diego, and Atlanta proposing multi-billion dollar transit investments (American Public Transportation Association 2016). Spending on public transit infrastructure is overall higher than in the past several decades, and ridership of public transit across the country is at its highest level in nearly 60 years (Neff and Dickens 2015), and per capita ridership continues to increase in urban areas. Given this enthusiasm for public transit, it is important that cities and regions utilize investments in the best way possible to achieve maximum benefits.

Urban planners have promoted compact and walkable urban forms and new models of land use and transportation since the early 1990s. There is mounting evidence to suggest that a majority of the general public would prefer living in walkable urban environments where driving is not a necessity (National Association of Realtors 2013). This is related to the phenomenon of “peak car” (Newman and Kenworthy 2015; Metz 2013), which has seen the decrease over the past decade in per capita driving due in part to technological innovations and shifts in cultural preferences. Research also suggests that millennials (people ages 18-35) have

different mobility patterns than previous generations (McDonald 2015; Hopkins and Stephenson 2014; The Rockefeller Foundation 2014). They prefer walking as a mode of transportation over driving (National Association of Realtors 2015), are more likely to live in places with good public transportation (The Rockefeller Foundation 2014), and are less likely to have drivers licenses and own their own cars (McDonald 2015; KiM Netherlands Institute for Transport Policy Analysis 2014). With this rising demand for walkable neighborhoods, central city neighborhoods that many once considered on the decline are becoming commodities, as evidenced by rapidly rising rents and new construction. Many cities are seeing increases in pedestrian activity in central neighborhoods, as well as increases in pedestrian fatalities (National Highway Traffic Safety Administration 2016; Schmitt 2016). How to create safe and inviting pedestrian environments must now be a main objective of urban planning practice.

In this paper, I explore two related questions: 1) how do residents in compact urban neighborhoods utilize walking and public transit in their daily lives, and 2) how do variations in compact urban environments influence walking behavior. Both questions relate to the concerns raised above regarding how to best invest in public transit and how to create walkable urban environments that are safe and inviting.

I explore the *theory of urban fabrics* (Newman, Kosonen, and Kenworthy 2016; Newman and Kenworthy 2015) as a way of understanding walkability and transit use in cities. The theory of urban fabrics suggests that different planning approaches are needed in different parts of the city based on their dominant urban form – walking, transit, or automobile urban forms. This has implications for policy makers and urban planners who promote public transit as an alternative to driving.

Walkability planning and public transportation planning would greatly benefit from adopting the theory of urban fabrics. This theory seeks to reestablish within each urban fabric its primary mode of transportation – walking within the pedestrian fabric, transit use within the transit fabric, and cars within the automobile fabric. Current transit planning suffers from its often-singular objective of getting people out of cars and reducing GHG emissions, and as a result, new transit proposals extend slow and inefficient bus and rail networks into far-flung suburbs where increased ridership is unlikely to meet expectations. In this paper, I suggest that current trends in regional transit development in many cities will not have the desired outcomes. This is because the areas where this new transit is built are firmly within the automobile urban fabric. Urban planners need to rediscover the relationship between the three types of urban fabrics and re-learn how to plan and prioritize each urban fabric separately.

Walkability and the Theory of Urban Fabrics

Pedestrians and walking are vital components of urban life, and they are important for the social, economic, and environmental well-being of cities and their residents (Jacobs 1961; Mumford 1981; Whyte 2009; Speck 2012; Appleyard 1981; Leinberger 2007). Starting in the 1920s and increasingly after WWII, urban planners and traffic engineers prioritized the automobile, significantly neglecting the pedestrian and transit elements of cities, and in some cases nearly destroying them. Automobile-centric cities quickly developed, and this transportation system still dominates our cities today, largely ignoring the idea that different modes of transportation are suitable in different parts of the city and for different reasons. As early as 1958, Lewis Mumford recognized a growing tension between the automobile and city dwellers. He argued that the pedestrian was the most efficient and flexible mode of transportation within a city and envisioned a transportation system in which the automobile was a small component and where the pedestrian was given priority (Mumford 1981). The opposite happened, as automobile dependent cities became the norm towards the end of the twentieth century.

Urban planners now generally accept that excessive automobile use, automobile dependence and sprawling urban forms are detrimental to urban social life and damaging to the environment (Newman and Kenworthy 1999; Rome 2001; Beatley 2004). As an alternative to automobile dominated urban forms, a sustainable urban form is one that prioritizes walking and non-motorized forms of transportation, mass transit, and compact and mixed use urban forms (UNCED 1992). This definition of a sustainable urban form has facilitated an end to planning for automobile dependence and made single use zoning an outdated concept in the current lexicon of urban planning practice.

Urban planning studies often refer to the 5Ds of compact development, which include *density* (of population and/or jobs), *diversity* (of land use mix within a given area), *design* (of the street network and its level of connectedness), *destination accessibility*, and *distance to transit* (Ewing 1997; Ewing and Cervero 2010; Campoli 2012; Stevens 2017; Cervero and Kockelman 1997). A compact neighborhood that reduces reliance on automobile use and promotes walking is one that has relatively high densities, mixed land uses, and a well-connected street network. These components in turn allow for destinations to be closer together, closer to where people live, and enable transit to be located close to where people live.

In general, urban planners have a firm understanding of the types of urban environments that are conducive to different types of transportation. In an influ-

ential meta-analysis of 62 travel behavior studies, Ewing and Cervero (2010) find that land use diversity, intersection density, and the number of destinations within a five- or 10-minute walk most significantly influence walking. They also find that transit use is related to proximity to transit and street design, while driving is most influenced by destination accessibility. These studies, however, do not tell planners how to build the types of environments that result in one type of travel over another or, more importantly, how to transform one type of urban environment into another. Additionally, since the emphasis for so long has been on compact versus sprawling urban development, research has tended to ignore variations between compact urban environments and the travel behaviors within them. This project addresses these needs.

Forsyth (2015) argues that definitions of walkability and walkability research fall into three categories. First is the means or conditions for creating walkability, which encompasses many travel behavior studies, examining how various characteristics of the built environment influence walking (Lee and Moudon 2006; Hess et al. 1999; Owen et al. 2004; Cerin et al. 2007; Ewing and Cervero 2010). The second category is the outcomes of walkability, which emphasizes specific outcomes of a walkable place, such as physical activity (Lee and Moudon 2008; Lee and Moudon 2004), decreased obesity (Frank et al. 2007), or transit use (Ryan and Frank 2009; Saelens et al. 2014). The final category is walkability as a proxy for better design, which is exemplified by literature on transit-oriented development (Dittmar and Ohland 2004; Bernick and Cervero 1997) and new urbanism (Duany, Plater-Zybek, and Speck 2000; Talen 2013).

Urban design research on walkability incorporates other physical as well as non-physical elements. This includes physical elements such as the presence of street trees, public seating, well-designed and accessible crosswalks, and other elements found specifically in the street right-of-way where walking takes place. It also includes harder to define elements, such as the aesthetic qualities of streets, sense of safety, and ambiance. Additionally, evidence supports the fact that personal characteristics, individual behaviors, social contexts, cultural values, and various policies also affect the walkability of a place, and that walkability varies from person to person even in the same place (Forsyth 2015). Walkability is a complex phenomenon that researchers approach in many different ways depending on their background and their purpose.

The theory of urban fabrics offers one possible way to begin to integrate the large-scale elements common to urban planning with the finer grain details of urban design in order to plan walkable neighborhoods and effective transit systems

Figure 1: Conceptual combinations of three urban fabrics. Source: Newman, Kosonen, and Kenworthy 2016

that meet the needs of a city's residents for more than just the commute to work. The theory of urban fabrics (Newman, Kosonen, and Kenworthy 2016; Newman and Kenworthy 2015) argues that every city is a combination of a walking city, transit city, and automobile city. This is a result of historical urban growth and the dominant transportation technologies at different stages of growth and development. As the automobile gained popularity in US cities, planners began to treat it as the only mode of transportation, dismantling extensive streetcar networks, widening roads, and constructing freeways. This automobile-centric planning paradigm is a legacy of the modernist planning, and the theory of urban fabrics is a first step in developing a new model. Without a theory that distinguishes between the different type of urban fabrics, the automobile-centric legacy will continue to undermine efforts to make cities more walkable and transit-oriented (Newman, Kosonen, and Kenworthy 2016).

Each urban fabric has specific characteristics, described by Newman, Kosonen, and Kenworthy (2016), which are important for identifying how to plan for them. The pedestrian urban fabric is typically about 2.5 miles in diameter and encompasses

the present day central business district. The transit urban fabric is up to 25 miles in diameter. Transit fabrics consist of early extensions of the walking city based on street-cars and subways, such as those in Los Angeles or New York, as well as suburban rail common in cities such as New York or Boston. The automobile fabric can be up to 50 miles in diameter and is loosely defined as any area not in the walking or transit fabric (Newman, Kosonen, and Kenworthy 2016). Much of the automobile fabric dates to the post WWII era. In many cities, the encroachment of the automobile fabric into walking and transit fabrics has destroyed these fabrics, making present efforts at planning in urban core areas and in transit corridors more challenging.

Newman, Kosonen, and Kenworthy (2016) identify key characteristics of each urban fabric. Pedestrian fabrics have narrow streets, frequent public spaces, street furniture, short blocks, buildings fronting on the street, minimal parking, and densities of 25,000 people per square mile or more. The transit urban fabric has streets wide enough for transit, high amounts of street furniture for transit (bus stops and shelters), street networks that are permeable for pedestrians to reach transit stops, minimal building setbacks, minimal parking for cars, good bicycle parking, and seats for pedestrians and densities between about 10,000 to 25,000 people per square mile. The automobile urban fabric has streets wide enough for car traffic, infrequent seating, a low permeability street network with large blocks and cul-de-sacs, large building setbacks, plentiful parking for cars, and densities under 10,000 people per square mile.

The theory of urban fabrics is an important step in walkability and transit planning. It provides a theoretical starting point for understanding why current policies have a limited impact on the desired outcomes. For over half a century, urban planners have been overly accommodating of the automobile in all parts of the city instead of prioritizing different modes of transportation in different parts of the city. Even with new directions in planning practice, such as street reclaiming and road diets (Engwicht 1999), complete streets (Smart Growth America 2015; McCann and Runne 2010; Schlossberg et al. 2013), and the pursuit of multi-modal transportation networks, urban residents continue to drive, traffic congestion worsens, and environmental conditions deteriorate. The theory of urban fabrics offers one possible explanation as to why this remains the case, even as cities increase transit service, invest heavily in public transportation, and improve pedestrian and bicycle accessibility and safety.

In response to the research questions posed in this paper, I make two hypotheses based on the theory of urban fabrics. In response to the first question, how do residents living in compact urban neighborhoods utilize walking and public transit

in their daily lives, I hypothesize that public transportation does not play a major role in daily activities of people who live *and* work in walkable urban areas. Transit is most important for those who commute to and from work in the downtown core and little else. In response to the second question, how do variations in compact urban environments influence walking behavior, I hypothesize that small variations in pedestrian-oriented infrastructure, public transit options and infrastructure, and automobile related infrastructure will have an impact on where people walk and how much walking takes place.

Methodology

This project uses a mixed methods research design using the urban core of Seattle and the Seattle region as the case study. The findings are based on data collected from neighborhood mapping and observations of walking and transit use activity, a travel and walkability survey, and interviews. The urban core was chosen as the primary study area due to its level of compactness. The urban core is comprised of several distinct neighborhoods but are all similar in density, street connectivity, and have a mix of land uses. Figure 2 shows the urban core study area and its Walk Score, which serves as a proxy of walkability and urban form. Figure 3 shows the land use mix of the study area.

Neighborhood mapping was conducted in June and July 2016 and is based on King County Assessor data, City of Seattle land use and zoning maps, and visual observations of the street environments. A total of 110 blocks within the urban core of Seattle were chosen for observation of pedestrian and transit use behavior (figure 4). Weekday observations of pedestrian activity and transit use were conducted in September and October 2016. For each block, pedestrians and transit user counts were taken in five-minute intervals, on three separate days in the morning, afternoon, and evening.

The travel and walkability survey was conducted online with residents throughout Seattle. The survey was comprised of 58 questions consisting of multiple choice and Likert scale questions as well as open-ended responses. The survey was open from August to November 2016. A total of 249 complete surveys were collected. The survey was advertised with flyers given to pedestrians and transit users, left on cars, sent by email, and posted on social media. It was advertised as a walkability and travel survey, so there is likely to be a degree of self-selection in participation as individuals who care about these issues are more likely to complete the survey, possibly skewing the results.

Figure 2. Seattle urban core WalkScore map showing study area neighborhood boundaries; a Walk Score of 100 is the most walkable. Source: WalkScore and Author

The final survey question solicited people who would be interested in taking part in a one-hour interview. A total of 43 individuals participated in interviews ranging from 30 minutes to just over 60 minutes and involved two mapping exercises. The first had participants map out the places they walk within the urban core of Seattle, and the second had them map out an idealized public transit system. As they drew on the maps, they talked about what they were doing, and relevant follow-up questions were asked in an open-ended interview format. Interviews were conducted in November and December 2016.

Figure 3. Land use map of the urban core of Seattle. Source: Author

Figure 4. Seattle Urban Core figure ground with observed blocks highlighted in red, N=110.

Table 1. Seattle urban core neighborhood populations, density, and WalkScore.

Neighborhood	Population	Density (per square mile)	Neighborhood WalkScore
Downtown	4,852	10,832	98
Pioneer Square	1,984	13,023	98
International District	4,259	25,960	97
Capitol Hill	26,960	32,746	91+
Belltown	14,326	43,488	97
South Lake Union	8,296	18,684	91
Lower Queen Anne	9,101	24,354	91
Seattle Urban Core	92,962	24,705	95 +/-
City of Seattle (2015)	684,451	8,161	73

Seattle

Seattle is ranked as the eighth most walkable large US city, with a Walk Score of 73, making it a “very walkable” city (“Walk Score,” n.d.). As of 2015, Seattle has one of the highest rates of commuting by public transportation (20.1 percent of commuters) and walking (9.6 percent of commuters) (American Fact Finder, n.d.). The city is actively seeking ways to make its urban environment more walkable and encourage alternative modes of transportation and is working to build and expand a multi-modal transit system throughout the metropolitan area. Since 2007, the Seattle Department of Transportation (SDOT) has pursued a complete streets (Schlossberg et al. 2013) policy, putting safety for all road users, including pedestrians, as its top priority, followed by mobility. The city has an ambitious *Vision Zero* goal to eliminate pedestrian, cyclist, and motorist fatalities by 2030.

The urban core, which serves as the study area, contains the downtown business district and retail center, as well as historic and mixed-use neighborhoods surrounding it, roughly 3.75 square miles in area. The urban core offers a range of transportation options, including local bus, express bus, commuter rail, light rail (LRT), and modern streetcars. In March 2016, the region’s LRT system, which opened in 2009 from Downtown to the Seattle Tacoma International Airport, opened its first extension connecting downtown to the Capitol Hill neighborhood and the University of Washington. Additional extensions are planned from the University of Washington to the northern suburb of Lynwood, and east into the suburbs of Bellevue and Redmond between 2021 and 2023. In November 2016, residents voted to approve a \$52 billion transit package that would add 62 more miles of light rail, develop bus rapid transit (BRT), and connect the region from Tacoma to Everett. The City of Seattle and King County Metro also have plans to develop several new Rapid Ride routes, the city’s version of BRT, and create a more fully formed BRT network within the city by 2024.

Table 2. Commute share of Seattle residents from US Census and travel survey.

Commute Mode	Seattle (US Census) (%)	Seattle (Travel Survey) (%, <i>N</i> = 187)	Urban Core (Travel Survey) (%, <i>N</i> = 114)
Drive Alone	58.4	20.86	16.7
Carpool	8.2	6.42	4.3
Public Transportation	20.1	33.15	30.7
Walk	9.6	19.25	28.0
Bike	3.8	20.32	12.3

Results

The provision of public transportation is vital to the environmental sustainability and economic vitality of cities, as well as to the well being of its residents. Seattle residents utilize walking and transit more than the average American for their commute to work – 20.1 percent versus 5.1 for commute by transit and 9.6 percent versus 2.8 percent for commute by walking (American Fact Finder 2015). Commuting by walking and transit has stayed the same in the US since 2009, while Seattle has seen an increase in transit use and walking from 18.6 percent and 8.3 percent, respectively. Table 2 shows commute mode for Seattle from the US Census and from the travel survey. The right column shows commute mode for residents in the urban core (identified by their ZIP code).

Transit use from the survey is 33 percent for the city and 31 percent for the urban core. Walking as a commute mode is 19 percent for the city and 28 percent for the urban core. Although the American Community Survey is likely more accurate, there is reason to believe that transit use has increased between early 2015 and late 2016. First is growth. The population of Seattle (the city, not the region) has increased by 80,000 people from 2010 to 2015 and has not slowed since. Many of these new residents are millennials employed in computer, technology, and creative economy jobs and they tend to have lower rates of automobile ownership and are more likely to want to use transit. Regional growth has added congestion to the highways, increasing commute times. Additionally, re-urbanization in the urban core has decreased the supply of parking, making it more expensive. Lastly, a two-station light rail extension north from downtown opened in March 2016 stopping in the Capitol Hill Neighborhood and at the University of Washington. This combination of push and pull factors encouraging people to switch from driving to transit for their commute has likely increased commute by transit above the 20 percent indicated by the US Census.

But how does the behavior of residents in the dense urban neighborhoods differ from those of the city as a whole? As the survey indicates, the levels of transit use are slightly lower – 30.7 percent versus 33.1 percent. Biking is lower in the urban core at 12 percent versus 20 percent and walking is significantly higher at 28 percent versus 19 percent citywide. Driving alone and carpooling are also lower in the urban core at 21 percent versus 27 percent. As we would expect, walking and transit use account for 60 percent of all commutes to work among those that live within the urban core, and a majority of those who use transit work in areas outside the urban core. Within the urban core, more commutes are made on foot. In other words, transit is used primar-

ily as a means for workers to get into and out of the urban core, while it is not a major component of travel within the urban core. Interestingly, fewer people bike to work within the urban core as compared to the city. From interviews it appears that, for many, biking to work acts as a substitute for transit. The reasons for this are the same as those given for why people walk instead of use transit between urban core neighborhoods. The most commonly cited reasons include inability of busses to navigate traffic, the unreliability of the busses being on time, and the benefit of getting exercise while getting to work. When the light rail is within walking distance, people are more likely to use it as a transit option due to it being a direct, frequent, and reliable mode of transit that avoids street level traffic altogether.

When asked about their primary mode of transportation, 36 percent indicated walking as their primary mode of transportation, followed by driving (24 percent), bus (17 percent), bike (15 percent), light rail (2.5 percent), and streetcar (0.5 percent). For those living in the urban core, the main mode of transportation is also walking at 50 percent, followed by driving (20 percent), bus (14 percent), bike (7 percent), light rail (3.3 percent), and streetcar (0.7 percent). When asked about specific destinations, such as grocery stores, drug stores, coffee shops, entertainment, and shopping, a majority of people indicated that their most common mode of transportation to each of these places was walking, followed by driving. When looking at the urban core subset, walking becomes even more dominant, with driving, transit, and biking becoming less common. These findings show that when compared to the city as a whole, residents of the urban core do not use transit as much and are significantly more dependent on walking.

In response to the second research question – how the physical environment influences walking and transit use – I find that it has a significant impact on the level of walking, while transit is less impacted by it. Six of the seven neighborhoods that were observed for pedestrian and transit use behavior have a high degree of land use mix. Most office and residential buildings have ground floor retail, and offices and residences are interspersed throughout the neighborhoods. The Downtown and South Lake Union neighborhoods have more offices than residences. Capitol Hill is the exception, and while there are many uses within the neighborhood, and there are several mixed-use buildings, there are more clear distinctions between the commercial and residential parts of the neighborhoods. From observations of pedestrian activity and transit use, and supported by interviews, Capitol Hill seems to be the most walkable neighborhood within the urban core. This is due to several factors: in addition to having a mix of commercial, residential and offices, the housing varies from single family homes, duplexes and townhomes to mid-size apartment build-

ings, with very few large buildings that fill entire blocks or buildings over 10 stories tall. Quiet, landscaped residential streets and human-scaled commercial streets provide an inviting pedestrian environment. This is compared to other neighborhoods where the streets are wider, traffic is faster, there is less curbside parking to act as a buffer, and there are fewer trees. The neighborhoods with the most amount of space dedicated to parking lots, driveways, and other automobile-oriented infrastructure and land uses tend to have lower levels of walking.

Discussion

The theory of urban fabrics has many implications for current planning practice, and the findings presented here begin to show evidence that a new approach to walkability and transportation planning is needed, and that the theory of urban fabrics can provide that framework. The theory of urban fabrics argues that each of the separate urban fabrics making up a city – pedestrian, transit, and automobile – prioritize these modes through their land use patterns and types of infrastructures. For much of the twentieth century, urban planners and engineers struggled with how to best accommodate the automobile into the urban fabric of the city, often tearing down buildings to widen streets, or demolishing entire neighborhoods to construct highways. These elements eroded the pedestrian and transit fabrics that made pre-automobile cities walkable and transit friendly.

Seattle presents an interesting case study. Its walking urban fabric is largely intact, and with the trends towards re-urbanization in the urban core, more and more pedestrians are using the streets. However, the quality of the pedestrian fabric is quite poor, having been heavily eroded by the automobile fabric throughout the twentieth century. This is exemplified by the abundance of parking, one-way streets, and narrow sidewalks throughout the urban core. Additionally, in Seattle, as in many other cities, the transit fabric of Seattle became nearly non-existent. With the opening of a new rapid transit LRT route in 2009 and its extension in 2016, the city is attempting to both restore the old and create a new transit fabric. The theory of urban fabrics can help planners identify many ways both fabrics can be improved.

One approach in Seattle to prioritize pedestrians and transit, as with many other cities, is with a complete streets policy. The result of modernist planning that favored the automobile was a planning model that prioritized cars, traffic flows, and efficient movement. It saw the complete separation of automobiles and pedestrians as the ideal urban form. Today, however, the dominant trend in transportation

planning is multi-modal streets, exemplified by complete street, which reverses the decades-old modernist planning regime by reversing the hierarchy of road users. In its ideal form, a complete street prioritizes pedestrians and cyclists, then transit, then automobiles. Often the road space can be seen as neatly divided into dedicated lanes for each separate mode of transportation. In Seattle, the complete streets policy has been about providing basic pedestrian infrastructure in more remote parts of the city, and about prioritizing transit in the urban core, with minor improvements to the pedestrian environment.

The findings from my surveys and interviews, however, show that transit is not the main mode of transportation within the urban core, even with significant improvements in levels of service within the last 10 years. This can be explained by the theory of urban fabrics. The urban core is the walking fabric of Seattle, exemplified by its high densities and densely gridded street network. Walking, as we have seen, is still the primary mode of transportation within this part of the city. People can easily walk from point A to point B within the urban core, often more quickly and efficiently than on transit. However, nearly every interview participant cited instances where being a pedestrian was not easy, and pointed to many parts of the urban core where pedestrians are not prioritized, even on streets that many planners would now consider complete streets – or at the very least, more complete streets. Transit is of course important for those unable to walk significant distances, but on the whole, this is a relatively small percent of the population of this part of the city, as a large majority of residents are under the age of 45. While the complete streets model is an improvement over half a century of automobile-centric planning, its goal is to more evenly distribute the road space among its many users. The theory of urban fabrics goes even further to reflect the reality of the urban environment and suggests that the different urban fabrics of the city are meant to prioritize that mode of transportation. Under this model, much of the urban core would be given over to pedestrians, with transit connections allowing for quick and easy movement between commercial areas and neighborhood centers.

In order to better prioritize pedestrians in this part of the city, planners should seek ways to widen sidewalks on several key arterials that are direct routes through neighborhoods. Currently many of these arterials have narrow sidewalks and no buffers between pedestrians and moving traffic (i.e. trees or parked cars). Adding such buffers would greatly benefit pedestrians, while also slowing traffic and making the roads safer for car traffic. Providing safer crossings at heavily trafficked intersections is another way to prioritize pedestrians in this fabric. Crosswalks should provide enough time for the slowest pedestrians and should make pedestrians feel

comfortable, not threatened. In a similar vein, the downtown CBD and Belltown, and to a lesser extent Lower Queen Anne, have large proportion of one-way streets. Research shows that one-way streets are less pedestrian friendly (Riggs and Gilderbloom 2016; Gilderbloom 2016). The City of Seattle could begin identifying ways to remove or reduce the number of one way-streets in this part of the city, as these are a key feature of how the automobile fabric eroded the pedestrian urban fabric. The City's *Vision Zero* program is actively seeking ways to improve pedestrian safety, and these are all things that will contribute to that goal and help reestablish the pedestrian urban fabric.

In order to better prioritize transit, the City of Seattle needs to rediscover its transit fabric. This is a much more difficult task as the pre-WWII streetcar-based transit fabric was completely destroyed and subsequently replaced by buses. Seattle residents point out that one of their main reasons for not using transit is its unreliability and indirect routes to where people actually go. Transit in fact has become really good at one thing – getting people into and out of downtown for their commute to and from work, evidenced by the fact that 47 percent of people who work in Downtown Seattle use transit to get to work, with only 30 percent driving alone (Fucoloro 2017). Beyond the commute to work, people are less likely to use transit because it doesn't always go to the places they need to go, and when it does, the length of the trip in time, uncertainty about connections, and unreliability due to general traffic conditions make it a less-than-ideal mode of transportation, especially for non-work trips.

To better prioritize transit within the transit urban fabric, the City of Seattle needs to find ways to reduce travel times between points, make transfers less of a hassle, and reduce delays due to automobile traffic. Residents view light rail very favorably, and developing a more robust light rail network would be one way to rebuild the transit fabric. Residents have a more favorable view of light rail because it avoids the congestion of streets altogether (either underground, elevated, or at-grade in its own lane) and provides reliable connections between neighborhood centers. The important thing that planners must remember is that different types of transit have limits, which the theory of urban fabrics reminds us. The theory is partly based on the idea of a travel time budget, which has shown cities grow to be about 60 minutes wide based on their different modes of transportation (Newman, Kosonen, and Kenworthy 2016). This is how the sizes of each urban fabric are determined, meaning that a transit urban fabric will be most effective when planned to be 60 minutes from one end to another. The current light rail construction to Lynwood (north) and Renton (east) essentially represent the 60-minute limit of

this system. A recently approved plan to expand LRT between Tacoma and Everett would make the system at least 3.5 hours wide. To connect such distant points, a commuter rail system would be more effective since it would have higher speeds and less frequent stops. In the City of Seattle, planners are in the process of developing a Bus Rapid Transit system (BRT), which would have many of the benefits of light rail, such as dedicated lanes, pre-pay boarding, and prioritized lights, while providing transit at much lower cost. By 2024, the City of Seattle will have a fully formed BRT network, which will begin to reestablish the transit fabric and do so that is more consistent with the theory of urban fabrics.

The theory of urban fabrics provides planners a framework by which prioritizing different modes of transportation in different parts of the city – pedestrians in the pedestrian fabric, transit in the transit fabric, and cars in the automobile fabric. The case of Seattle shows that a dense urban core within a vibrant city is still a place where walking is the main mode of transportation, even after decades of alterations to incorporate the automobile and more recently to increase transit accessibility. It shows how an entire city's transportation network can suffer when all modes are incorporated – walking becomes hazardous, using transit becomes tedious and time consuming, and driving becomes unbearably frustrating. Many cities across the US are experiencing growth in the number of pedestrians in urban core areas, places where the walking fabric naturally exists and the concerns raised in Seattle regarding how pedestrians and transit are not prioritized, and the automobile fabric overwhelms them are present in nearly every US city. Urban planners can apply the principles that the theory of urban fabrics proposes, and the specific changes to the urban fabric that I suggest above for Seattle, to any city and adjust it to each unique context. Planning in a way that acknowledges the unique properties and benefits of each mode of transportation could go a long way in building a more viable transportation system in any city.

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