THE DECLINE AND ASYMMETRICAL RESURGENCE OF AMERICAN TRANSIT: A CASE STUDY OF SEATTLE

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THE DECLINE AND ASYMMETRICAL RESURGENCE OF AMERICAN TRANSIT: A CASE STUDY OF SEATTLE

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SUMMARY

Public transportation projects are some of the most complex and costly components of urban development. While urban sites may develop naturally through the combined and only partially coordinated efforts of countless private groups, they inevitably reach a critical mass which requires the development of a shared infrastructure. While this problem is not unique to the modern era, the size, density, and intensity of modern urban uses demands a level of advanced and extensive transportation infrastructure that is unprecedented. The extreme costliness and impact of this infrastructure makes its design and implementation a difficult and controversial matter, particularly when divergent strategies are possible. Mass transit is not the predominant mode of travel for most twenty first century Americans. Before the automobile era, however, transit modes of all types graced the country's cities, providing a level of service unmatched by most modern transit systems through high frequency and dense routes.

This research investigates the transportation history of Seattle, a prominent but relatively young American city, to determine the critical cultural, political and social factors which led that city to redevelop its transit systems successfully after their initial dismantlement during the early car era. The research will focus on the unique trends which allowed Seattle to avoid the transit stagnation of other cities in the mid to late twenty-first century. Seattle's contemporary transit conditions are summarized through the use of spatial and survey data and compared to transit conditions from the peak of the historic streetcar era. Contemporary transportation planning documents and processes are considered to yield insight into the unique transportation planning culture of the Seattle region. Finally, the region's urban and transportation history is reviewed to identify and track the processes most responsible for the city's relative success in developing modern transit when compared to similar cities.

CHAPTER ONE: Introduction

Contemporary urban problems stem from a complex and diverse range of social, political, cultural and technological systems. They present opportunities to implement a compelling array of possible solutions, fixes, and stopgap measures with the potential to create positive change for the inhabitants of urban communities around the world. While the contemporary political and technological achievements, revolutions in design, and activist programs intended to tackle these problems continue to make steady but incremental progress towards a better future, it is difficult to remember the temporal scale of the urban environment. Humans first developed urban settlements during the Neolithic revolution as agriculture became a critical technology (Bairoch, 1988). The largest cities in the modern world, despite their advanced technologies and designs, exist on sites first settled by Neolithic cultures thousands of years earlier. Shanghai, the world's largest city, juxtaposes towering modernist skyscrapers glistening with neon with temples dating from the Tenth Century, all atop an urban site first settled around 5000 BC by the Neolithic Majiabang culture (Peregrine & Ember, 2001). It is easy to forget that the places so often idealized by modern urban planners, bustling and beautiful mid-sized cities in Northern and Western Europe, are themselves the products of countless iterations upon the urban form extending across multi-millennial histories.

Despite the scale of urban history, modern urban transportation is defined by a technology which rose to prominence with amazing speed: the automobile. The privacy and initial convenience offered by this technology allowed it to overtake traditional collective forms of transportation without any great struggle. This convenience and privacy was compounded by the affordability created by modern industrial processes. Innovators such as Henry Ford helped

to create a transportation technology with no immediate market rival. Ford's Model T rose to such cultural prominence that, when it ceased production in 1927 after 15 million production units, most major American publications, including *The New Yorker* and *The New York Times* ran mock obituaries for the vehicle as a tribute to its legacy (Berger, 2001). With such powerful cultural and social appeal, it is no wonder that the affordable automobile dictated much of America's twentieth century transportation policy. American infrastructure funding after World War II was diverted almost entirely towards automobile friendly initiatives, including the creation of an Interstate Highway System. Throughout this auto-oriented rush, traditional effective urban policy was crushed to make way for untested transportation policies which we now know create many adverse impacts on the environment, human society, and personal life. Within several decades of this shift, historians and transportation scholars began to identify the adverse social changes linked to the automobile and its associated policies (Mumford, 1981).

Now, in the twenty-first century, ample scholarly research on the negative impacts of the automobile is available. The environmental impact alone is the subject of a number of publications from a variety of technical and social fields. Ganiev et al. find that the pace of growth of the world's automobile fleet presents a larger climate change impact than the world's industrial growth, noting that Russia's automobile fleet exerts a greater negative force on the environment than its electric power stations (Ganiev, Ipatov, Romanov, Petrushov, & Moskvitin, 2011). Likewise, Sperling et al. find that, as of 2005, transportation in the United States comprised a larger portion of greenhouse gas emissions than any other sector, totaling 33% of all emissions in the country (Sperling, Cannon, & Lutsey, 2009). Yevdokimov finds a similar figure for Canadian greenhouse gas emissions as of 2009, where 26% of the nation's emissions stem from transportation (Yevdokimov, 2010). The United States, however, with its huge number of

vehicles per capita and total vehicle miles travelled, maintains the transportation system with the largest climate impact of any in the world. Auto-oriented culture, then, is perhaps a greater threat to the environment than traditional dirty industry, non-biodegradable waste, or nonrenewable fuel usage for power production. More worrying still is the fact that most Americans lack an accurate understanding of the impacts of their behaviors on the environment. Truelove and Parks find that college students regularly link their willingness to perform certain actions to the actions' effects on global warming, but they do not accurately rate which actions contribute to or mitigate global warming (Truelove & Parks, 2012). This indicates that, even as youth culture changes to acknowledge the negative impacts of the automobile, broader cultural, political, and educational changes are necessary to successfully mitigate the automobile's impact on the environment. These cultural changes will enable actual physical shifts in urban form and transportation technology towards more sustainable strategies.

Global warming is not the only adverse effect to stem from an auto-oriented American transportation system. Personal health and wellbeing is also negatively affected through automobile travel. According to the U.S. Department of Transportation, 33,561 people were killed in motor vehicle traffic crashes in 2012, at a rate of 1.13 per 100 million vehicle miles traveled (National Highway Traffic Safety Administration, 2014). In contrast, only 67 individuals were killed while riding urban mass transit (Bureau of Transportation Statistics, 2012). This direct cost is not the automobile's only effect on human wellbeing. Human health is directly linked to physical activity, something which can easily be improved through regular walking and cycling as opposed to driving. Younger et al. find a myriad of negative health effects associated with an automobile based urban form, including increased rates of respiratory illness and asthma, traffic fatalities, increased rates of cardiovascular disease and osteoporosis,

increased anxiety and depression, and exposure to "road rage" incidents (Younger, Morrow-Almeida, Vindigni, & Dannenberg, 2008). Unfortunately, switching to active modes is not as healthy and safe in the United States as elsewhere in the world. Pucher and Dijkstra find that walking and cycling, healthy alternatives to driving which increase physical activity, are much more dangerous in the United States than in Europe and elsewhere (Pucher & Dijkstra, 2003).

Automobile-oriented design also poses a direct risk to the general effectiveness of American transportation infrastructure in coming decades as effects of climate change begin to manifest more severely. Peterson et al. find that climate change will increase maintenance costs due to increased rail buckling, melting tarmac, and bridge failure. Precipitation increases will increase underpass and general roadway flooding (Peterson, Horvitz, & Wehner, 2006). Thus, the climate change problem contributed to by automobile travel will increase the cost of the infrastructure needed for that travel, creating a vicious cycle that requires a change in strategy to be broken. Jaroszweski, Chapman, and Petts find that climate change impacts will require an interdisciplinary approach with contributions from a variety of sciences, economics, and urban planning to successfully adapt transportation to a changing future (Jaroszweski, Chapman, & Petts, 2010).

Contemporary urban problem-solvers may avoid the historical and cultural elements of urban life because their scale is intimidating. History and culture, however, are important facets of urban problem solving given the temporal scale of solutions necessary to tackle the aforementioned problems associated with auto-oriented design. If the world's most ideal urban forms require centuries to evolve organically, how can individuals with limited time, resources, and skills hope to solve the perennial issues within their own communities? Perhaps it is better to fight the small fights, to enact policy changes and implement new technologies which nip at the

edges of foundational flaws in the modern urban form. Foundational problems, however, often demand a longer term approach. As America's great metropolitan regions continue to add population through the twenty-first century, the important micro-changes which most planning endeavors may feasibly bring about must be guided according to a vision that respects the incredible scale of urban history. America's auto-centric urban forms are the fundamental causes of many transportation-related and general urban issues; these forms were engendered over the course of a lengthy urban history and will require an equally long process to revise. While fuel efficient vehicles, increased transit service, and policies designed to promote alternative transportation modes all tackle the symptoms of automobile-oriented design, it is impossible to create a policy or technology which can undo the sprawling character of American cities overnight. Many of America's largest and fastest growing cities experienced the majority of their growth during the automobile era, leaving them without a historic, walkable core to serve as a template for continued growth. These cities, in particular, must respect the element of time as they work to reform their ailing infrastructure. Decades or even centuries may be required to transform cities which are and always were designed for automobiles into walkable, dense urban areas that offer equivalent levels of service for multiple transportation modes.

Despite the frustrating scope of transportation and urban reform, a few American cities demonstrate diligence and success in returning to (or newly creating) an urban form conducive to human interaction, health, and sustainability. The city of Seattle, Washington, despite much of its growth taking place in the car era, demonstrates a transit and alternative transportation mode share upwards of 33.7% (University of Oklahoma Institute for Quality Communities, 2013). While this figure still demonstrates a reliance on automobiles much greater than that seen in entirely transit-oriented and walkable cities such as New York City, London, or Paris, all of

which demonstrate alternative mode shares upwards of 60% (University of Oklahoma Institute for Quality Communities, 2013) (Transport for London, 2009) (DRIEA Ile-de-France, 2013), it is impressive considering the general reliance on automobiles across the United States and the history of America's transit systems. During the late 19th century and early twentieth century, American cities, like their counterparts around the world, relied heavily on public transportation modes for a wide range of trip types. During the mid-twentieth century, these systems were dismantled in favor of automobiles and buses which could not rival the efficiency and quality of service offered by previous transit systems. Seattle experienced this trend as deeply as most American cities. The importance of transit in the region fell to abysmal levels as suburban-style growth facilitated increased automobile usage. While this story is not unique to Seattle, the city's ability to slowly challenge and even reverse these trends is noteworthy. While the relative importance and quality of transit in Seattle in the twenty-first century remains much less than at its peak in the early twentieth century (56.3% high frequency population coverage today versus 91.88% high frequency population coverage in 1933), the region continues to seek the growth of transit and alternative modes and the promotion of a dense and diverse urban core. If Seattle's approach to modern American transportation woes is unique and successful, it is important to study the city's transit history from its heyday onwards to its present condition.

While Seattle's modern transit service coverage is greater than that seen in many other American cities, it cannot rival the frequency and extent of the Seattle streetcar system which, at one time, operated 410 streetcars on 26 routes with three additional cable car lines totaling 231 miles of track, plus an additional 60 gasoline buses to serve as feeders to the primary network (Crowley, 1993). In order to fully understand the changes undergone by Seattle's transit system and their impact on Seattle's urban life, coverage and usage must be analyzed across time,

thereby revealing the long-term impacts of the various historical, cultural, political, and social forces constantly working upon the urban form. The following chapter of this work analyzes both contemporary and historical population coverage for Seattle's transit system as well as contemporary transportation mode share data to characterize Seattle's transportation network and to identify its unique and successful qualities as they differ from the networks of other American cities. This allows the subsequent research into Seattle's history to be applied towards clarification of those processes which may have exerted the greatest influence on the contemporary Seattle transportation network. Chapter Three reviews transportation planning documents from the Seattle region in an attempt to identify the primary cultural components of the modern Seattle planning process and their impact on mass transit planning. Chapter Four conducts a long term historical review of Seattle's transportation network which extends from the beginnings of the streetcar era to the twenty first century, making use of historical, political, and cultural insights to suggest trends which may have influenced Seattle's modern success. Chapter Five offers conclusions regarding the relationship between these historical processes and the unique qualities of success found through this work's analysis of Seattle's contemporary transportation network.

CHAPTER TWO: Characteristics of Seattle's Alternative Transportation Modes

Seattle's Transportation Mode Share Characteristics

Transportation mode share is an easily understood and accessible measure of the general character of a city or region's transportation system. Seattle suffers, like many American cities, from congestion, high automobile usage, and a fair amount of megalopolis sprawl. It is by no means a great departure from the mainstream character of America's large cities. While more centralized and dense than the most sprawling regions of the American South, it cannot rival the density of some of the nation's densest cities. According to 2010 census data, the City of Seattle achieves a population density of 7,774 persons per square mile. This figure does not approach the massive densities of the United States' most walkable and transit dependent cities such as New York, with 27,016 persons per square mile, Boston, with 13,321 persons per square mile, and San Francisco, with 17,246 persons per square mile. Despite this lack of density when compared to cities well known for their transit services, Seattle remains competitive in terms of alternative transportation mode share to work. 2008-2012 American Community Survey (ACS) five year estimates reveal that Seattle ranks seventh out of all large American cities in terms of number of individuals who report transit, walk, or bicycle modes as their primary modes to work. Table 1.1 displays these alternative mode shares for the top seven cities in the United States, along with their urban area population densities. Urban area densities, rather than city densities, are chosen to better reflect the density of the large region due to discrepancies in how city boundaries are formed across the United States.

Table 1: Top Seven US Cities by Alternative Transportation Mode Share (ACS 2012 and 2013 estimates)

City	% of Commuters by Bike, Walk, or Transit	Persons / Sq. Mile
New York	67	27,779
Washington, D.C.	54.6	10,528
Boston	52.1	13,340
San Francisco	46.7	17,867
Philadelphia	36.5	11,380
Chicago	34.8	11,864
Seattle	33.7	7,774

This data reveals that one third of Seattle residents consider alternative transportation modes to be their primary means to work. This figure approaches the alternative mode shares on work trips seen in Chicago and Philadelphia, both of which display population densities much higher than those found in Seattle. When Seattle is compared to other metropolises which are more similar to it than those listed above it easily outclasses them. Table 2 displays regional, rather than city, population characteristics for the Seattle region and five others which are somewhat similar to it either in their size, density, or proportion of growth which has taken place in the era of modern transportation and automobile technologies. Larger area (census-defined metropolitan statistical area and urban area, rather than city) figures are used to better reflect the regional similarities between these metropolitan areas. Table 3 provides alternative mode share figures for the central cities of these regions. This reveals that, when Seattle is compared to its more similar peers at the regional level, it easily outclasses them in terms of alternative mode share.

Table 2: Cities with Regional Population Characteristics Similar to Seattle (2010 US Census)

MSA Name	MSA Population	Core Urban Area Population	Core Urban Area Persons / Sq. Mile
Denver-Aurora-Lakewood, CO	2,543,482	2,374,203	3,554
Portland-Vancouver-Hillsboro, OR-WA	2,226,009	1,849,898	3,528
Phoenix-Mesa-Glendale, AZ	4,192,887	3,629,114	3,165
Baltimore–Columbia–Towson, MD	2,710,489	2,203,663	3,073
Seattle–Tacoma–Bellevue, WA	3,439,809	3,059,393	3,028
Houston–Sugar Land–Baytown, TX	6,086,538	4,944,332	2,979

Table 3: Alternative Mode Share for Peer Cities to Seattle (2012 ACS and 2010 US Census)

City	% of Commuters by Bike, Walk, or Transit	Urban Area Persons / Sq. Mile
Seattle	33.7	3,028
Baltimore	27	3,073
Portland	24.1	3,528
Denver	15.1	3,554
Houston	7	2,979
Phoenix	5.7	3,165

It is difficult to draw any immediate conclusions regarding Seattle's apparently superior ability to attract its residents to alternative modes. The city has only recently surfaced in American popular culture as one of the most attractive and fashionable cities for young people. While it cannot claim the same historical urban pedigree of top-tier cities such as New York and Boston, it somehow outclasses the alternative transportation characteristics of cities with similar sizes, densities, and general visibility to the popular culture. While New York, Boston, San Francisco, and the other top cities listed in Table 1 are highly visible and well known among American culture, Seattle is perhaps less well known and more in line, from this perspective, with cities such as Houston, Denver, Phoenix, and Portland, all of which more closely match it in terms of population characteristics. This implies some sort of transportation advantage not based

in pure population density characteristics which are often signs of the potential for strong alternative mode shares.

A closer look at Seattle's regional mode shares for both general and work trips further confirms the city's unique qualities. The 2009 National Household Travel Survey (NHTS) is the most comprehensive travel survey conducted in the United States. While it fails to capture the sample sizes needed to deeply analyze individual regions, it is highly useful when comparing national trends to local trends. Table 5 displays full mode shares for both all trips and trips to work for the Seattle Core Based Statistical Area (CBSA) as per the 2009 NHTS using weighted and annualized trips. This area, used by the NHTS to delineate regions, is the definition which provides the study area most similar to that used by Seattle's own regional travel surveys. While the alternative mode share figures yielded by the NHTS are significantly less than those given by the ACS, they still prove useful as comparative measures. This discrepancy can be at least partially explained by the difference between the ACS city-level study area and the NHTS regional study area. Table 6 displays combined mode share statistics for both general and work trips for the five peer regions previously noted in Table 2. Table 4 provides a mode key for the coded modes used in both Table 5 and Table 6.

Review of these data demonstrates once again that Seattle outclasses its population and density peers in alternative mode share. Due to mode definitions used by the NHTS, carpool and vanpool modes are not easily separated from other automobile-borne means of travel. Traveling by automobile is only separated into "travel alone" and "travel with others." This is a limitation of the data. Furthermore, the National Survey fails to adequately capture less common modes in its limited sample size, yielding zero trips to work by bicycle for the Seattle region, a clearly inaccurate figure. The analysis conducted in Tables 5 and 6, however, is a purely comparative

exercise. More accurately sampled and weighted mode share data for the Seattle region taken from local travel surveys is provided later in this chapter. Barring these limitations, the non-single occupancy vehicle (SOV) and mode shares yielded by this analysis provide a demonstration that, even when congruent methodologies for transportation analysis are applied across regions in terms of sampling and weighting, as in the NHTS, Seattle remains on top when compared to its peers in terms of the share of trips conducted by transit, carpool, vanpool, bicycle, and walk modes. The Seattle CBSA, according to this data, demonstrates a non-automobile mode share for all trips of 21.77%, as compared with a combined non-automobile share of 15.92% for the peer regions. This is a 36.7% advantage over the peer regions. There is clearly something at work in Seattle which allows it to maintain an advantage over similar regions in terms of multimodal transportation. More in-depth mode share analysis adapted and weighted according to the specific demographics of the Seattle region reveals more accurate and useful details regarding the city's contemporary transportation network.

Table 4: Mode codes for 2009 NHTS mode share analysis in Tables 5 and 6

Code	Mode
1	Car, van, SUV, Pickup truck, Other truck, or RV alone
2	Car, van, SUV, Pickup truck, Other truck, or RV with others
7	Motorcycle
8	Light electric vehicle (golf cart)
9	Local public bus
10	Commuter bus
11	School bus
12	Charter/tour bus
13	City to city bus
14	Shuttle bus
15	Amtrak/intercity train
16	Commuter train
17	Subway/elevated train
18	Streetcar/trolley
19	Taxicab
20	Ferry
21	Airplane
22	Bicycle
23	Walk
24	Special transit (people w/ disabilities)
97	Other

Table 5: Seattle Core Based Statistical Area Mode Shares (2009 NHTS)

	All Trips		Trips to Work	
Mode	**Weighted Trips**	**Share**	**Weighted Trips**	**Share**
1	1,544,397,329	37.61%	245,270,277	73.45%
2	1,668,180,202	40.62%	58,486,268	17.51%
7	18,268,965	0.44%	2,955,714	0.89%
8	0	0.00%		0.00%
9	93,917,095	2.29%	14,575,320	4.36%
10	14,566,064	0.35%	1,196,395	0.36%
11	32,828,189	0.80%		0.00%
12	0	0.00%		0.00%
13	0	0.00%		0.00%
14	1,034,914	0.03%		0.00%
15	0	0.00%		0.00%
16	2,595,356	0.06%	1,398,961	0.42%
17	0	0.00%		0.00%
18	0	0.00%		0.00%
19	0	0.00%		0.00%
20	2,572,825	0.06%		0.00%
21	9,594,619	0.23%		0.00%
22	62,265,305	1.52%		0.00%
23	627,041,495	15.27%	10,053,297	3.01%
24	3,429,396	0.08%		0.00%
97	25,739,255	0.63%		0.00%
Total	4,106,431,009	100.00%	333,936,231	100.00%
Non-SOV Share		62.39%		26.55%
Non-Automobile Share		21.77%		9.04%

Table 6: Combined mode share characteristics for Seattle's peer regions listed in Table 2 (2009 NHTS)

	All Trips		Trips to Work	
Mode	**Weighted Trips**	**Share**	**Weighted Trips**	**Share**
1	8,200,073,245	38.39%	1,290,172,043	76.83%
2	9,760,237,618	45.69%	244,855,446	14.58%
7	25,818,529	0.12%	5,869,951	0.35%
8	25,769,140	0.12%	13,592	0.00%
9	261,961,580	1.23%	35,584,838	2.12%
10	16,319,355	0.08%	1,375,869	0.08%
11	357,529,748	1.67%		0.00%
12	3,960,266	0.02%	150,562	0.01%
13	1,399,034	0.01%		0.00%
14	7,730,220	0.04%	46,262	0.00%
15	9,484,347	0.04%		0.00%
16	22,956,140	0.11%	7,494,707	0.45%
17	15,721,067	0.07%	556,636	0.03%
18	4,550,335	0.02%	189,049	0.01%
19	66,860,245	0.31%	5,862,380	0.35%
20	1,010,792	0.00%	878,030	0.05%
21	17,913,574	0.08%	58,784	0.00%
22	250,617,006	1.17%	32,555,580	1.94%
23	2,243,181,675	10.50%	46,133,744	2.75%
24	12,286,010	0.06%	67,832	0.00%
97	54,397,139	0.25%	7,454,720	0.44%
Total	21,359,777,065	100.00%	1,679,320,024	100.00%
Non-SOV Share		61.61%		23.17%
Non-Automobile Share		15.92%		8.59%

The 2014 Puget Sound Regional Travel Study provides the detailed mode share data necessary to more fully understand the characteristics of Seattle's transportation network. Designed and weighted with the unique demographic characteristics of the Puget Sound region in mind, this study surveyed 7,361 households to collect complete travel information for a full 24-hour period. The data can be analyzed unweighted or weighted to reflect travel characteristics for the whole region based on the representative sample. The study covered all areas designated as part of the Puget Sound Regional Council (PSRC), the Seattle-based MPO for the region.

Figure 1 compares the study areas for the ACS, NHTS, and PSRC survey data used in this chapter. The PSRC study area largely mirrors the CBSA definition used in prior tables as part of the NHTS portion of this mode share analysis. Table 7 displays the coded mode key for the PSRC survey, while Table 8 displays the results of the mode share analysis. Not surprisingly, the results differ fairly significantly from those yielded by the NHTS data. There is also a five year discrepancy in the publishing dates of the data. Weightings for the PSRC survey are not annualized, but are instead intended to generate an estimation of 24-hour transportation characteristics for the Seattle region. Mode definitions also differ significantly between the PSRC and NHTS datasets. The PSRC mode definitions are perhaps easier to understand in terms of how planners and the general population think of transportation. They separate trips driven alone from trips driven with others, and further split these trips between trips with only other household members and trips with non-household members. This helps to differentiate between the many shared trips taken by household members, including ferrying children to school and activities, family shopping trips, and other general household chores, from the more difficult to arrange and purposeful carpool trips we associate with a typical public definition of the term 'carpool.' Vanpool trips are also delineated from other forms of automobile trips undertaken with multiple persons. In comparison, the NHTS data merely separates various forms of automobile (car, truck, van, etc.) and then uses other variables to check for multiple person trips. This is a more difficult to analyze and understand data format. The PSRC data is extremely easy to understand and separate according to the transportation modes typically considered over the course of a transportation planning exercise. The PSRC modes also include definitions for paratransit and modern hired car services such as Lyft and Uber. This, ultimately, allows the

2014 PSRC travel survey to serve as the most effective available source of information regarding Seattle's regional transportation mode share characteristics.

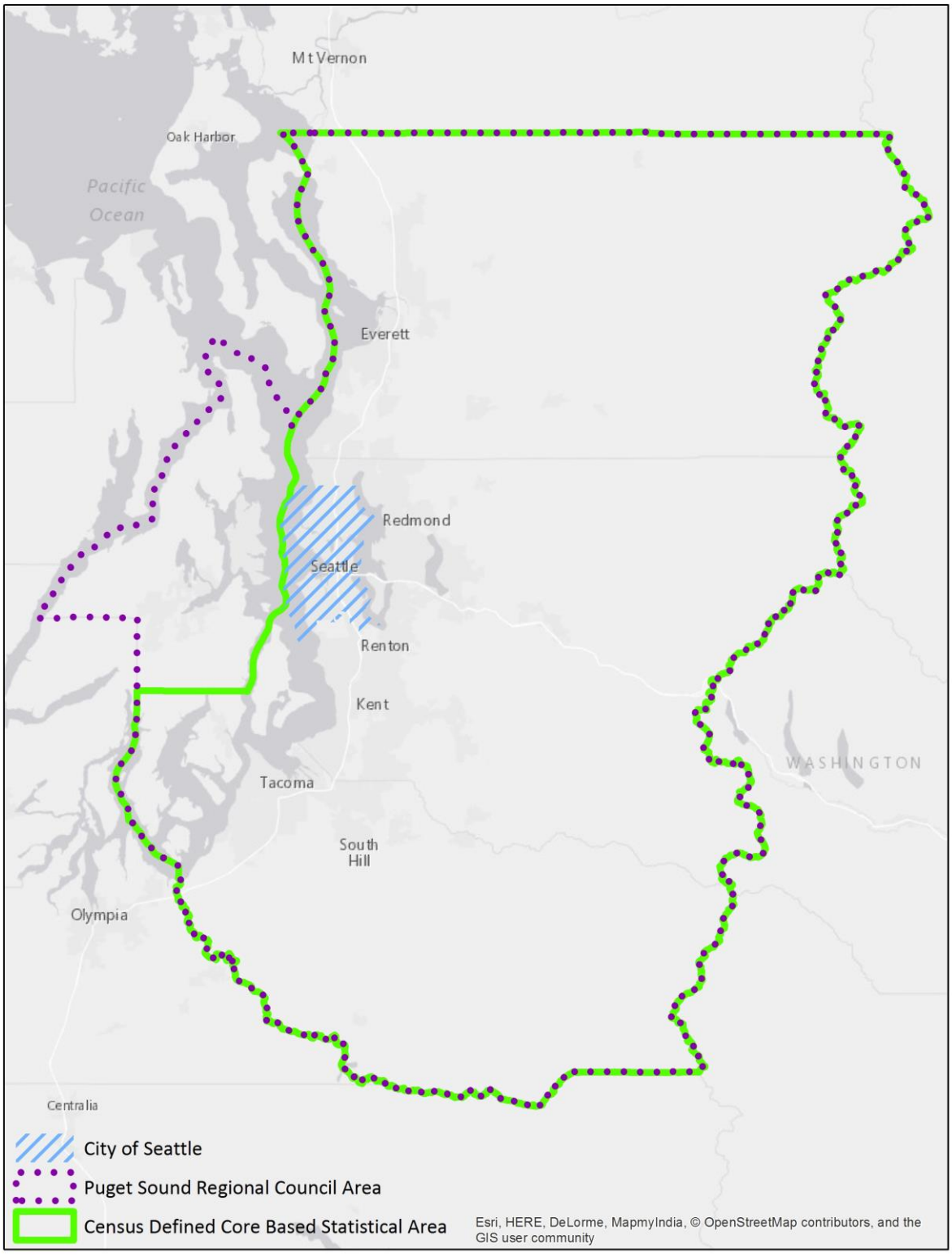

Figure 1. Study areas for various travel surveys of the Seattle region (US Census, 2010) (PSRC, 2014).

Review of the mode share analysis results demonstrates that nearly 24% of Seattle regional trips are undertaken by non-personal automobile modes. The non-automobile definition does include vanpools, shuttle buses, paratransit, and hired car services. It does not include carpools either with household members or non-household members. When limited to trips to work, the Seattle region displays an even greater 27% share of non-automobile trips. This is a massive portion of trips undertaken by alternative modes for a city with a density that cannot nearly rival the population densities seen in America's top tier cities. Furthermore, despite the lack of a heavy rail system, the region displays a 5.48% total general trips share for all transit modes, and a 10.92% transit share for trips to work. Considering that the study area for this survey includes the entire Seattle region and is not limited to merely the most well-served, urban areas such as Seattle and Bellevue, these figures represent a powerful presence for transit across the regional transportation network. Bicycle mode shares are 1.35% for general trips and 2.28% for work trips. Once again, this is significant number of trips considering the regional scope of the survey. Walk trips comprise a hefty 13.6% of general trips and 11.88% of work trips. These characteristics demonstrate that many Puget Sound regional residents are willing or even prefer to make use of alternative modes for their transportation when possible. The significant portion of walk trips for general purposes, slightly reduced for trips to work, suggests a willingness to engage in active travel modes for local neighborhood trips. The increased transit usage for work trips, nearly double that of general trips, suggests that larger regional trips, perhaps from suburbs to urban cores where employment centers are located, may prove more attractive for transit usage than general trips.

Table 7: Mode codes for use with the PSRC mode share analysis

Code	Mode
1	Drove alone
2	Drove/rode ONLY with other household members
3	Drove/rode with people not in household (may also include household members)
4	Motorcycle/moped/scooter
5	Vanpool
6	Bicycle
7	Walk, jog, or wheelchair
8	Bus (public transit)
9	Train (rail and monorail)
10	Ferry or water taxi
11	Streetcar
12	School bus
13	Taxi or other hired car service (e.g. Lyft, Uber)
14	Paratransit
15	Private bus or shuttle
16	Airplane or helicopter
17	Other (e.g. skateboard, kayak, motor home, etc.)

Table 8: 2014 Puget Sound Regional Travel Study Mode Share Characteristics

	All Trips		Trips to Work	
Mode	**Weighted Trips**	**Share**	**Weighted Trips**	**Share**
1	5,625,047	41.50%	1,151,213	64.31%
2	3,948,750	29.14%	89,987	5.03%
3	782,904	5.78%	60,372	3.37%
4	32,525	0.24%	11,310	0.63%
5	41,869	0.31%	18,897	1.06%
6	183,455	1.35%	40,743	2.28%
7	1,842,886	13.60%	212,709	11.88%
8	595,272	4.39%	156,505	8.74%
9	60,037	0.44%	17,294	0.97%
10	40,925	0.30%	12,167	0.68%
11	2,570	0.02%	754	0.04%
12	302,670	2.23%	1,608	0.09%
13	12,230	0.09%	1,149	0.06%
14	4,542	0.03%	0	0.00%
15	40,851	0.30%	8,823	0.49%
16	22,205	0.16%	5,010	0.28%
17	14,060	0.10%	1,546	0.09%
Total	13,552,798	100.00%	1,790,086	100.00%
Non-SOV Share		58.50%		35.69%
Non-Automobile Share		23.58%		27.29%

Seattle's Transit Population Coverage

Seattle's regional mode share characteristics suggest either a populace more willing than those of regional peers to make use of alternative modes, a more effective alternative transportation mode network than those found in peer cities, or some other process at work which contributes to Seattle's advantage over other regions. Analysis of the physical characteristics of the primary transit networks of the region may reveal further details regarding their success when compared to similar systems in other cities. The presence of high frequency transit (vehicle headways less than 15 minutes) is well known to facilitate increased transit usage. The convenience offered by transit services which do not require rigid adherence to timetables and assuage fears regarding missed vehicles is a great boon to the potential transit rider. Seattle's major transit operators provide a variety of both these high frequency services and more traditional local bus services. Spatial analysis can be used in order to understand the Seattle population's access to these services and to compare the contemporary network, built and developed over the course of the decades since the fall of the early twentieth century streetcar network, with the original streetcar services offered in Seattle during transit's heyday. This temporal comparison provides some measure of the relative decrease in importance of transit to the Seattle region over the course of the nearly eighty years since the dismantlement of the Seattle streetcar network in 1940. While transit is undoubtedly less important to Seattle now than it was in the 1920s or 1930s, it may be that Seattle's ability to retain the historic importance of its transit networks is a major contributor to its general success in promoting alternative transportation modes. Contemporary and historical GIS analysis is used in the following sections to reveal both general and minority population coverage for Seattle's transit networks.

When GIS-based population coverage analysis is combined with and contextualized by historical, cultural, and social research it is possible to further refine conclusions regarding the impact of a given transit network configuration. Seattle's contemporary and historical transit systems, then, must be considered through both the empirical methods made possible through spatial analysis and historic census data and the qualitative methods enabled through the review of historical, cultural, and policy resources. This population coverage analysis, while limited in terms of its ability to precisely portray the characteristics of Seattle's historic streetcar network due to the unavailability of more detailed data, still allows the character of Seattle's modern transit network to be discussed in terms of historical and cultural processes influential to the contemporary success of Seattle's alternative transportation modes. Understanding of these long term processes is the core interest of this research; chapter three of this thesis undertakes a long term review of Seattle's transportation history in an attempt to clarify the findings of the mode share and population coverage analyses undertaken in this chapter.

Population Coverage Methodology

Transit service area analysis is a common and effective way of visually and statistically analyzing the population coverage offered by a given transportation network. Standards for this type of analysis generally include the use of a 0.25 mile buffer around transit stops or routes, using census blocks or tracts to estimate population coverage (Horner & Murray, 2004). The use of transit stop buffers with the smallest available analysis zone size creates the potential for the most precise estimates of transit population coverage. However, the use of route buffers and larger analysis zone sizes is viable when more precise measures are not available. Transit route buffers will always cover a larger area than transit stop buffers, and smaller zone sizes will always allow greater precision in terms of population analysis (Horner & Murray, 2004). Given

the knowledge of these limitations, however, it is possible to analyze population coverage even when the ideal data is not available.

The historic population coverage offered by Seattle's transit system at the height of the transit era is estimated using resources from the Washington State Archives and the National Historical Geographic Information System (NHGIS) provided by the University of Minnesota (Washington State Archives - Digital Archives, 2014) (Minnesota Population Center, 2011). Contemporary transit population coverage is estimated using resources from the King County Geographic Information System Center (King County GIS Center, 2014). An original map of the extent of the 1933 Seattle Municipal Street Railway transit network is the foundation of the historic analysis, allowing the 1933 streetcar and bus network to be georeferenced, digitized, and analyzed using the geoprocessing techniques provided by the GIS software. An original traffic flow map from 1930 provides a supplement to the Seattle Municipal Street Railway network map in order to lend additional context to the analysis. Historic 1940 census tracts for the city of Seattle from the NHGIS are the spatial analysis zones used for population coverage analysis. Original census demographic data from the NHGIS provides the population figures needed to conduct population coverage estimates. Contemporary 2010 datasets from the King County GIS Center provide shapefiles for analysis of King County Metro's transit routes. These datasets, in combination with information made available through the King County Metro website, provide frequency, mode, and alignment information needed for the modern population coverage analysis.

Study Areas

Given the aforementioned datasets, study areas for both time periods were established. In order to take into account the growth of the Seattle urban and metropolitan regions, the 2010

study area was expanded beyond the 1933 study area. Both study areas are limited according to the extent of the observed transit networks and the boundaries of the reasonably dense, (census-defined) urban area of Seattle. The 1933 Seattle Municipal Street Railway operated almost entirely within the Seattle city limits, while the urban area of Seattle, not yet officially defined by the Census Bureau, occupied roughly the same space. Thus, the Seattle city limits provide a reasonable study area boundary for the 1933 analysis. The phenomenon of massive, megalopolis-style sprawl beyond traditional city boundaries was not yet a primary component of the American urban form during this period. 2010 study boundaries were limited according to both the operational extent of the King County Metro transit network, the boundaries of King County, and the census defined urban area of Seattle. These boundaries were used in conjunction to create a study area which primarily follows the Seattle urban area boundary, but limits its extent at the boundaries of King County, thereby excluding the portions of the Seattle urban area which extend beyond the operational limits of Seattle's primary transit network. These two study areas, while not spatially identical, allow for the population coverage analysis to account for the massive population and urban area growth experienced by the city of Seattle over the course of the twentieth century.

Historic Data Limitations

With study areas established, population data for Seattle can be analyzed. Historic 1940 census tracts provided the highest resolution population data available for the 1933 analysis. While these zones do not temporally match the 1933 transit network, no tract-level or smaller data is available for the city prior to 1940. Despite this discrepancy, 1940 tracts provide a reasonably accurate estimation of 1933 population and demographic levels due to the relative stagnation experienced by the city during the 1930s Great Depression era. Population statistics

for Seattle as a whole confirm this trend. Table 9, below, demonstrates the stagnation of Seattle's population between 1930 and 1940.

Table 9: Historic Population Characteristics of Seattle, 1890 to 2010 (Moffatt, 1996)(US Census, 2010)

Year	Population	Percent Growth	National Rank
1890	42,837	N/A	70
1900	80,671	88.32%	48
1910	237,194	194.03%	21
1920	315,312	32.93%	20
1930	365,583	15.94%	20
1940	368,302	0.74%	22
1950	467,591	26.96%	19
1960	557,087	19.14%	19
1970	530,831	-4.71%	22
1980	493,846	-6.97%	23
1990	516,259	4.54%	21
2000	563,374	9.13%	23
2010	608,660	8.04%	23

The 1930s granted Seattle a marginal 0.74% increase in population. This caused the city's national population ranking to drop, indicating that the city experienced stagnation even beyond some of the United States' other prominent urban regions. This stagnation allows 1940 census tracts to serve as viable population measures for an analysis of a 1933 transit network. 2010 population and demographic statistics, available at the Census Bureau block group level for the entire study area, allow for a more precise population analysis to be conducted for the modern transit network. While the increased precision of the contemporary analysis creates a discrepancy with the 1933 analysis, it does not reduce the validity of conclusions as the underlying assumptions regarding service area and study area definitions remain the same.

One half mile buffers around transit routes were established to create the service areas necessary for analysis. While one quarter mile buffers may often be used as the boundaries for transit service areas, the constraints placed on modern networks due to funding issues and the

increased attractiveness of transit for younger generations suggest that the reasonable service area may be expanded. While ample research regarding transit catchment areas exists, conclusive evidence that a specific buffer size provides improved predictive power is not available. However, Guerra and Cervero find that 0.5 mile buffers may be slightly more effective than 0.25 mile buffers when predicting ridership or service coverage based on population (Guerra, Cervero, & Tischler, 2012). Without expansion of the buffer range to 0.5 miles, the realistic expectations of modern transit users may not be captured. Due to the operational nature of streetcars, explicitly defined stops are not available for the 1933 network. This prevents the often preferred stop-buffer analysis from being utilized in this scenario. Traditional streetcars, with their relatively low speeds and ease of stopping, are able to load passengers at nearly any intersection or reasonable stopping point, eliminating the need for the well-established stop locations seen in modern transit networks. Route buffers were therefore used to provide congruency between the 1933 and 2010 analyses, despite the availability of spatial data for 2010 transit stop locations.

Transit Population Coverage in 1933

Original data and visual resources from 1930s Seattle immediately suggest a transit system vastly different from those found in twenty-first century American cities. Like nearly all streetcar operators throughout the United States during the 1930s, Seattle's Municipal Street Railway (owned by the city after the purchase of the Seattle Electric Company in 1918) struggled to make ends meet as economic hardship, inflation, and fixed streetcar fares prevented them from raising fare revenue. Mandated nickel fares put in place in 1899 and competition from increasing numbers of affordable automobiles (Crowley, 1993) prevented the revenue growth needed to compensate for inflation and rising maintenance costs. Furthermore, automobile

competition became more and more appealing as the cost barrier to car ownership dropped in the late 1920s and 1930s, challenging the previously indisputable cost advantage of streetcars for middle income Americans (Post, 2010).

Despite these difficulties, the Seattle Municipal Street Railway continued to operate an extensive, multimodal transit system designed to serve the entire population of Seattle. While upwards of 100,000 private automobiles and trucks roamed Seattle's streets by 1937 (Crowley, 1993), the extent of transit service remained massive up until the actual dissolution of the Municipal Railway itself. Figure 2, available on the following pages, displays the full extent of the Seattle Municipal Street Railway network, including buses, cable cars, and streetcars, as of 1933. This figure provided the historic information necessary to georeference and digitize the 1933 network for population coverage analysis. Review of the Railway map reveals a downtown core with rail service on nearly every street, a dense array of radial and grid lines extending outwards from the core, and a series of long distance feeder bus lines providing additional rail access.

Traffic flow patterns and volumes for 1930s Seattle lend further evidence of the extent and intensity of transit service during the period. Figure 3, on the following pages, is an original display of traffic flow in Seattle as of 1930, prepared by the Seattle Department of Streets and Sewers. It also includes peak hour traffic counts for several major bridges across the city. These counts reveal an unprecedented number of transit vehicles crossing during the peak hour, likely beyond anything offered by any modern American transit service. Table 10, available on following pages, displays the peak hour vehicle counts in a more legible format. These 1930 counts demonstrate that, at multiple locations, 60 to 80 or more streetcars passed in one direction in one hour. This is a staggering figure, indicating that more than one streetcar per minute

crossed these count locations, indicating a frequency of transit service far beyond most options available to modern transit riders.

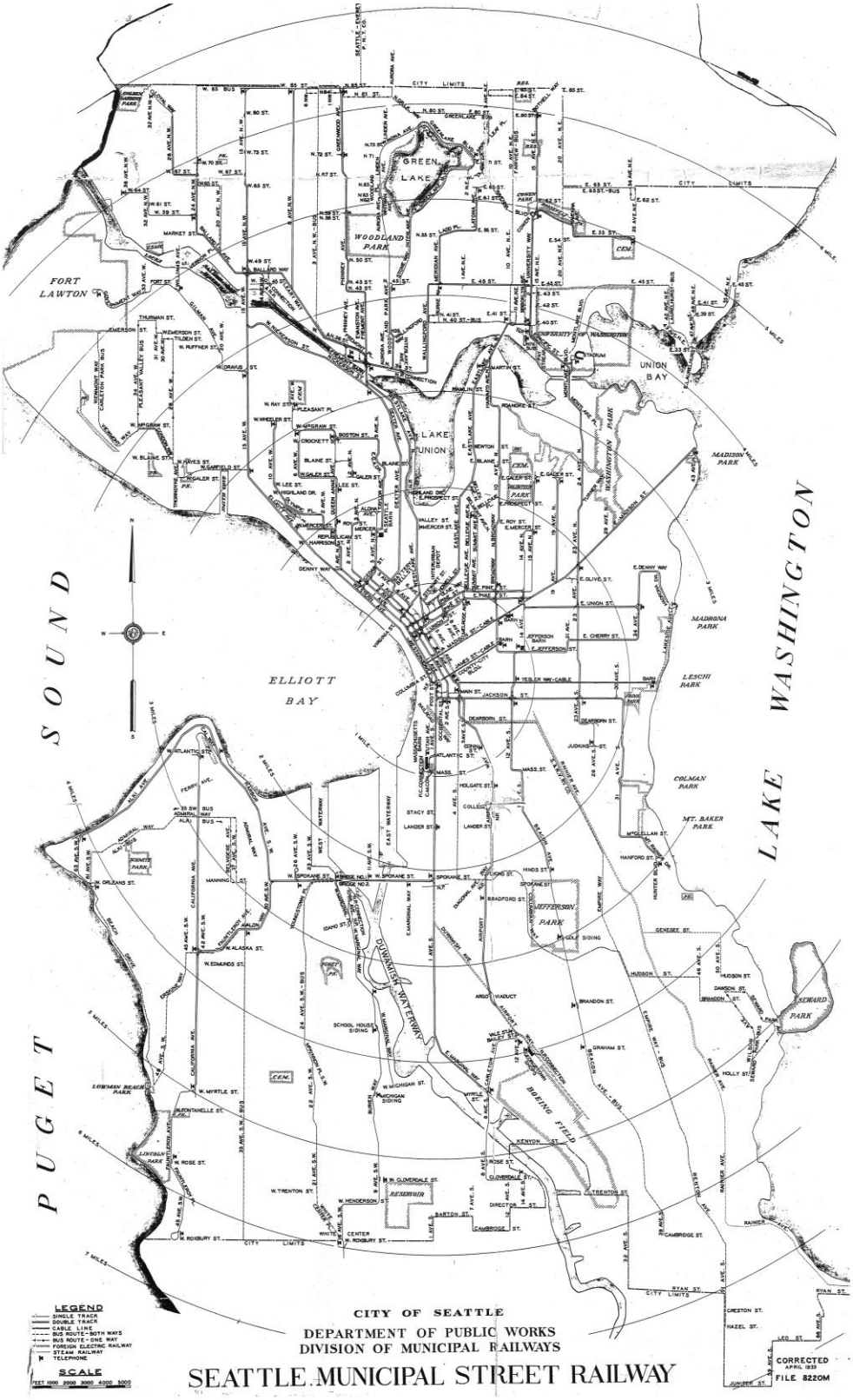

Figure 2. Seattle Municipal Street Railway Network, 1933 (Washington State Archives - Digital Archives, 2014)

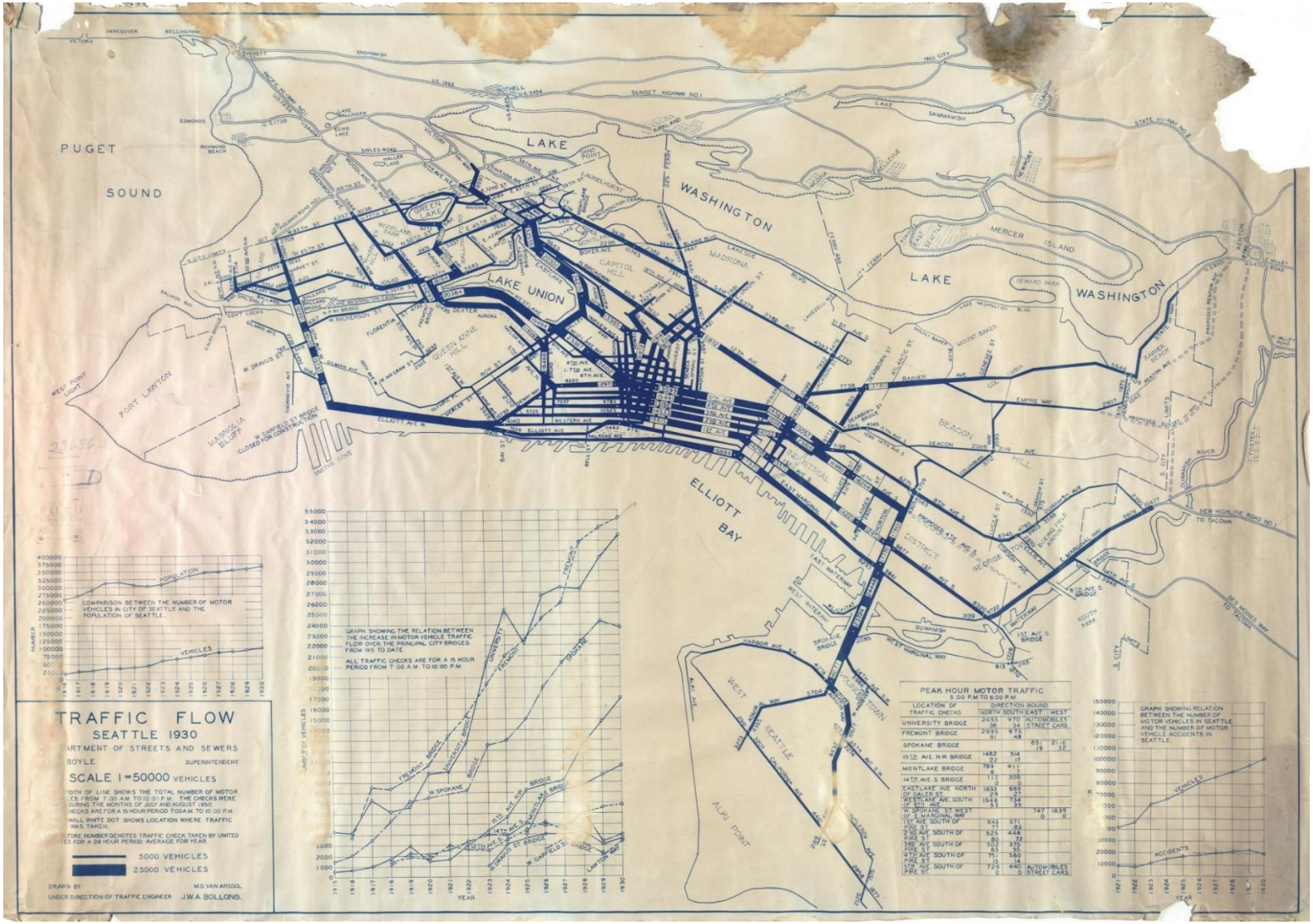

Figure 3. Seattle Traffic Flow, 1930 (Washington State Archives - Digital Archives, 2014)

Table 10. Seattle 1930 Peak Hour Traffic Counts (Washington State Archives - Digital Archives, 2014)

	Direction Bound			
Location of Traffic Checks	**North**	**South**	**East**	**West**
University Bridge	2455	970	**Automobiles**	
	38	34	**Streetcars**	
Fremont Bridge	2695	975		
	61	48		
Spokane Bridge			651	2116
			19	32
15th Ave NW Bridge	1482	514		
	22	17		
Montlake Bridge	789	411		
	6	7		
14th Ave S Bridge	113	308		
	0	0		
Eastlake Ave North of Galer St	1633	669		
	29	27		
Westlake Ave South of 9th Ave	1346	734		
	53	39		
W Spokane St West of E Marginal Way			747	1839
			0	0
1st Ave South of Pike St	645	571		
	77	85		
2nd Ave South of Pike St	525	448		
	80	72		
3rd Ave South of Pike St	502	375		
	85	55		
4th Ave South of Pike St	751	580		
	15	14		
5th Ave South of Pike St	726	440	**Automobiles**	
	0	0	**Streetcars**	

Historic Transit Coverage Analysis Results

With the character and extent of the Municipal Street Railway established, analysis of the population coverage provided by the network is possible. High frequency and low frequency services are separated in order to provide a measure of total transit coverage as compared to high quality transit coverage. Both total population coverage and nonwhite population coverage are provided in order to evaluate the change over time in transit service for potentially disadvantaged groups. Figure 4 displays the digitized Seattle Municipal Street Railway network with transit modes separated. All modes were considered "high frequency" other than buses based on descriptions of the historic network and traffic flow data from the previously displayed figures. Figure 5 displays the coverage extent of the 1933 transit network with population density based on 1940 census tracts displayed as a background. This figure reveals that, when the entire transit network is considered, almost the entirety of Seattle is covered by transit service. Figure 6 displays the same population density data with the transit network limited to only high frequency services. This reduces overall coverage, but still retains an extremely high level of transit service. Only the distant fringe neighborhoods of Seattle lack coverage by high frequency transit, instead being served by longer range feeder buses. Figure 7 displays this same network with nonwhite population percentages as a background. This shows a concentration of nonwhite residents in the central city where they have full access to high frequency transit. All population coverage figures for 1933 Seattle are available on the following pages. Detailed coverage percentages are available in Table 11.

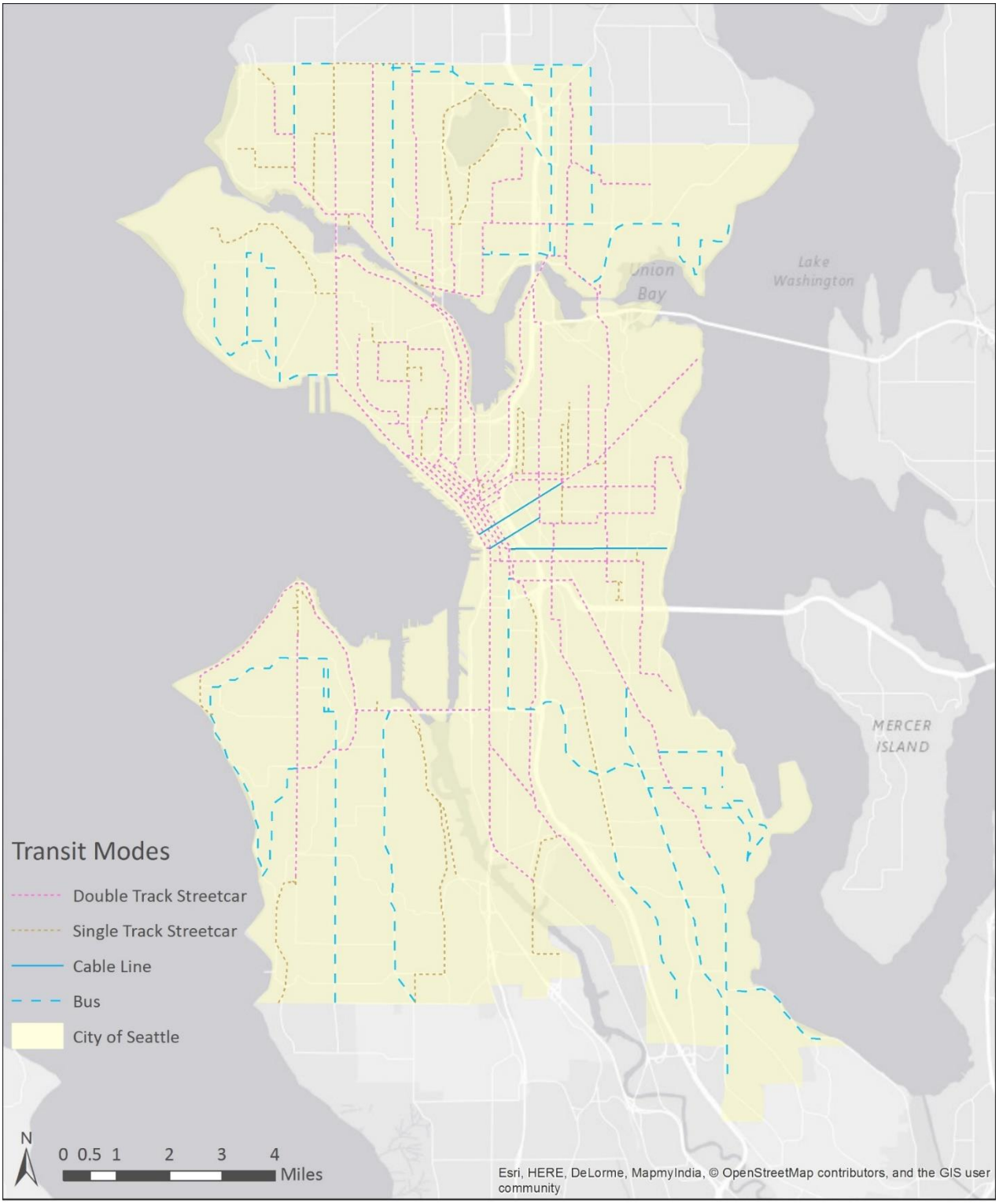

Figure 4. Seattle Transit Extent, 1933 (Minnesota Population Center, 2011) (Washington State Archives - Digital Archives, 2014)

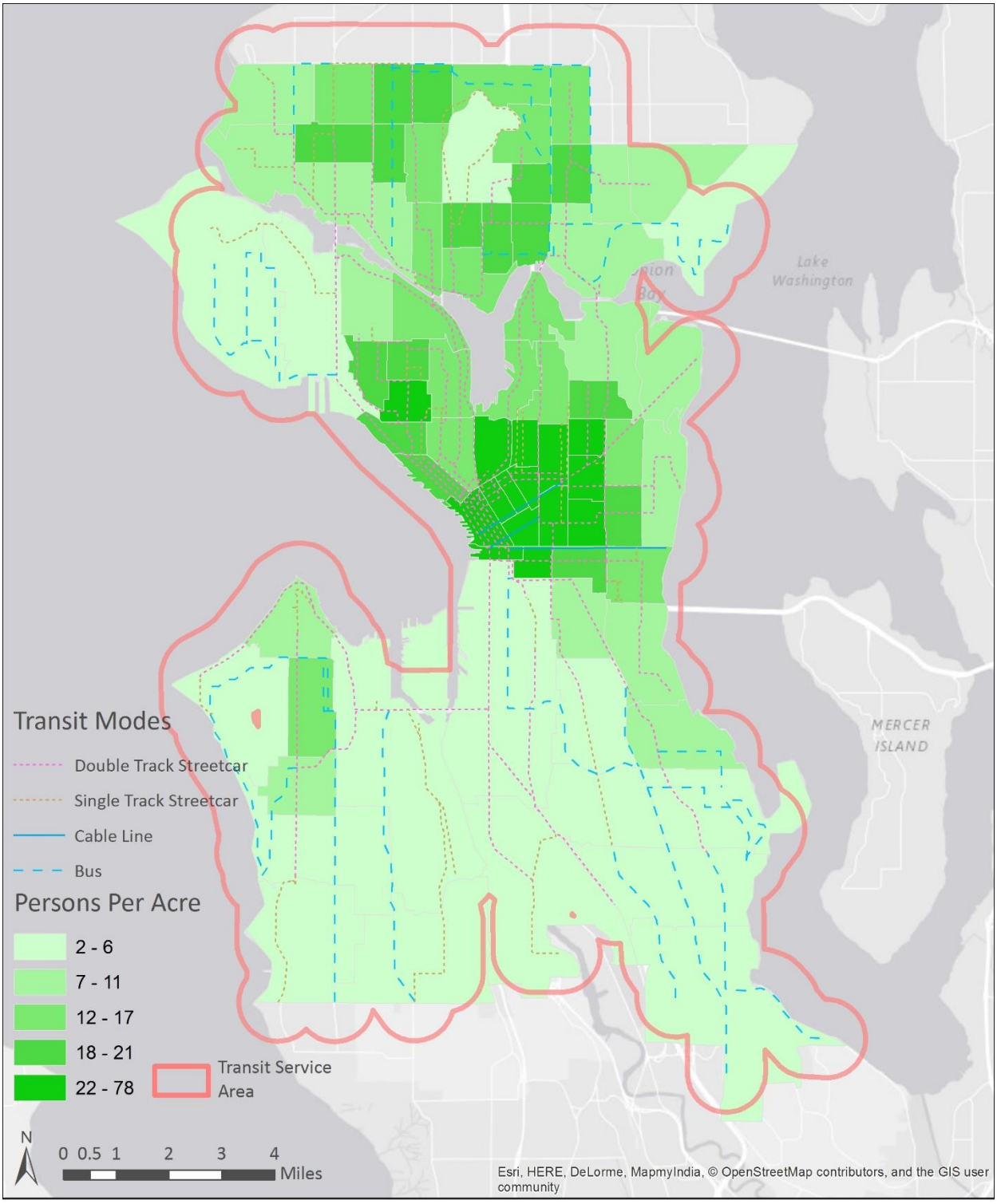

Figure 5. Seattle Population Density and Transit Coverage, 1933 (Minnesota Population Center, 2011) (Washington State Archives - Digital Archives, 2014)

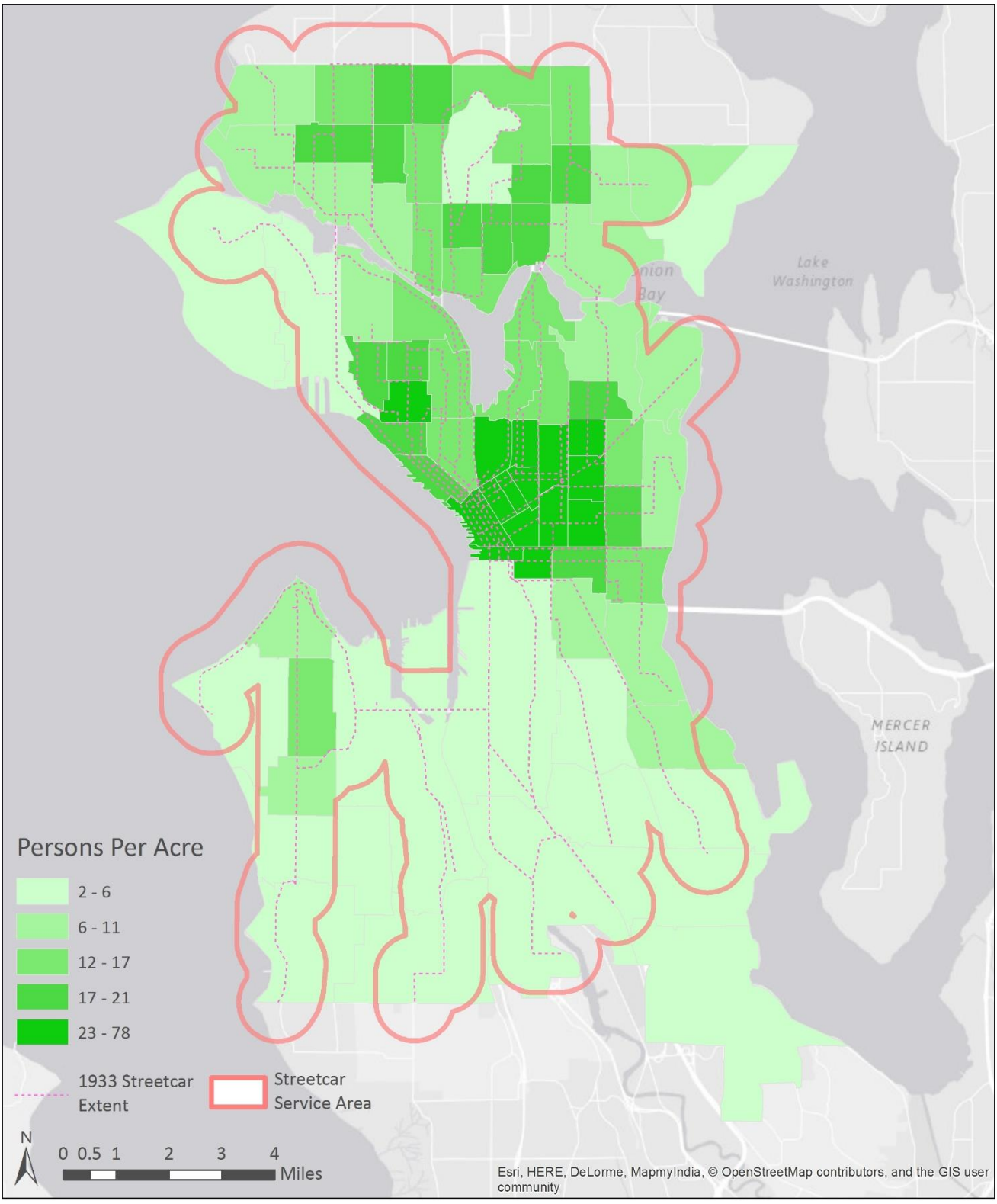

Figure 6. Seattle Population Density and High Frequency Transit Coverage, 1933 (Minnesota Population Center, 2011) (Washington State Archives - Digital Archives, 2014)

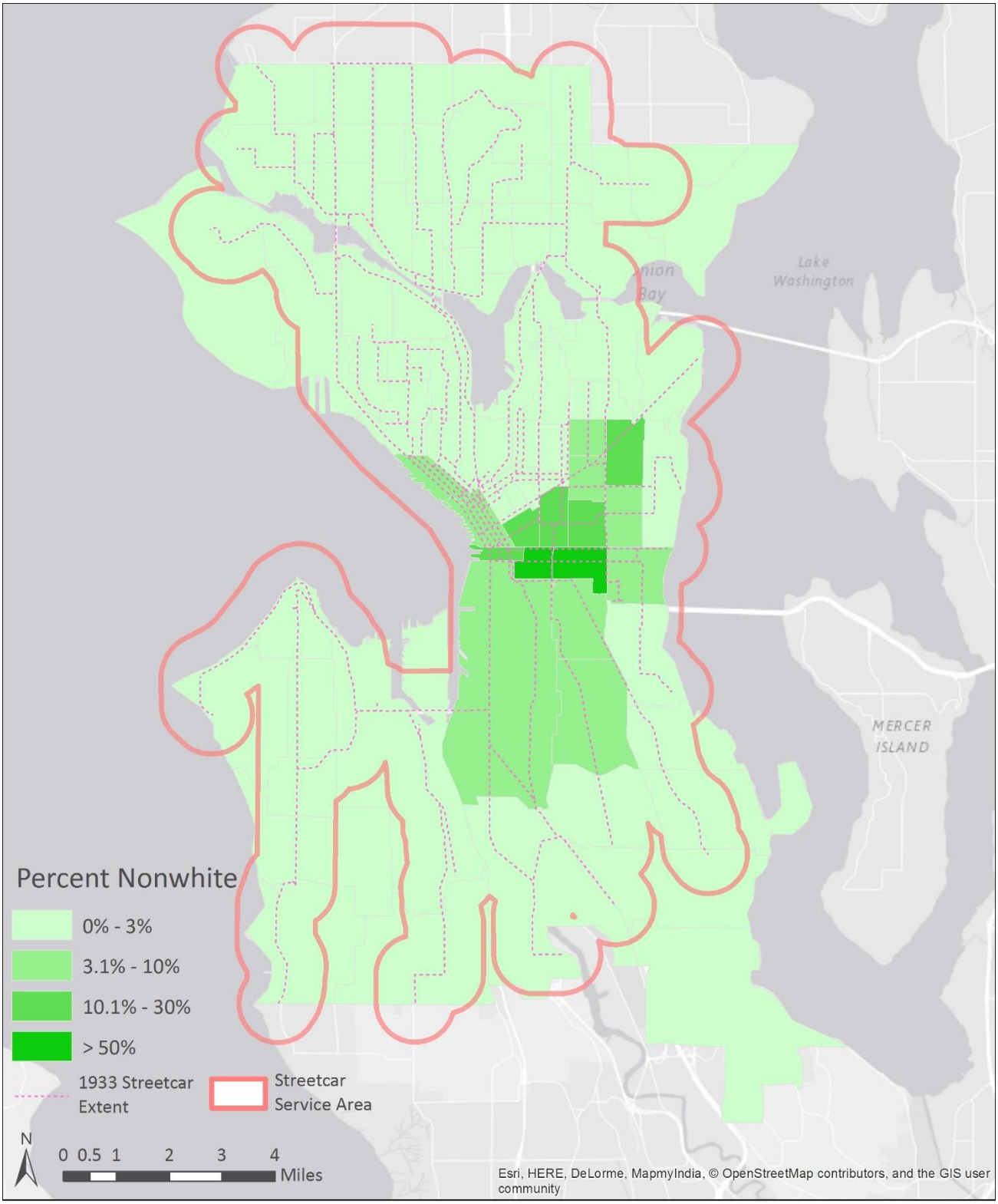

Figure 7. Seattle Population Percentage Nonwhite and High Frequency Transit Coverage, 1933 (Minnesota Population Center, 2011) (Washington State Archives - Digital Archives, 2014)

Table 11: Population Coverage Characteristics for Seattle's Transit Network, 1933

Figure	1933 All Transit	1933 Streetcar
Study Area (Acres)	41,937	41,937
Transit Accessible Area	40,358	33,793
Area Coverage	96.24%	80.58%
Population	368,302	368,302
Transit Served Population	362,012	338,378
Population Coverage	98.29%	91.88%
Non White Population	14,201	14,201
Non White Transit Served Population	14,154	13,972
Non White Population Coverage	99.67%	98.38%

The results in Table 11 reveal that the vast majority of Seattle's residents received access to high frequency streetcar transit as of 1933. While area coverage within the city limit study area reached only 80% for the streetcar service, the majority of residents, 91.88%, lived within one half mile of this network. When all transit modes and routes are considered, almost the entirety of the study area and population are covered by transit service. This reveals a level of service likely unmatched by any twenty-first century American transit network. While it is a given that Seattle's modern transit network does not attain these levels of coverage, the following analysis of the 2010 Seattle transit system reveals that the city still attains a level of high frequency service coverage above what one might expect from a mid-density and mid-size American city.

Seattle's 2010 Transit Population Coverage

Coverage analysis of the 1933 transit system reveals that Seattle's population was at one time almost entirely served by high frequency streetcar service. Given the universal presence of the automobile in modern American culture, repetition of such a level of service is highly unlikely in Seattle's current transit service, primarily operated by King County Metro. Despite this, Seattle's present transit service rightfully appears to be a high quality and effective example

of a modern multi-modal transit network, even without the presence of a heavy rail system. While the top-tier transit cities discussed previously in this chapter maintain heavy rail systems and population densities above those found in the Seattle region, the Seattle transit system manages to provide a level of coverage and service which pushes residents to achieve alternative mode usages which approach those found in the most transit oriented regions of the country. Figure 8 shows a publicly available map of Seattle's core district, roughly similar to the study area of the 1933 coverage analysis, with all available transit lines displayed. The density of routes appears to offer a high degree of population coverage and service. However, the urban area in need of transit service is much greater in 2010 than it was in 1933, extending far beyond the boundaries of the 1933 coverage analysis study area. Furthermore, the typically reduced frequencies offered by modern transit services compared to early twentieth century streetcar services limits the availability of high frequency transit to contemporary Seattle residents. These factors combine to present a reduced population coverage from earlier levels, despite the busy and dense modern transit map which, to many users, may suggest an extremely high level of population coverage.

2010 Transit Coverage Analysis Results

With the limitations of modern transit systems in mind, Seattle's 2010 transit population coverage must be considered. Figure 9 displays a digitized version of Seattle's transit service as well as the designated study area. This clarifies the mixed mode and route type nature of Seattle's modern transit. Both radial and grid routes are available, with a variety of express and local services offered. Figure 10 displays the service area offered by Seattle's full transit system, demonstrating that large portions of the urban area's outlying neighborhoods are not adequately covered by transit service. Figure 11 displays only high frequency services, defined as all

services with 15 minute or shorter headways, further reducing the coverage offered by modern transit. Figure 12 shows high frequency transit in front of 2010 census block groups displaying population density. Service area buffers are not displayed to preserve the readability of the image. This figure shows a clear relationship between existing high frequency transit routes and higher densities. Figure 13 displays high frequency transit over nonwhite population percentages. While the majority of Seattle's nonwhite residents live near the well covered central city, many neighborhoods south of the core area near Boeing Field are primarily nonwhite. This indicates that, while most nonwhite residents are served well by transit, some majority nonwhite neighborhoods are underserved. This series of figures suggests a reduction in transit service coverage in 2010 from 1933 streetcar-era levels. All 2010 population coverage figures are available on the following pages, while results are displayed in Table 12.

Figure 8. Seattle Central Area Transit Service (King County Metro, 2014)

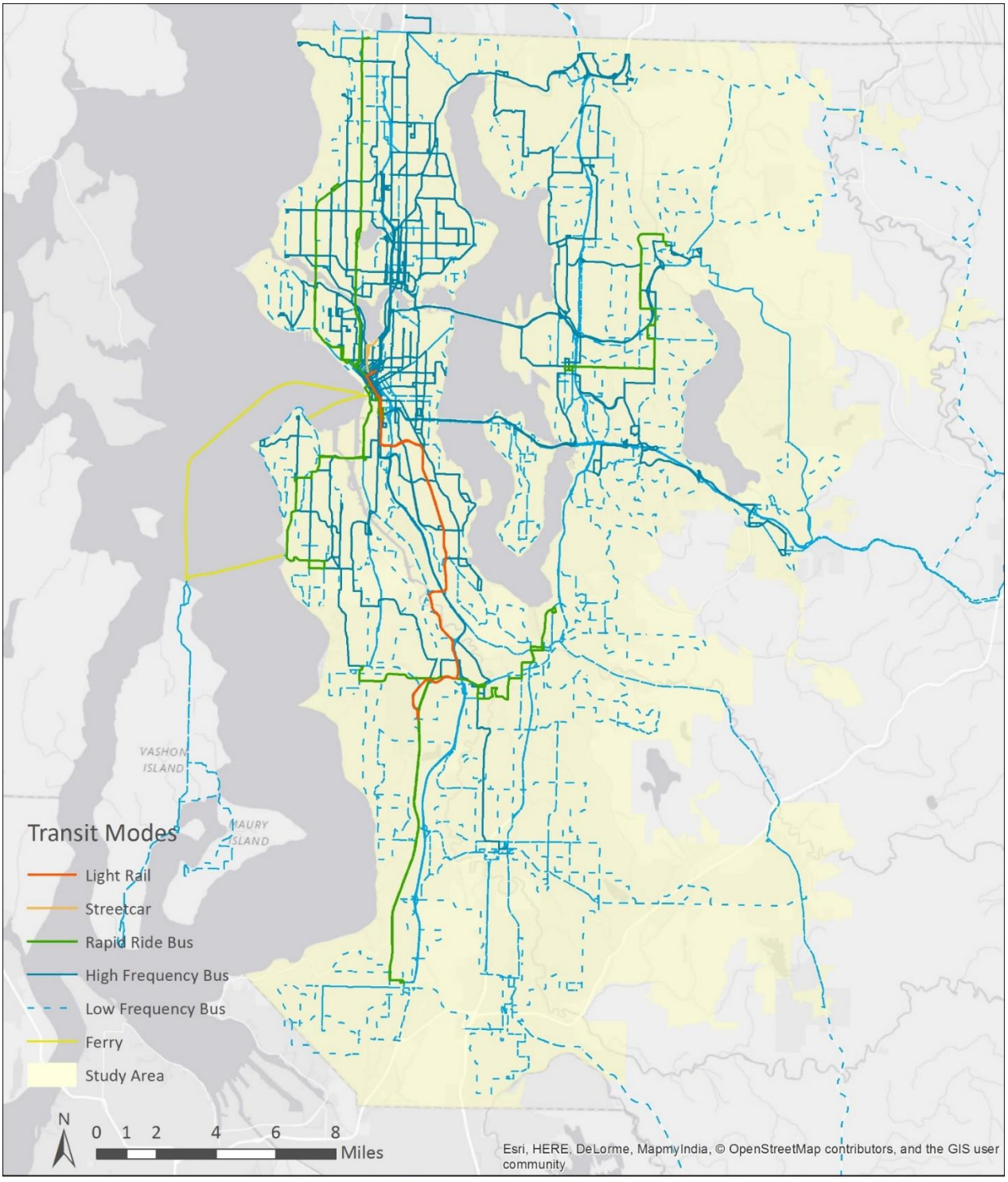

Figure 9. Seattle 2010 Transit Extent by Mode (King County GIS Center, 2014) (United States Census Bureau, 2014)

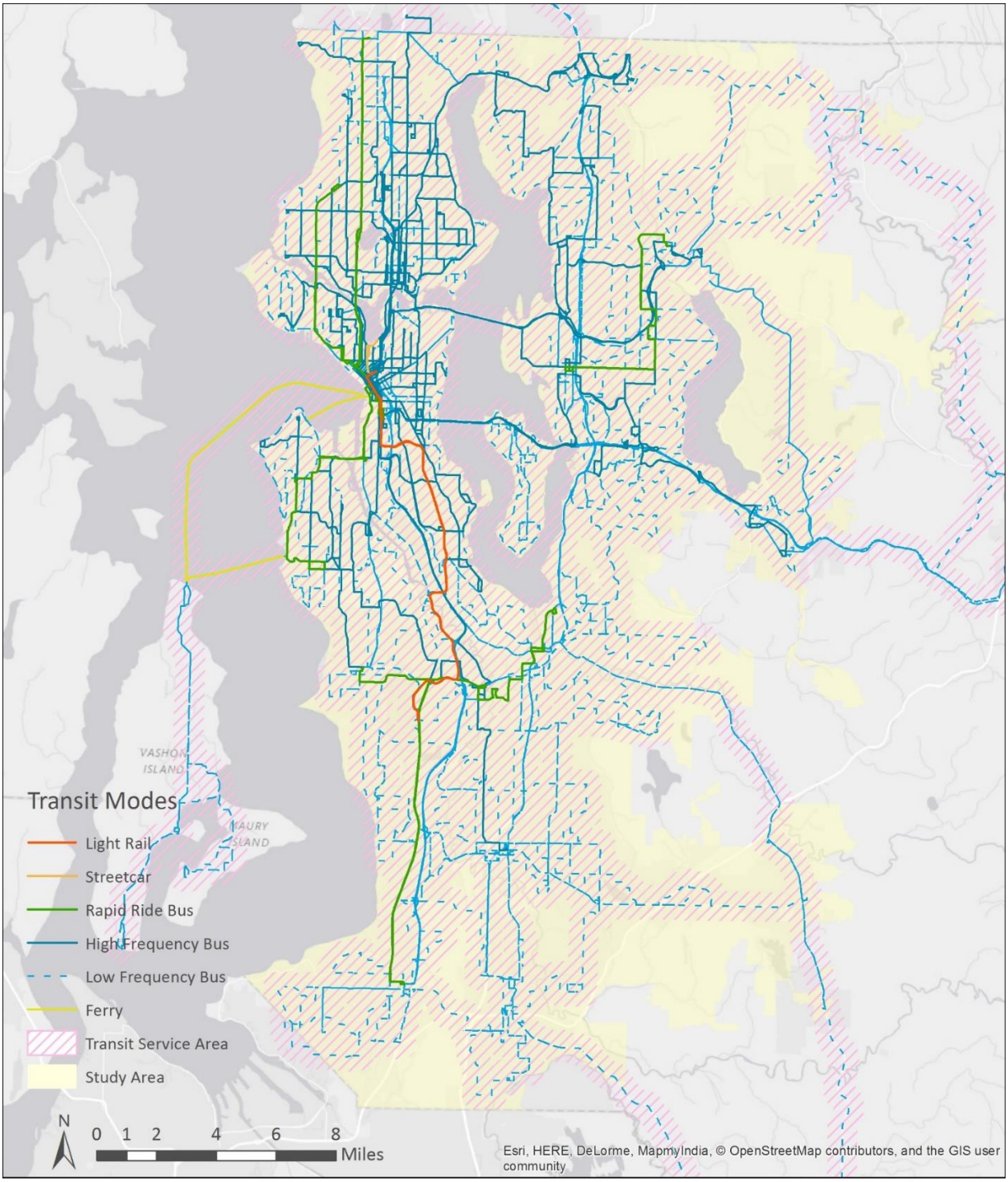

Figure 10. Seattle Transit Population Coverage, 2010 (King County GIS Center, 2014) (United States Census Bureau, 2014)

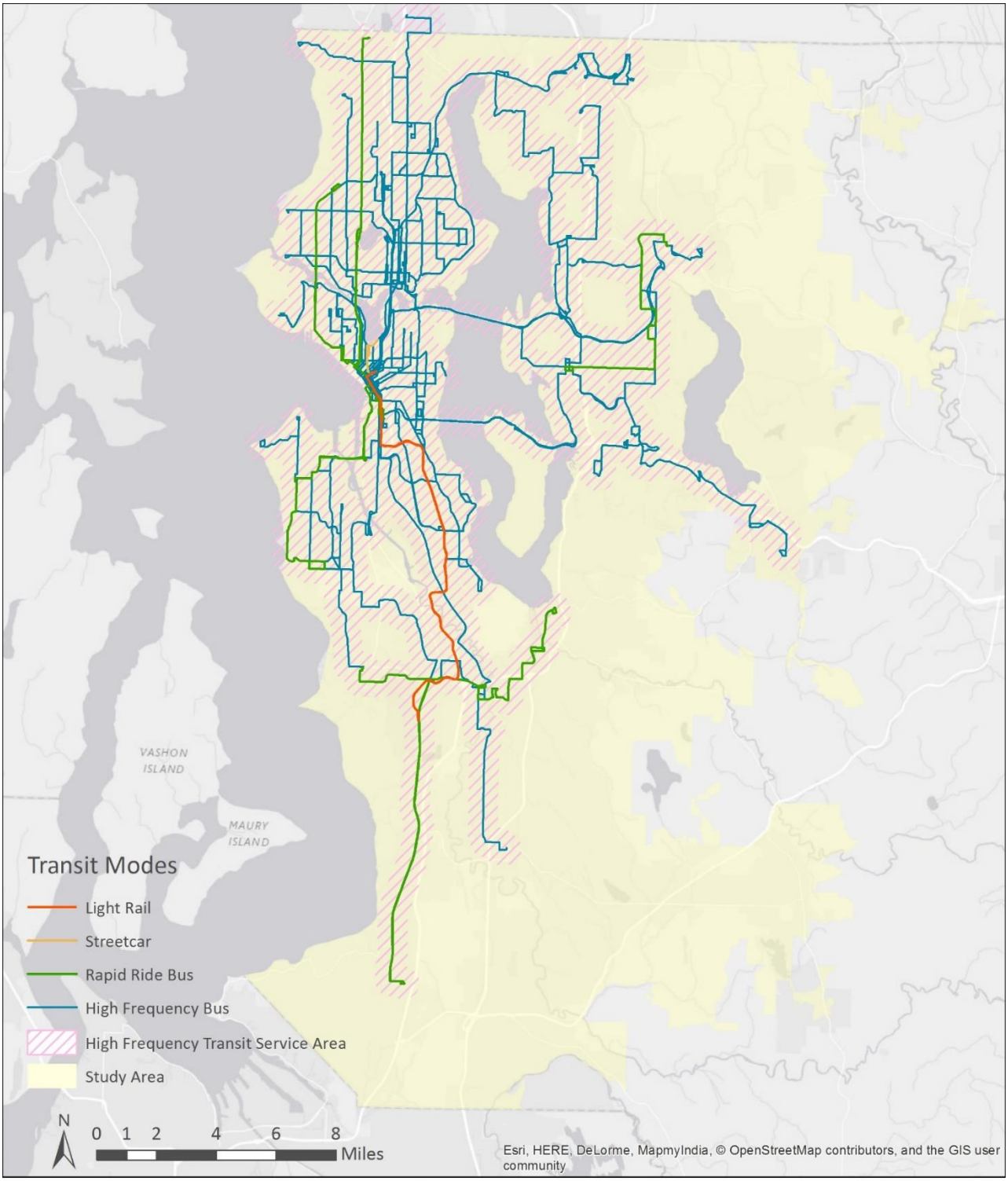

Figure 11. Seattle High Frequency Transit Population Coverage, 2010 (King County GIS Center, 2014) (United States Census Bureau, 2014)

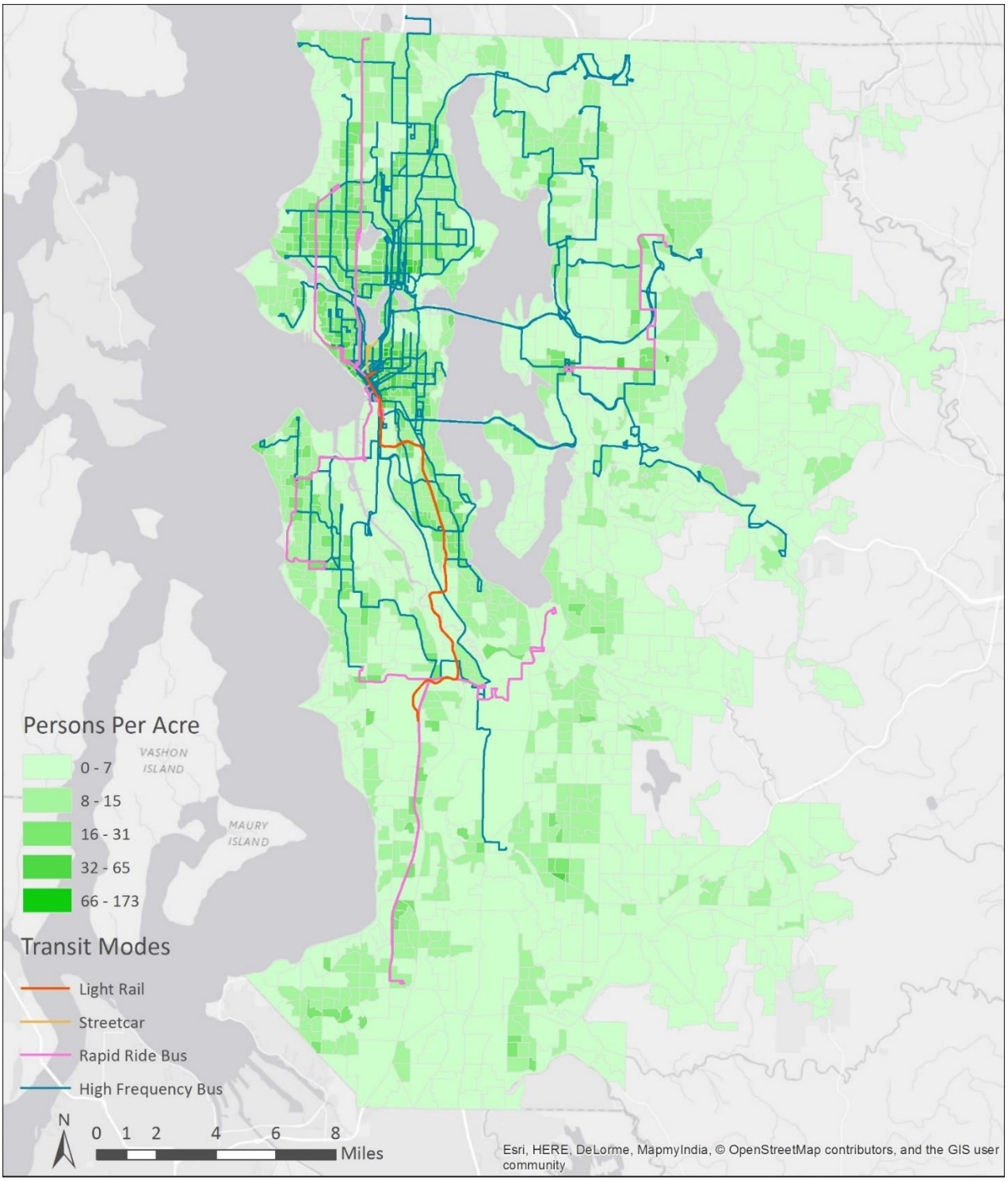

Figure 12. Seattle Population Density and High Frequency Transit, 2010 (King County GIS Center, 2014) (United States Census Bureau, 2014)

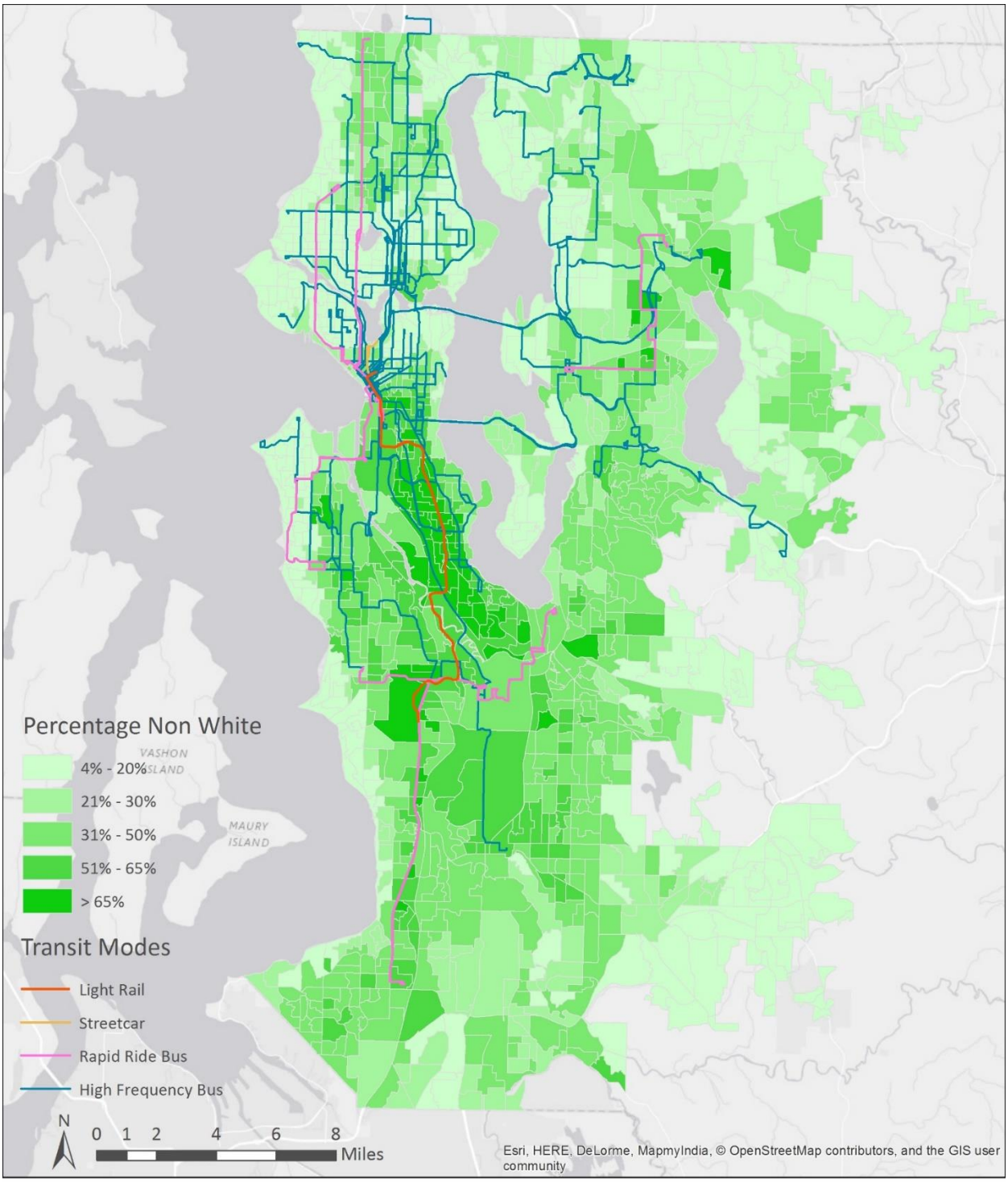

Figure 13. Seattle Percentage Nonwhite Population and High Frequency Transit, 2010 (King County GIS Center, 2014) (United States Census Bureau, 2014)

Table 12: Population Coverage Characteristics for Seattle's Transit Network, 2010

Figure	2010 All Transit	2010 High Frequency Transit
Study Area (Acres)	325,947	325,947
Transit Accessible Area	251,884	121,263
Area Coverage	77.28%	37.20%
Population	1,800,177	1,800,177
Transit Served Population	1,643,822	1,013,513
Population Coverage	91.31%	56.30%
Non White Population	588,436	588,436
Non White Transit Served Population	553,636	338,059
Non White Population Coverage	94.09%	57.45%

The evidence of Seattle's present day reduction in transit coverage is overwhelming. Large portions of the 2010 study area are without access to high frequency transit despite the generally impressive mode share characteristics of Seattle's transportation network. At the height of the streetcar era, Seattle's residents enjoyed a general transit population coverage of 98.29%, with a high frequency streetcar coverage of 91.88%. Present day Seattle, for all of its impressive alternative mode usage characteristics and high quality multimodal systems, experiences a high frequency (15 minute headway or less) transit population coverage of only 56.3%, and an even smaller area coverage of 37.2%. This level of coverage, while much less than 1933 levels, is still impressive within a modern transit context. Many American cities provide far fewer high frequency routes to their transit users, forcing regular riders to adhere diligently to time tables, arrive early to abate the risk of early vehicles, and generally plan their lives around somewhat arbitrary transit schedules. This phenomenon is a huge deterrent to potential transit choice riders who may own automobiles but desire alternative transportation choices. The convenience of infrequent transit routes cannot match that offered by the car. Seattle's 2010 general transit coverage retains a high service level of 91.31%; however, this does not prevent the

aforementioned problems regarding choice riders and schedules which intrude on the daily lives of many users. The provision of low quality transit service to nearly all residents of a region in order to satisfy the needs of transit dependent users is the bare minimum expectation of transit systems in America. The fact that Seattle provides this service as well as a high quality service which reaches just over half of the population is a major success.

Nonwhite population coverage statistics present a difficult question. The statistics themselves indicate that, in both timeframes, nonwhite residents of Seattle experience a slightly greater degree of population coverage than white residents. This is due to the concentration of nonwhite residents in the central city area where transit service is greatest. However, these figures do not take into account the presence of majority nonwhite neighborhoods south of the central city in 2010, visible in the population coverage analysis figures, which may not be covered by high frequency transit services. Therefore, the nonwhite population as a whole is well covered but some primarily nonwhite neighborhoods are not.

Conclusions

The decline of transit in America may be an inevitable byproduct of technological and social changes which took place in the twentieth century. The above population coverage analysis confirms the suspicion that present day transit services, even those operating in relatively progressive jurisdictions with high quality services and decent ridership levels, do not match their historic streetcar era counterparts in terms of population served, particularly in terms of high frequency service. Nonetheless, residents of the Seattle region are observably more likely to use alternative transit modes than their counterparts in regions with similar populations and population densities. The high frequency services offered by King County Metro and the other Seattle regional operators may be critical factors in the Seattle population's willingness to take

transit, walk, and bike as evidenced by the mode share analysis of multiple data sources earlier in this chapter. Nonetheless, the story of Seattle's alternative transportation mode success cannot be explained merely through the presence of a greater degree of high frequency transit lines, across all modes, than other similar cities. Seattle's peer cities also once maintained streetcar systems which offered nearly complete high frequency service coverage to residents, just as the 1933 Municipal Street Railway network did for Seattle. Some long term historical, cultural, and political processes must be at work in Seattle in order to explain the region's ability to retain a degree of transit importance that was entirely lost in peer cities such as Houston, once the operator of an equally impressive streetcar network.

It is critical that transportation planners in modern America accept the importance of high frequency service as a major attractor for transit choice riders. Without focusing efforts on improving headways in major cities, potential riders will repeatedly choose automobiles over transit and alternative modes for all but the most specifically transit oriented trips. Low quality and frequency service meant to provide only basic mobility to captive transit riders is not enough to make transit a viable and important part of modern urban American life. Failure to restore the importance of transit may allow the continuation of negative sociological trends tied to modern transportation. These trends include a total loss of the notion of public space in many cities as streets, by area and importance the most prominent public spaces, are monopolized for automobile use, cutting out positive public uses ranging from recreation, social gathering and dialogue, and street commerce (Jong, 1986). Transportation scholars suggest that the negative socio-psychological impacts of extreme individualization, a byproduct of automobile travel, cannot be allowed to continue without severe consequences for personal physical and mental well-being as well as general environmental health (Nijkamp, Rienstra, & Vleugel, 1998).

The presence of automobiles and the convenience advantages they almost always retain over transit dictate that increased attention must be paid to transit quality factors. These factors, whether they include higher frequencies, improved information availability, mobile web-accessible transit applications, improved shelter and station facilities, or comfort and safety enhancements, must be the focus of twenty-first century transit planning. Psychological and social attachment to automobiles and other individualized travel modes demands that great attention be paid to social and psychological comfort factors in the development of transit systems in order to feasibly attract automobile users to public transportation (Nijkamp, Rienstra, & Vleugel, 1998). While technical enhancements which improve cost and operating efficiencies are useful in attracting policy and financial support from public and private power groups, these enhancements do not necessarily improve the attractiveness of transit for potential users. Dedication to increased transit route frequencies may prove a turning point in the ongoing struggle to recapture the American urban public's interest in public transportation. The historic decline in transit population coverage and, in particular, high frequency transit population coverage as discussed in this analysis, is a critical component of the American disinterest in communal travel. Failure to improve the social, cultural, and psychological environment of non-automobile travel through efforts such as decreased vehicle headways will result in the stagnation of transit in the structure of urban America and, in turn, continue the slew of negative social and environmental impacts engendered by severe individualization and isolation.

Chapter Three of this research discusses the successes and failures of Seattle's transportation planning endeavors through a review of Seattle regional planning documents, popular coverage of transportation trends and projects in the area, and key studies which have attempted to characterize the regions transit service. This review exposes some of the cultural

and political processes at work in the region which contribute to its success and helps to contextualize the unique characteristics discovered in this introductory section. With these qualities understood alongside the characteristics researched in Chapter Two, Chapter Four's historical research can be directed towards those trends which appear most responsible for the region's present day transportation environment.

CHAPTER THREE: Seattle's Contemporary Transportation Planning Culture

Every city orients its planning process around the wants, needs, and cultural affinities of its residents. While professional planning expertise weighs heavily into the process of transportation planning, the planners are ultimately employed by the people and charged to serve them. This creates great potential for local culture and politics to influence the outcome of any transportation planning project. Even private sector consulting planners with national or multinational firms experience this effect; they still attend public meetings and report to clients who are often heavily invested in accruing popular support for their personal goals. While it is difficult to comprehensively measure the viewpoints of a given population towards a range of transportation planning issues, transportation planning documents, as well as popular coverage of these plans and their associated projects, contain rhetoric that is directly linked to the cultural attitudes of their associated regions. Neighborhood level plans may yield further insight into public attitudes towards transportation planning as they are often driven by grassroots coalitions with support from a variety of local and regional players.

Seattle, like any major American city, is served by a range of planning and transportation departments, neighborhood planning enterprises, private advocacy groups, and transit operators, all with a stake in the future of transportation in the region. Investigation of the interaction between these groups and the broader public is critical to an understanding of the cultural attitudes unique to Seattle which may have allowed it to succeed where other cities have failed. The goals and priorities, as well as the language used to express them, set out in Seattle comprehensive planning documents, neighborhood plans, and other transportation proposals are proxy indicators of the general population's approach to transportation issues. Seattle regional media coverage of these transportation plans may compound the trends found in planning based

sources. Academic investigation of Seattle's transportation planning process and its outcomes offers a third platform for analysis of Seattle's regional cultural character and its impact on the region's contemporary transportation systems. If key cultural traits can be identified, they can be traced through the region's transportation history and potentially linked to key events, practices, or elements of Seattle's historical transportation planning process. This Chapter makes use of Seattle regional and local plans, records of public involvement with these plans, popular coverage of transportation planning, and prior academic research into Seattle's transportation networks to seek a cultural context for the unique alternative mode share properties of the Seattle region.

Transportation Plans at the Regional and Local Levels

Seattle's regional planning structure is not altogether different from the structures found in other major American cities. The Puget Sound Regional Council (PSRC) serves as the Metropolitan Planning Organization (MPO) for the city of Seattle and its surrounding region, including King, Pierce, Snohomish, and Kitsap counties. Its 1991 MPO Certification declares it the designated MPO for the Seattle/Everett, Tacoma, and Bremerton/Port Orchard Urbanized Areas. Coverage of these counties creates an MPO area approximately 6,380 square miles in size. In comparison, the MPO boundary for the Houston-Galveston Area Council (HGAC) encompasses 12,763 square miles across thirteen counties. Bordered by the Skagit MPO to the North and the Wenatchee Valley Transportation Council to the East, the PSRC is a relatively compact MPO area considering the population and density of the urbanized areas which it serves. Metropolitan areas with comparable populations and levels of development are often, as in the case of Houston, guided by MPOs burdened with much broader study areas. This compactness may be advantageous to PSRC planners who are charged with providing detailed

and comprehensive transportation planning advice and support to local governments, lessening the burden of serving a vast study area divided into countless local jurisdictions.

The PSRC is structured into a variety of boards. At the highest level, the General Assembly includes representatives from county governments, mayors, councilmembers, and commissioners who operate jointly to adopt the PSRC budget and make major regional decisions. This allows local leaders an opportunity to directly influence and collaborate within regional transportation planning issues, a critical component of developing rational and equitable regional transportation alternatives which synchronize the goals and needs of a variety of municipalities. Beneath the General Assembly, the Executive Board, composed of a smaller group of local leaders, meets more regularly to carry out the regional responsibilities dictated by the more irregular General Assembly. Subcommittees to the Executive Board review proposals and make recommendations. The Operations Committee, also staffed by local leaders, advises the Executive Board on budgets and work programs, while the Transportation Policy Board, which contains a slightly more diverse group of members which includes business and transit agency representatives as well as local political leaders, advises the Executive Board on key transportation issues. The Economic Development District Board fulfills the federal requirement for economic development leadership in the region, consisting, like the other Boards, of local political leaders, Chamber of Commerce members, and other economically invested parties. Review of the members of these advisory boards reveals a highly diverse membership that includes traditional mayors of constituent cities and representatives from Native Tribes whose lands fall under the PSRC jurisdiction. The PSRC also retains a large planning and administrative staff which provides the technical services necessary for long range regional planning. Upwards of eighty transportation planners, GIS analysts, administrators, accountants,

and directors generate in depth and comprehensive plans which seek to meet the goals set out by the various councils and their local leadership members (Puget Sound Regional Council, 2015).

Beyond the MPO level of transportation planning, the Seattle region is served by various local planning departments, transit providers, and departments of transportation. One of the most prominent is the Seattle Department of Planning and Development (SDPD). As the Planning Department for the largest and most prominent city in the Puget Sound Region, this department is responsible for the full range of city planning services for Seattle, including transportation planning. Whereas the PSRC provides a platform for discussion of larger scale transportation issues, the SDPD can focus its efforts on solving local and neighborhood transportation issues. Nevertheless, as the central employment and population hub of the region, Seattle must pay close attention to its ability to accommodate a wide range of regional transportation services, many of which serve primary destinations in Seattle. With a small planning staff, much of the Department's activities revolve around the coordination of various neighborhood and advocacy groups seeking improvements to their local communities. While the Department is not altogether different from the planning departments of other major cities, it does retain an urban design staff and a design commission in addition to the expected general planning and code enforcement staff. Furthermore, many of its initiatives and plans maintain an urban design focus which is not as prominent in the works of other city planning departments in much of the United States. This design focus lends a strength to neighborhood and corridor level planning which often benefits greatly from the expression of effective building and street designs in collaboration with broader transportation planning and policy goals (Seattle Department of Planning and Development, 2014).

In addition to a Department of Planning and Development, the City of Seattle is served by the Seattle Department of Transportation. Whereas many city transportation departments focus their efforts on maintenance, traffic engineering, and roadway needs analysis, the Seattle Department of Transportation maintains a full corridor and neighborhood planning team. This allows it to directly engage in the planning process for bicycle, pedestrian, and transit modes. This focus on planning level transportation work is evident throughout the public resources provided by the Seattle Department of Transportation. Rather than a department focused on roadway management and oversight, it is essentially another planning office that complements the Seattle Department of Planning in the development of neighborhood level, multimodal, transportation alternative development. The presence of a multimodal planning focus within Seattle's primary transportation office represents a commitment to a transportation network which serves the full range of Seattle residents and strives to accommodate their wants and needs through direct planning initiatives rather than indirect engineering. Whereas many transportation departments are oriented towards general operational, maintenance, and safety improvements, the Seattle Department focuses on the full range of transportation planning services. This clearly contributes to the City's ability to effectively create and maintain a transportation network with a neighborhood oriented focus and strong alternative mode options (Seattle Department of Transportation, 2014).

While Seattle is not the only municipality within the PSRC region, it is the most prominent. Other cities within the region retain their own planning departments, as do regional transit service providers such as King County Metro and Sound Transit. Effective collaboration between all of these agencies is critical to the region's success. The PSRC is perhaps the most important platform for this collaboration; however, the commitment to regional collaboration

alongside strong neighborhood planning and design focus within Seattle's own planning agencies demonstrates that the Puget Sound region's municipalities are dedicated to fulfilling their constituents' needs. If local planning departments orient towards neighborhood and corridor planning as well as public involvement, they can carry accurate advice and advocacy into their memberships with the PSRC. This creates a stream of planning leadership which allows both regional and local projects to be developed effectively and with genuine consideration of community needs.

Transportation 2040

If planning is a more integrated and prominent process in the Seattle region than elsewhere in the United States, it stands to reason that the region's planning documents and initiatives will reflect this integration in their goals and treatment of the importance of collaboration and community. Transportation 2040, adopted in 2010 and updated in 2014, is the region's current comprehensive transportation plan (Puget Sound Regional Council, 2010). Like all comprehensive transportation plans, it attempts to cover the full range of potential transportation problems and improvements throughout the region, ranging from transit expansion and enhancement projects, bicycle and pedestrian enhancements, managed lane facilities, roadway maintenance issues, and others. Consideration of the plan's goals and strategies as outlined in its initial sections yields some insight into the cultural, political, and social context within which it was prepared.

The initial chapters of Transportation 2040 demonstrate a clear emphasis on support for alternative transportation modes, transit oriented design, walkability, total trip reduction, and environmental impact reduction. These goals are nearly always found in some form in the United States' major transportation plans. However, Seattle's Transportation 2040's stated goals and

strategies revolve almost entirely around these concepts, eschewing much of the language typically found in such documents regarding roadway capacity and operational improvements, road network expansions, and managed lane and toll strategies which preserve an automobile focus while attempting to mitigate congestion. The introductory chapter of the document, entitled "Toward a Sustainable Transportation System," makes clear the alternative mode, sustainability, walkable design, and multimodal approach of the Seattle regional planners. It's opening comments state, "Transportation 2040 establishes three integrated strategies for addressing congestion and mobility, the environment, and transportation funding. … - more transit, more biking and walking facilities, more ferries, and more complete roadways" (Puget Sound Regional Council, 2010). This strategy statement, the first clear enunciation of the document's planning goals, focuses entirely on alternative mode development. Its only mention of roadways suggest a complete streets style of investment, while transit, pedestrian and bike facilities, and ferries are all listed prior to roadway investment. As far as opening statements go, this is as clear a defense of alternative transportation modes as the critical solution to contemporary American transportation problems as can be mustered. While roadway expansion is not emphasized, freight transportation is highly emphasized. The PSRC highlights the region's role as a major North American trade gateway and provides clear support for expansion and operational enhancements to the region's ports and other freight infrastructure. The closing comments of the document's introduction state, "[This document] recognizes the opportunity to address past harms to the natural environment, and to improve water and air quality. It includes the design of walkable cities and bikeable neighborhoods, as well as facilitation of telework and other options to reduce or eliminate trips" (Puget Sound Regional Council, 2010). This statement further confirms the

plan's commitment to reduction of total automobile trips and growth of alternative mode use with the intention of lessening environmental impact.

Moving forward into the goals and strategies section of Transportation 2040, a clear collaborative effort with other agency strategies and goals can be seen. As a complement to the City of Seattle's emphasis on urban design in its planning department, the PSRC regional plan lays out clear physical design strategies in its opening pages. Ten design guidelines, intended to guide transportation system development along lines congruent with the region's general comprehensive plan, are established. Local jurisdictions are suggested "to foster these characteristics and conditions as they permit development and build transportation infrastructure" (Puget Sound Regional Council, 2010). The ten guidelines are quoted below:

1. Encourage a mix of complementary land uses, particularly uses that generate pedestrian activity and transit ridership.
2. Encourage compact growth by addressing planned density.
3. Link neighborhoods; connect streets, sidewalks, and trails.
4. Integrate activity areas with surrounding neighborhoods.
5. Locate public and semipublic uses near high capacity transit stations in designated urban centers and activity centers.
6. Design for pedestrians and bicyclists.
7. Provide usable open spaces for the public.
8. Manage the supply of parking.
9. Promote the benefits of on-street parking.
10. Reduce and mitigate the effects of parking. (Puget Sound Regional Council, 2010)

The above list is entirely concentrated on design strategies which promote alternative mode use throughout the region. Land uses that support transit and pedestrian activity are preferred. Compact growth and design for pedestrians is made a primary goal. On street parking is favored, while mitigation of the negative effects of parking supply is supported. All ten of these goals, the primary physical design goals of the entire regional transportation plan, are oriented towards sustainable growth which supports alternative transportation modes and walkability. While it is certainly not surprising that a regional plan advocates for these transportation strategies, the level of support for alternative modes and walkable design displayed in Transportation 2040 is above what most regional plans offer. Furthermore, none of the primary goals contained in Transportation 2040 are oriented towards roadway expansion, or even maintenance of current levels of automobile use. Instead, emphasis is placed entirely on reducing automobile travel and increasing alternative mode use.

Transportation 2040's opening section ends with a discussion of desired outcomes. It states that its investments will "reduce the length of vehicle trips, increase transit ridership, focus new transportation infrastructure in already urbanized areas, and provide additional information and tools to help implement the growth strategy" (Puget Sound Regional Council, 2010). These outcomes, like the design strategies previously discussed, focus on creating compact rather than sprawling growth, reducing automobile travel, and focusing infrastructure improvements in areas that are already urbanized. Transit oriented communities are also discussed at length as a desired outcome of the 2040 plan. These communities are justified as tools to curb land consumption, cut energy consumption, meet demand for walkable communities, promote health through active transportation, and reduce greenhouse gas emissions (Puget Sound Regional Council, 2010). As a supplement to the main planning document, the official Transportation 2040 Map, displayed

below as Figure 14, solidifies the plan's focus on transit and urban centers. It displays identified urban growth areas and proposed and existing transit infrastructure. Roadway expansions are not displayed at all. As one of the critical interfaces between the public and the regional transportation plan, this map clearly expresses the PSRC's commitment to alternative modes and does not attempt to belie its focus on transit and de-emphasis of cars.

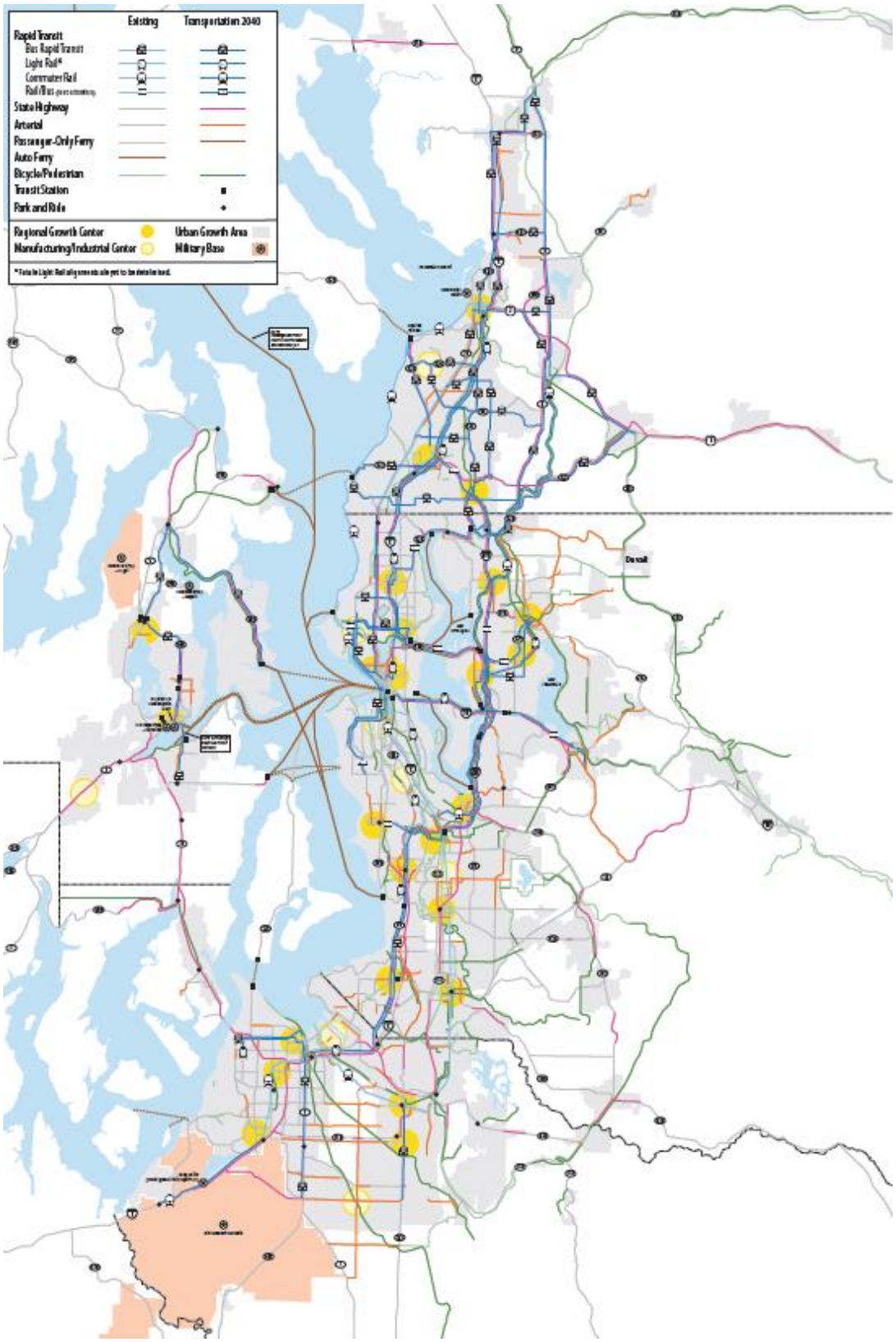

Figure 14: Transportation 2040 Map (Puget Sound Regional Council, 2010)

As the goals and strategies section of Transportation 2040 comes to a close, it leaves the reader with a clear sense of the plan's commitment to alternative transportation modes. No mention of roadway capacity increase or urban expansion is made, while transit, walkability, and compact growth are repeatedly stressed. The rhetoric contained in this section of the document demonstrates a focus on improvements to transportation in urban areas with regional connections between urban centers enhanced through new travel mode options. Expansion of existing roadway infrastructure to create new development opportunities is completely deemphasized. While transportation planning across the United States trends towards these strategies in recent years, not all jurisdictions demonstrate the same complete commitment to alternative mode development. Houston's current regional transportation plan, the 2035 Regional Transportation Plan Update, displays less of an emphasis on alternative modes and a greater emphasis on congestion reduction and travel demand management. In comparison with the Seattle plan, Houston's four strategies discussed in its opening section are:

1. Increase roadway and transit capacity.
2. Reduce peak-period travel demand.
3. Improve the efficiency of existing facilities.
4. Coordinate land use and transportation investments. (Houston-Galveston Area Council, 2010)

Houston's planners clearly hold different priorities to their Seattle counterparts. Whereas Seattle's first listed strategy is "more transit," Houston's first strategy is more "roadway and transit capacity." Roadway is listed prior to transit. As cities with nearly identical population densities within their urbanized areas, roadway networks primarily organized around grid patterns, and large employment centers, both cities are theoretically capable of supporting transit

at nearly the same levels. Nonetheless, Houston places roadway capacity before transit and makes no explicit mention of walkability and alternative mode expansion. It instead focuses its goals around improving efficiency and capacity of existing roadways and reducing peak period travel demand in an attempt to lessen congestion. Multimodal support is not nearly as evident.

Seattle's uniquely strong commitment to transit and multimodal urban design is one of its greatest planning strengths. The culture of the Puget Sound region and the design of its planning process lend themselves to this style of transportation planning, giving the region a competitive advantage over similar cities such as Houston. The pro-transit and pro-active transportation cultural context seen in the Seattle region is undoubtedly at work in the Seattle Transportation 2040 comprehensive plan, allowing it to support alternative modes in a way not possible in other regions, including those with similar urban form characteristics.

Neighborhood Level Planning

If Seattle's regional vision is firmly oriented around transit and alternative mode development then its city and neighborhood plans likely carry this same focus. The Seattle Department of Planning and Development maintains a list of all ongoing initiatives. There are nearly forty of these plans, and a large portion of them revolve around transit and alternative mode planning. Some are even more innovative. The Waterfront Seattle plan focuses on refitting waterfront areas formerly obstructed by the Alaskan Way Viaduct into public spaces that serve adjacent communities. The removal of the Alaskan Way Viaduct and its replacement with an underground highway is one of the largest highway removal projects in the United States. The Seattle Planning Department intends to make use of this opportunity to further an agenda that is oriented around public space, walkability, and waterfront access rather than increased trip capacity.

Alongside this major initiative are a number of smaller plans intended to synchronize Seattle city planning efforts with new transit proposals from the region's major operators, King County Metro and Sound Transit. Sound Transit, the operator of the region's light rail system which currently serves the SeaTac Airport and downtown Seattle, maintains a series of plans seeking to expand light rail service across the region to Bellevue, Redmond, and beyond. The Seattle Department of Planning currently lists multiple projects intended to facilitate growth around planned light rail stops, including transit oriented development. Many of the department's other initiatives revolve around greenspace development, walkability enhancements, and urban design visions for specific neighborhoods. As with PSRC's efforts, the City of Seattle's efforts display a genuine commitment to the regional transit efforts spearheaded by Sound Transit and King County Metro.

While Seattle serves as the employment and population center of the Puget Sound Region, key employment and population nodes exist beyond its borders. The cities of Redmond and Bellevue serve as critical activity and economic centers, with Redmond home to Microsoft, one of the largest employers in the region and one of the most important technology companies in existence. If Seattle's regional solidarity is to remain meaningful, these cities must also be on board with the transit oriented focus seen in Seattle and at the regional level. The City of Bellevue Planning Department, like its Seattle counterpart, maintains multiple plans, consisting of the majority of its current initiatives, designed to facilitate the implementation of coming regional transit. Bellevue somewhat parallels its Seattle neighbor, providing a Shoreline Management Update plan to increase public access to lakes and streams, a Station Area Planning initiative intended to plan transit oriented developments around the six proposed Sound Transit stations within the City, an Eastside Light Rail plan which details the city's contributions to the

East Link Light Rail project, and a Transit Master Plan which seeks to coordinate these new projects with existing transit infrastructure and to continue to support development of increased transit options within the City. Bellevue, then, is potentially even more focused on transit than its larger neighbor, perhaps because it feels it has even more to gain from increased transit service to its regional employment centers which may not be as well served as Downtown Seattle.

Redmond is an even more unique case of alternative mode planning. While the City's current transit infrastructure is not as extensive as that seen in Seattle, it is also planned to receive Sound Transit Light Rail service in the near future. In the decades leading to this regional light rail service, the City cultivated an image as a regional bicycling center. It is well known for its Redmond Derby Days festival centered on the Redmond Bicycle Derby race around Lake Sammamish, an event begun in 1939. Redmond, then, is not merely committed to alternative mode planning; it is regionally known as a hub for alternative transportation culture. The Redmond Planning office maintains a plan designed to integrate Sound Transit Light Rail into its existing development patterns. It also maintains a series of corridor enhancement plans, all of which are focused around retrofitting existing streets for a more complete streets oriented design.

The synchronization seen in the transportation planning environment of the Puget Sound Region is one of its greatest assets. Whereas other regions face major struggles between central cities which seek increased local and regional transit and satellite and bedroom communities which prefer traditional roadway development, the Seattle region appears congruent in its transportation message: more transit, more walkability, less automobile trips. The success of major transit providers such as King County Metro and Sound Transit is in large part due to this harmonious regional disposition towards alternative transportation infrastructure. This is the region's true competitive advantage, drawn from the pervasively active, environmentally

conscious, and urban oriented regional culture. Cultural trends, however, do not arise and grow powerful over the short term. These trends are always rooted in historical processes and events which guide the evolution of a region's urban form and the attitudes of its residents.

Public Attitudes Toward Transportation Planning

Regardless of a region's commitment to transit and alternative mode development among its planning leadership, public attitudes remain a critical ingredient of effective transportation planning processes. As planners tend to favor alternative modes more than non-planners, public response to the Seattle region's transit aspirations must be considered in order to accurately gauge the influence of Seattle regional culture on the area's transportation network. Public meetings, workshops, and media coverage of transportation projects all reflect the concerns and aspirations of citizens who may or may not share the views of their planning leadership. Planners are charged with serving the needs and desires of their communities; however, their technical knowledge and interest in cutting edge transportation infrastructure sometimes puts them at odds with community members they are intended to represent. Nonetheless, most transportation planners are heavily influenced by the communities they represent as community service remains a primary tenet of the profession.

A public workshop conducted in January 2011 regarding the implementation of a variety of development scenarios for uses surrounding the proposed Capitol Hill Rail Station yields telling dialogue between planners and the public (Seattle Department of Planning and Development, 2011). The Capitol Hill Rail Station is an underground light rail station that will serve as part of the University Link extension to Seattle's Sound Transit rail network. Planners at the urban design framework workshop produced notes regarding the public's response to various scenarios. The notes overwhelmingly show public support for design elements which support

increased density, walkability, and alternative mode access. Furthermore, several comments are noted in favor of permeable surface usage to minimize environmental impact. Pedestrian only alleys and shared pavement designs are favored, with the public supporting curbless environments and paving treatments to vehicular right of way from pedestrian right of way (Seattle Department of Planning and Development, 2011). These sentiments demonstrate not only a willingness to accept transit oriented development, but a desire to bring it to its maximum possible alternative mode potential. Public support for shared space, a design style quite uncommon in the United States, is a remarkable testament to the community's awareness of and commitment to alternative transportation.

Public support for transit at the larger scale is also strong. The East Link Extension of the Sound Transit Light Rail is one of the highest profile transit projects in the Puget Sound region. Currently in the final design phase, the project is targeted for opening in 2023. While this deadline may not be met, the project is well on its way. Designed to connect Bellevue and Redmond to Downtown Seattle via light rail, the project represents a $2.8 billion investment into regional transit, funded through collaborative support from cities served by the project and federal transportation dollars. This collaboration between cities and municipalities demonstrates a regional political support for transit. Public support for such large projects, however, is often less agreeable. A public meeting held at the City of Mercer Island, a small island city between Seattle and Bellevue, in November 2014 by Sound Transit reflects a locally concerned but regionally supportive population. Notable public comments include concerns over increased traffic due to park and ride facilities which draw regional commuters, a lack of available parking for local residents, a need for increased bicycle and pedestrian enhancements to balance increased traffic, and the possibility of a Mercer Island resident only Park and Ride which

prevents Bellevue and other residents from parking on the island (Sound Transit, 2014). These comments reflect a concern over community impact that is in itself still alternative mode oriented rather than an actual rejection of regional transit service due to expense or other ideological complaints.

This type of public commentary appears prevalent throughout the Seattle regional transportation planning process. It reflects a culture and urban community which fully embraces regional transit expansion and increased walk and bike infrastructure. While concerns over negative local impacts are present in Seattle communities, as they are everywhere large scale regional transportation projects are planned, these concerns do not reject the need for alternative mode infrastructure. Even among the public, the Puget Sound region demonstrates a significant degree of congruent support for non-automobile transportation. This support enables the synchronous transit planning efforts and shared funding strategies ongoing throughout the region which bring diverse cities, regional agencies, tribal groups, and business interests together in a powerful, pro-transit coalition.

CHAPTER FOUR: Political and Cultural Trends in Seattle's Transportation History

Seattle's contemporary transportation planning environment is uniquely supportive of alternative transportation modes. While Seattle lost its extensive streetcar network in the mid twentieth century, as most American cities did, it did not lose its commitment to communal transportation. Whereas other American metropolises embraced the automobile completely and turned their backs on the mass transit transportation systems which had served them for decades, Seattle retained an affinity for collective travel that allowed for the contemporary resurgence of mass transit in the Puget Sound region. This is a result of cultural and political trends unique to the region. Seattle does not display an urban form advantage great enough to completely explain its relative success over similarly dense cities with comparable gridded street networks.

If Seattle's contemporary success in transit planning is the result of its unique cultural and political environment more so than any inherent advantage of urban form, its cultural and political history must be considered. Cultural change, slow and subtle enough to often be invisible to human perception as it happens, is driven by the full range of experience of a region's people. Physical environment, cultural traditions, economic successes and failures, and the influence of key personalities all play a role in defining a region's long term cultural trajectory. A city such as Seattle, with its long and rich history filled with diverse characters, exciting and pristine environments, and adventurous homesteading and economic endeavors, is certain to feature a contemporary culture deeply rooted in the events of the past. While its European history is not as lengthy as those of America's great Northeastern colonial metropolises, Seattle's broader human history sets it apart from the majority of North America. The seafaring culture of its Native residents, the collaborative spirit which defined its early European leaders (but not always its residents or territorial governors), and the culture of

frontiersmanship and adventure which defined its early settlers set Seattle apart from its earliest days. These unique qualities engendered a cultural path unique among America's great cities that continues to drive the Puget Sound region today.

Seattle's Founding and Earliest Infrastructure

From its earliest days, Seattle was a city reliant on communal transportation. The Puget Sound region's extensive network of waterways dominated the area's early infrastructure from its founding by a few key families in 1851. This party, known as the Denny Party after its key members, arrived by ship to the area around Alki Point, a beach area where they declared an intent to build another "New York, By and By" (Crowley, 1993). Even prior to European settlement, this region was traversed almost entirely by canoe by the resident Native Duwamish tribes. The steep ring of hills along the east shore of Elliott Bay, now the downtown district of Seattle, made inland travel difficult. The advantage of this shore, however, was the steep drop-off which made for an excellent harbor.

The terrain limitations of Seattle's founding site, its lumber based economy which, by 1853, supplied lumber to regions as distant as San Francisco, and the water-based traversal methods adopted by white settlers from their encounters with Natives dictated a waterborne infrastructure for the City from the beginning. The first steam powered boat to dedicate its operations to the Puget Sound region, the *Eliza Anderson*, arrived in 1858, marking the beginning of a modern transportation network for the region. Without the presence of steam powered ferries, Seattle's growth may have stalled in its early days. J. Willis Sayre, a historian and resident of Seattle from the late nineteenth century onwards, observed a total reliance on steamboat travel across the region, noting a complete lack of roadways, even between major settlements such as Seattle and Tacoma. There "was not even a horse in Seattle," and "travel

across Lake Washington…was in canoes owned and paddled by Indians" (Crowley, 1993). As the earliest street railways and larger continental railways arrived, intermodal cooperation was standard. The Port of Seattle, operator of a range of early steamboat ferries, purchased and operated the first major street railway shuttle between Downtown (the harbor's location) and West Seattle (located near Alki Point, the first settled area of Seattle) from small local operators. Intermodal and waterborne transit, then, was the standard for Seattle from its inception.

The lack of established roadways between Puget Sound's various burgeoning European settlements forced a reliance on communal transportation across the entire region. Even in an era where solitary travel was much less common than it is today due to the ubiquity of automobiles, Seattle residents grew accustomed to mass transit as their default mode of travel. Any trip beyond the few blocks of Seattle's early settlement required a communal effort which forced diverse residents to share time and space together as they travelled from one Puget Sound destination to another to conduct their affairs. Travel by horse or carriage, while often conducted in groups, was a more private and solitary mode than ferry travel which placed a large number of individuals together on a vehicle in potentially tight quarters. Even as roadway and railway infrastructure grew during the City's boom years during the Klondike Gold Rush of the 1890s, the ferry, operated by numerous private and public entities, remained predominant (Johnson, 1999). Competition between King County's public fleet and the many smaller private operators in the region spurred transportation infrastructure growth across the region as these groups competed for the patronage of the prospectors streaming into the City (Newell, 1966). Even Seattle's first automobile travel relied on ferries. The first automobile ferry in the Puget Sound region, and in all of the Northwest, began operation in 1914 under a private operator, Captain

John L. Anderson (Crowley, 1993). Even the mighty automobile, soon to dominate America's transportation network everywhere in the country, paid its dues to the ferry in Seattle.

Rail, too, played a key role during the early decades of Seattle, as it did in most of the United States throughout the nineteenth century. Puget Sound's various fledgling cities competed for access to rail, with Tacoma achieving the first victory in 1873 as the western terminus of the Northern Pacific Railroad. Unfortunately, a recession eliminated the owner's fortune and prevented completion of the rail, leaving the competition still open to a new victor. Tacoma remained the rail hub of the region, however, while the first rail access between Tacoma and Seattle was completed in 1884. Seattleites faced a three hour trip to Tacoma in the early days as the Northern Pacific Railway failed to install a turntable at its Seattle terminus, forcing trains to reverse the entire way to Tacoma (Crowley, 1993). While ferry transportation grew across a myriad of private and public operators from the earliest days of Seattle, creating a wide selection of competing services for residents, the railroad's entrance into the region was lackluster at best. Nonetheless, locally owned rail lines soon began to arise, including the Seattle, Lake Shore, and Eastern (SLSE) Line, a local service which linked a variety of ferries and Puget Sound regional cities beginning in 1877. This railway was the first to secure access to Seattle's downtown waterfront, creating a Railroad Avenue, now Alaskan Way, which continues to function as a major artery for the region. Seattle's regional hegemony was cemented by the turn of the twentieth century, in no small part due to its success in fostering a locally driven, diverse, and intermodal infrastructure that complemented its equally diverse economy. Whereas other cities pigeonholed their economies into narrow lumber or coal markets, Seattle worked to attract merchants, developers, businessmen, and other investors whose enterprises fostered a local competitive spirit which raised the caliber of the city's infrastructure projects. When the Great

Northern Railroad reached Seattle in 1893, providing it with its first transcontinental link, the city's leaders resisted the temptation to yield to the line's owner and cut out a portion of waterfront right of way for the new railway parallel to the SLSE's line. Instead, a mile long tunnel was created underneath the city to prevent the bisection of Seattle's bustling downtown waterfront district (Crowley, 1993). This ambitious project is just one more reflection of the commitment of Seattle's leaders to genuine urban development, locally driven economic growth, and ambition in terms of infrastructure. Whereas other Puget Sound cities may have granted any wish to achieve transcontinental rail access, Seattle stuck firmly to its model of locally driven infrastructure and economy, forcing the big railway to play by local rules.

Seattle's legacy of locally driven, intermodal and communal travel, powerful enough to force the compliance of the ever-independent automobile in its early days, is a direct result of Seattle's early and continued reliance on waterborne travel dictated both by the landscape and by the influence of the native Duwamish and their traditional canoe-based culture. While Seattle, like all other American cities, was reshaped by the Interstate Highway System following World War II, its residents remained committed to the ferry system and intermodal and communal travel in general. Writing in the 1970s near the end of his life, Seattle resident and novelist Nard Jones wrote in his final work, a non-fiction account of Seattle's past and its link to the present and future of the city, a fond and nostalgic account of the region's changing transportation system. The introduction to Jones' work, by no means a purely transportation focused book, leans heavily on imagery supplied by the past, present, and future of Seattle's transportation system. He writes of the "fathomless harbor" which dictated the difficult but critical founding site of the city, the city's "fast-moving as well as sleek and beautiful" automobile ferries, and, in contrast and with a definite bite, the modern 1970s Seattleite "who would die rather than give up

his car and the freeways" (Jones, 1972). His work seeps with an underlying criticism of the city's turn away from its waterborne and communal transportation traditions, leaving the reader sensing a regret over the automobile's dominance over the urban form of the 1970s, perhaps one of the darkest decade's for Seattle's mass transit infrastructure. During his quiet reminiscence over the importance of the water to Seattle's history, Jones states, "I look across one of the great harbors of the world, a fact which seems to escape most of today's Seattleites, so firmly bigamist are they in their wedding to sky and freeway" (Jones, 1972).

As a long-time Seattle resident who loved and admired the city during the years when the automobile still served the ferry and the streetcar, Jones undoubtedly appeals for a return to a balanced, multimodal transportation system. While he would not live to experience the present pace of transit's resurgence in the Puget Sound region, the attitude and culture he represents as a Seattle native survived the automobile's heyday in the 1960s and 1970s and continues to drive Seattleites' commitment to transit. The ferries continue to ply the waters of Puget Sound, and transit continues to grow in ridership and extent, approaching the former importance it held during the late nineteenth and early twentieth centuries during Seattle's first decades.

Seattle's Early Urban Transit

While Seattle's early infrastructure was defined by its waterways and continental rail access, the city's mass transit options were not confined merely to ferries and railroads. The American Streetcar Era of the late nineteenth and early twentieth centuries did not bypass Seattle. In fact, it was strengthened by the cultural and historical expectation of regional residents that transportation was a primarily communal activity. While cars made their inevitable mark on Seattle over time, their advance against the streetcar was stalled by the region's traditional reliance on ferries and other mass transit modes. While Puget Sound could not remain road-less

and horse-less as described by Sayre forever, its first major introduction to horses and roads was in the form of public transit.

The earliest urban mass transit to arrive in Seattle was a horse powered street railway proposed by Frank Osgood. Opened in 1884 with a nickel fare, the Seattle Street Railway was the first of its kind in the Washington Territory and soon served the entire extent of downtown. While business leaders resisted implementation of the railway along Front Street and other early downtown streets due to concerns over traffic, Second Avenue, a burgeoning new development area, became the rail's primary corridor. While horsecar travel provided for the earliest transit needs within Seattle, its limitations prevented it from serving as a solitary solution. Horsecars were limited by three to four year horse service lives, the need for up to ten horses per car to serve steep grades, and a predilection for rough cobblestone streets in order to gain the necessary traction to start smoothly after a stop (Post, 2010). As the city expanded across its hilly terrain, horse cars rapidly failed to meet the needs of the population and its leaders.

Cable cars were the next transit technology to arrive in Seattle. San Francisco, a famously hilly city, first introduced cable cars in 1873. J. M. Thompson, one of the architects behind the San Francisco system, joined with Seattle investors to design a cable car line which traversed an 18 degree grade and connected the Seattle waterfront with a new park along Lake Washington on the eastern shore of the city in 1887 (Blanchard, 1968). This service was linked to steamboat service across the Lake. Like the other early transportation modes in Seattle, this service relied on intermodal connectivity to provide a service highly appealing to residents. Similarly, it was formed by a group of local investors whose primary interests were in both the growth of their own businesses and the flourishing of the Seattle economy. This local spirit permeated Seattle's early transit developments and, when these developments failed, spurred public support to keep

them afloat during financial crises. While the cable line failed financially during the Panic of 1893, its service was maintained under a cooperative public and private management until 1940. Further cable railway lines emerged during the late nineteenth century, some reaching as far as the city limits, and all managing to conquer the city's precipitous hills. Many of them were linked to new park and "suburban" developments, allowing the city to expand into transit-based fringe neighborhoods even before the arrival of the electric railway.

The Electric Streetcar

While cable cars were the first innovative solution to Seattle's transit needs, the city was never slow to adopt the newest transportation technologies. With a population of 25,000, Seattle opened its first electric streetcar line on March 30, 1889, simultaneously retiring its horse powered service. Seattle was the first city on the West Coast of the United States to operate an electric streetcar, continuing its legacy as a region with an economy driven by innovative and effective infrastructure. While residents may have doubted the ability of electric streetcars to traverse the city's steep hills, engineering solutions were found to provide service everywhere it was needed. The "Counterbalance," constructed in 1901, was a pair of 16-ton rail trucks which operated in tunnels underneath the streetcar tracks on Queen Anne Avenue, a steep corridor in the central city. Streetcars arriving to the hill were hooked to the counterbalance system by an operator and tugged up the grade by a combination of gravity and the streetcar's own electric power. Crowley notes that the corridor is still referred to as "the Counterbalance" at the time of his writing in 1993 (Crowley, 1993). Feats of engineering such as this, as well as the city's commitment to cutting edge intermodal and communal transportation, defined and continue to define Seattle's attitude towards infrastructure. Land and economic development in Seattle was always driven by transit in the early days and, as such, transit became an integral part of the

community's lifestyle. Fervor and competition over cable and electric streetcar development reached such heights as to lead the City to stage a "build-off" between two rival streetcar enterprises, one cable and one electric, in 1890 in a track-laying race to the developing area of Lake Union (Crowley, 1993).

Perhaps the first great mistake in Seattle's transit development came with the arrival of Stone and Webster (S&W) Management Company, a consulting firm which soon founded a regional holding company, Puget Sound International Railway and Power Company, with the intent to establish a transportation and utility conglomerate extending "from Vancouver, British Columbia, to Vancouver, Washington" (Crowley, 1993). As of 1899, S&W consolidated 22 cable and streetcar lines and applied for a franchise for all of Seattle's electric power and street railway services. While this offer appealed to Seattle leaders at the time due to inconsistencies between various service providers, it created a potential for failure beyond that experienced by small, private operators. Post notes in reference to S&W, "It was just these sorts of systems that were most quickly put in a financial bind because of inflation and because of competition from motor vehicles" (Post, 2010). Nevertheless, S&W took over Seattle's power and streetcar utilities as the Seattle Electric Company in a franchise granted by the city until 1952. Outraged residents lobbied for a reduced 35 year franchise, a free transfer requirement, and discounts for bulk ticket purchases. Voters did manage to pass a bond issue to build a City-owned hydro-electric plant to provide competition with the Seattle Electric Company in 1902 (Crowley, 1993). In response, S&W sought a ban on municipal utilities at the state and federal levels. Nothing stopped the S&W conglomerate from monopolizing street railway transit in Puget Sound.

The campaign for increased municipal ownership of utilities and transit services continued throughout the early twentieth century. The Seattle Port Commission was formed in

1911 to retake control of the waterfront's destiny from the transcontinental railways which had come to dominate it. The Municipal Plans Commission was created in 1910 to write Seattle's first comprehensive plan, a movement spearheaded by Virgil Bogue, the City's chief engineer and a protégé of the Olmsted Brothers who had created the City's park system in 1903 and 1908 (Crowley, 1993). Bogue's plan, however, was so ambitious as to repel local voters whose primary concern was wresting control of their utilities and transit away from the monopoly of S&W into municipal hands. His plan, which proposed billions of today's dollars in rapid transit, including 91 miles of elevated and subway rail, was rejected two to one by voters in 1912. Municipal control over Seattle's transit, however, made a degree of progress, with a second street railway operation owned by the City opening as a competitor in 1913. Meanwhile, S&W's system continued to outrage riders and, soon, to fail financially. Richard C. Berner notes that Seattle Electric Company's service was overcrowded, erratic, prone to accidents, and featured open cars even in the winter (Berner, 1991). Ultimately, while Seattle residents clamored for an effective transit system owned by a municipal power they were forced to make do with a corporate monopoly which seemingly lacked the will or know-how to operate an effective and successful streetcar system.

As the City of Seattle continued to build its own public railways, S&W's decline continued. The nickel fares mandated in the 1899 franchise agreement could not sustain the company given the rates of inflation across the intermittent years. In a terribly timed episode of overeager spending, the City offered to purchase the entire S&W owned Seattle Electric Company railway system for $15 million in 1918. Voters accepted the plan, even as the City's own railways lost money and the Ford Model T began its ascent to hegemony over the transportation world through increasing affordability. This poorly planned and overpriced

transition left little hope for the survival of the street railway without serious outside investment. Unfortunately, the nation's transportation investment was rapidly turning towards gasoline powered automobiles, buses, and highways. While Seattle residents never turned their backs on the streetcar and, in fact, used it and other transit modes extensively, failed management from both public and private leaders prevented the system from becoming a sustainable transportation solution.

Trackless Trolleys and Buses

Seattle's ailing streetcar system reached its operational height during the Great Depression Era. While its revenues continued to fall, it peaked at a total operation of 410 streetcars along 26 routes and three cable lines, with 60 additional gasoline buses serving 18 feeder routes in 1936 (Crowley, 1993). Pressure from General Motors to replace more of the city's streetcars with buses soon morphed into pressure to sell the entire system to a new company which would replace the entire system with gasoline powered vehicles. While the first buses began operation in the City in 1919, residents were still hesitant to allow the dismantlement of their traditional transit system. A new plan to replace Seattle's transit arose from the Beeler Organization, an engineering firm which proposed replacing all railways with trackless trolleys, now known as trolleybuses, with feeder bus routes as a supplement. The trolleybuses were first introduced in Salt Lake City in 1928 and were used in Portland from 1934 onward. Trackless trolleys maintained the advantage of streetcars in that they did not require a power source onboard each vehicle, but instead relied on a central power hub and a wire system. They did, however, take advantage of automobile steering and traction systems to eliminate the need for rails altogether. This advantageous combination became a popular replacement for streetcars in England and elsewhere in Europe and Canada, but did not catch on in the United

States in most jurisdictions. These vehicles were easy to adapt to for streetcar mechanics and operators, require little to no new infrastructure, did not block the roadway as the streetcar did, and produced greater acceleration and speed than their tracked counterparts (Post, 2010). Seattle, then, was lucky to receive a recommendation for such vehicles from the Beeler Organization rather than a general replacement of all streetcar lines with gasoline or diesel buses.

In 1940, Seattle began its full conversion to trackless trolleys, retraining much of the former streetcar staff and using many of the same routes. Cable car service was halted as well. Seattle was the first American city to rely primarily on trackless trolleys for public transportation, continuing the City's tradition of innovation in transit service and infrastructure design. While some individuals suspected a deal between the bus and automobile lobby led by General Motors and Seattle leaders, the contemporary press largely celebrated the new Seattle Transit System (Crowley, 1993). The Seattle trolleybus network remains the second largest in the United States to this day, bested only by San Francisco, and remains a primary component of King County Metro's operations.

The foresight and commitment to innovation among Seattle's transportation leaders and its vocal population in the 1930s and 1940s granted the city a transit system which retained the region's legacy of communal transportation infrastructure and unique travel modes unlike anything else seen in the United States. Even as streetcars failed throughout the nation, Seattle dug through the ashes to assemble a new system worthy of the intermodal, transit-based legacy of the early days of Puget Sound. Trolleybuses are rare enough in the United States that many residents of major cities are entirely unfamiliar with them as a transportation technology. That Seattle chose this technology which uniquely suited its needs even as other cities chose buses at

the bidding of corporate lobbies indicates a local commitment to transportation above that seen elsewhere.

The Automobile Years

Despite Seattle's unique success in finding a replacement for its ailing streetcars, the City did not escape the tyranny of the automobile entirely. Trolleybuses and ferries aside, Seattle also made way for the automobile, as many cities did, at the behest of the Federal Government and the Interstate Highway System. Car culture became attractive, affordable, and inescapable during the 1950s and 1960s, driving transportation planning agencies across the United States to place the car first and foremost on the list of roadway denizens. Seattle's successful and intuitive retrofit of its transit system with trolleybus technology perhaps saved transit's future in the region, preserving much of the legacy of the streetcar and cable car era while utilizing new technology and methods to streamline operations. Without this insightful shift, transit may have been lost entirely to the automobile as federal highways arrived, just as it was lost in other cities around the country.

The First Highways

The once centralized Seattle metropolitan area expanded outwards, as did many other regions, during the decades following World War II. Suburban development patterns took hold, with the suburban shopping center and its accompanying master planned neighborhoods manifesting in the outer portions of the region. While these urban forms arose, the Seattle region escaped full sprawl-ification due to the presence of smaller but still historic urban centers throughout King County which galvanized sprawling growth into a slightly more compact, traditional form than that seen in other regions. Puget Sound's many waterways also placed constraints on sprawl, forcing new developments to cluster more so than they may have without

such physical barriers. Seattle's suburban growth, then, while still sprawling, benefited from the same physical and historical characteristics which led Seattle to maintain a compact, transit-oriented, and walkable city center during its early development years. Nonetheless, the population of Seattle's suburban areas grew by 28 percent from 1950 to 1960. Car registrations in King County doubled to a total of 373,000 (Crowley, 1993).

While technology was the root catalyst behind the automobile trend throughout the United States, public policy served to enable and solidify the dominance of the car, even in traditional transit-oriented cities such as Seattle. The Federal Aid Highway Act of 1944 pushed funding-starved local governments and agencies to accept Federal support for infrastructure projects as World War II came to a close. These Federal policies, however, directed funding towards highway projects rather than roadway and bridge maintenance or transit projects. This policy catapulted major grade-separated highway projects to the top of Seattle's list of infrastructure needs from a political perspective. A register of projects compiled by the Streets division of the City Engineer's Department in 1943 lists the construction of the Alaskan Way Viaduct, a major grade separated highway along downtown Seattle's waterfront, 29 out of a list of 31. In 1945, this major highway project was on the top of the City Engineer's list (Ott, 2011). Federal law required that the State Department of Highways conduct a study of commuter habits in Seattle prior to approval of the project. This study generated a report in 1946 that indicated 56 percent of Seattle daily commuters used public transit (Ott, 2011).

Despite the pro-transit findings of this study, the appeal of Federal aid money was great enough to push the city council to vote forward the creation of a development fund for the Alaskan Way Viaduct in 1947. Construction opened on the project in 1950, with the initial roadway open for use in 1953. The Seattle waterfront, perhaps the most critical historical and

economic feature of the city, was willingly and completely cut off from the rest of Seattle by this highway project, demonstrating a shift in priorities at the local level driven by Federal policies. After the funding-starved years of the Great Depression and World War II, it is not surprising that Seattle's infrastructure and political leaders jumped at the opportunity for major transportation improvements to their beloved city, even when these improvements defied the transit and waterborne legacy of earlier decades. While Seattle's transit and ferry culture was still alive and strong at the time of the Viaduct's project approval, as evidenced by state sponsored commuter studies, the redirection of public and private funds towards highways and cars at every level of government began to weaken this tradition. With the inevitable and now well documented drawbacks of auto-oriented design less visible due to the early stages of the United States' automobile reorientation, Seattle's leaders were merely grateful to receive sorely needed infrastructure funds to develop their aging transportation systems.

The Interstate Highway System of the 1950s further solidified Seattle's new automobile-oriented design. Interstate 5, first planned in 1953 to operate as a tollway with a 50 foot right of way for rail transit included, was pushed forward by the availability of funding provided by the Federal Aid Highway Act of 1956. Unfortunately, the highway's toll and rail design was rejected at the state level and redesigned as a freeway without transit service. Despite this, transit scoping studies were completed as part of the project, including a study by the same designers responsible for what became San Francisco's Bay Area Rapid Transit System. Further local activity in defense of transit and traditional urban design came from architects Victor Steinbrueck and Paul Thiry who objected to Interstate 5's bisection of downtown and proposed various lids over the I-5 trench (Crowley, 1993). While these proposals failed to be incorporated during the Interstate's initial construction, I-5 is now bridged by multiple lids which support

parks and reconnect downtown's once divided halves. That Seattle's local infrastructure leaders realized the importance of maintaining transit service and walkability even as federally funded highways reshaped their city is a testament to the region's commitment to the traditional urban form. While the earliest proposals to incorporate transit into highways and to limit the environmental and spatial impact of grade separated roadways failed in Seattle due to overwhelming political support for highways, they provided an intellectual haven that allowed the city's transit and walkable culture to survive the onslaught of highway construction. Furthermore, they provided a foundation upon which modern Seattle retrofits of highway infrastructure to support traditional transportation modes could build from.

The Rise of Metro Transit

The rise of automobile oriented policy dictated the reorganization of transit operations throughout the United States. Seattle's early transit systems, operated by a combination of private contractors and city agencies, were no longer appropriate models for urban mass transit. The regional scale of modern development required regional, rather than, city-based, transit systems operated by agencies which understood regional needs. In King County, a region with 138 incorporated municipal governments during the 1950s (more than any other county in the country than Chicago's Cook County), the need for regional cooperation on infrastructure and planning issues was particularly extreme. Puget Sound's early development pattern, which created a myriad of distinct townships and urban centers dotting the shorelines of the region's many waterways, was both a blessing and a limitation given the post-World War II city planning environment. These cities provided a traditional urban backdrop from which to grow new regional development and mitigate automobile-oriented sprawl; however, they also made cooperation over regional transit a serious challenge in the early days.

Seattle's regional transit emerged from the collective political realization that traffic congestion, water pollution, sprawling development, and sewage treatment were not problems solvable at the municipal level. Led by Seattle Mayor Gordon Clinton, a municipal league of King County leaders conceived of a metropolitan municipal corporation that would handle such regional problems at the behest of a council leadership drawn from mayors, county commissioners, and city councilmembers, with a majority of seats reserved for Seattle leaders. Proposed before voters in 1958, King County Metro was created with unanimous support barring some opposition from suburban communities which resented the prominence of Seattle in the governing body. Metro was not conceived primarily as a transit operator. Its main objective was initially to regulate, plan and manage sewage and water infrastructure. Metro quickly appealed to regional resident's historic love for their waterways through the publication of a brochure headlined by a photograph of Lake Washington featuring five children and a sign written, "Warning: Polluted Water. Unsafe For Bathing" (Crowley, 1993). While regional transit was out of the public spotlight, Metro's management of pressing water issues accrued popular support for the agency in its early years.

Transit service continued to weaken throughout King County in the 1950s and 1960s, particularly outside of Seattle proper, where the trolleybus continued to provide effective service. Despite Seattle Transit's reasonable level of service, it continued to lose fares and money through the 1960s, in part due to its failure to coordinate regionally to provide effective transit service between King County's various urban centers. Marginal successes were won through the implementation of park and ride lots and high occupancy vehicle and bus lanes on the Interstate system in the early 1970s. The success of these regionally oriented programs at drawing residents back to transit renewed political and public support for a regional transit system after

the failures of regional transit plans in the 1960s, including a denial of public support for a heavy rail plan funded by federal dollars which ultimately went towards the creation of the MARTA system in Atlanta. In 1972, Metro, an organization originally created to handle regional water problems, was given a vote of confidence by King County voters and granted the right to design and operate a regional transit system (Oldham, 2006). The planning process leading to this critical victory returned to Seattle's traditional methods of heavy public involvement, collaboration between agencies and municipalities, and innovation. Whereas the transit plans of the 1960s focused on a large scale, expensive, top down approach to transit planning featuring regional heavy rail and expensive infrastructure that repelled tax-averse suburban voters, the 1972 plan proposed a bus and trolleybus only system that made use of existing infrastructure and continued the park and ride system. The planning process included massive public participation with workshops where citizens drew their own transit lines. Upwards of 10,000 citizens throughout King County provided their input. A multinuclear approach was taken, with bus routes organized to provide service between growing urban centers such as the University District, Bellevue, the industrial area at Duwamish, and downtown Seattle. This multicenter rather than radial approach to transit design, along with the unprecedented scale of public participation which is now considered the "classic Seattle participation process" by the city's transit leaders (Crowley, 1993), resulted in the much needed success of Metro's plan in 1972.

The birth of a true regional transit system in the 1970s sparked a return to the region's transit based, cooperative, and highly innovative transportation traditions. King County Metro, with the unanimous support of both Seattle and its suburbs alike, began operation in 1973. It garnered an eight percent increase in transit ridership across the region in the same year (Crowley, 1993). Implementation of high occupancy vehicle lanes along several state highways

during the same year, an innovative move made at the state level, may have contributed to this success. While the call for an all natural gas bus fleet in the plan which won the 1972 charter did not come to fruition due to the failure of the selected bus model's manufacturer, this innovative and environmentally conscious approach to transit technology left a lasting effect on Metro's goals and strategies. Natural gas buses were later successfully mandated in 1993. Articulated buses, a rare and novel technology in North America, also formed a key component of the original Metro plan and would allow the system to carry more passengers at a lower cost. Like the employment of the trolleybus in earlier years, the articulated bus demonstrated Seattle's willingness to innovate within its transportation systems. Perhaps even more innovative, however, was the implementation of a free fare zone for all buses within downtown Seattle. The "Magic Carpet" zone began in September 1973 and was subsidized by the City of Seattle. This free ride zone was a major success, made international headlines, and continued to operate until 2012. This free core bus service was the lynchpin of King County Metro's success during its early years. Not only did it attract more riders than a paid service, it allowed buses to keep traffic moving due to their short boarding times at stops.

Innovative policy and technology was the cornerstone of transit's success in Seattle. Articulated buses, free ride zones, park and ride services, massive public participation efforts, and a multicenter network design allowed Seattle and King County Metro to succeed during a time when other cities failed to effectively implement regional transit service. Public willingness to accept these innovations during the 1970s coincides with Seattle's heritage of unique transportation technologies, compact and transit-based urban forms, and a focus on communal rather than individual travel from its earliest days in the nineteenth century. Whereas other major cities struggled to gain the political approval of outlying municipalities during the

implementation of their regional transit services, King County Metro successfully brought its many beneficiaries on board through a public participation process which allowed unprecedented collaboration between citizens and transit planners. Public respect for the natural environment of Puget Sound, borne out of the region's strong waterborne recreational and economic traditions, also contributed to residents' willingness to accept a regional transit system and hesitancy towards the implementation of further freeways which would separate them from their beloved waterfronts.

Transit in the Twenty First Century

The success of Metro's 1972 plan renewed Seattle's legacy of environmental respect, communal urban form, technological innovation, and public and private cooperation in its infrastructure design. It set the stage for the City's contemporary climate of transit innovation and expansion. While transit will likely never return to the level of importance it maintained in the early twentieth century, it continues to strengthen and grow throughout the Seattle region in a way unseen in many great American metropolises. The anti-sprawl, anti-automobile spark which created Metro also rekindled the region's desire to remain cutting edge, environmentally engaged, and community oriented. Major transportation projects in twenty-first century Seattle reflect this spirit and the Puget Sound cultural legacy just as strongly as Metro's original 1972 plan.

The great highways of the 1950s and 1960s continue to give way to more transit-friendly, community oriented, and walkable environments. The Alaskan Way Viaduct, the looming herald of the automobile's ascent to dominance in the Seattle region, will be replaced by a massive tunnel underneath the old highway which will reconnect downtown Seattle to its vital and treasured waterfront by 2019. While the replacement tunnel project is highly controversial due to

its expense and unexpected delays in construction, it will reverse much of the damage done by highways to the Seattle waterfront area after its completion. While it will still facilitate a large volume of automobile travel, with all of the environmental drawbacks that such travel entails, it will recreate the link between the City and its most valuable natural resource. Seattle's residents and their leaders, through approval of this project, became part of a group of only a few American cities with the willingness to remove major highways and to replace them with less intrusive designs meant to restore the historic character of the American city. Seattle's innovative and transit-friendly heritage once again manifests itself here, providing the cultural backdrop necessary to allow public approval for such a unique and potentially controversial project.

Actual transit service expansion also continues in the contemporary Seattle region. The Central Puget Sound Regional Transit Authority, formed by the Snohomish, King, and Pierce County Councils in 1996 and known popularly as Sound Transit, maintains a variety of regional express bus, commuter rail, and light rail services throughout the region. Whereas King County Metro provided the new platform for regional transit cooperation needed in the 1970s, Sound Transit provides a platform for the even broader collaboration needed as the region continues to grow. The agency's most notable contribution to regional transit is the Link Light Rail system, the first modern full service rail transit to operate in the region since the closure of the streetcars during the 1940s. Opened for full operation in 2009, the system provides service between SeaTac airport and downtown Seattle, with multiple intermediate stops serving neighborhoods along the route. Expansion of the service is already under construction, with a University Link line scheduled for operation by 2016 that will extend the existing line northward to the University of Seattle. Further lines were approved in a 2008 ballot measure which called for expansion of the University Link northward to Lynnwood and implementation of a new line east to Mercer Island,

Bellevue, and Microsoft's main campus in Redmond. These approved plans, when completed, will provide the Puget Sound region with an effective, high frequency, dedicated rail transit service which reaches many of the major activity centers throughout the metropolitan area. While Seattle failed to accept the proposed construction of a federally funded heavy rail system in the 1960s, it approved and funded the Sound Transit light rail service through voter-approved sales and vehicle excise tax increases. This incredible success in transit expansion, like Seattle's earlier successes, was derived from the region's traditional cultural affinities for local-led, collaborative, community oriented urban planning.

While Sound Transit's Link Light Rail system is the most prominent and critical transit success for Seattle since the heyday of communal transportation, King County Metro continues to innovate and expand services. The South Lake Union Streetcar, opened in 2007 and operated by King County Metro, is the first true streetcar service to operate in Seattle since the historic system's decline. It makes use of modern vehicles, a newly planned right of way, and serves local passengers from Seattle's downtown northward to Lake Union. The streetcar, once expunged from every American city and yet to return to most of them, finds a fitting a predictable resurgent home in Seattle. As with the Link Light Rail, this streetcar does not operate in isolation as a one-off victory for transit advocates. It is part of an extensive planned streetcar network which will serve most neighborhoods of the city with five distinct lines, short headways, and modern amenities. The first expansion line, the First Hill Streetcar, is under construction and will open to the public in 2015. Decades have passed since the streetcar's historic dominance and few Seattleites remain who remember it as their transportation mode of choice; despite this, the transit, community, and environment oriented culture of Puget Sound maintained the streetcar's cultural legacy long enough to allow its return in a fully updated, modern form. Not a mere

historic tribute or tourist attraction, Seattle's new streetcars will provide real and practical service to the city's residents, few of whom are old enough to have personally experienced the positive effects of streetcar transit during Seattle's past. Rather than a throwback, the Seattle Streetcar is a return to effective transportation solutions that are congruent with Seattle's cultural and historical legacy.

CHAPTER FIVE: Conclusions

Seattle's effectiveness at restoring historic patterns of mass transit gives it a definite advantage over peer cities throughout the United States. While the city does not quite rank among the nation's most transit-friendly regions, among middle tier cities, it is unmatched. The oldest and most dense cities of the American Northeast, including New York City, Washington, and Philadelphia all retain transit systems with higher ridership rates and better alternative mode shares across commuter trips. Barring these most prominent of American cities, however, Seattle rises to the top of the transit world, demonstrating an ability to implement effective transit and alternative transportation options that extend beyond the dense Seattle core to more distant urban centers such as Bellevue and Redmond. Among cities which similarly came to prominence in the booming car era with comparable population densities and regional populations, Seattle displays an altogether more cohesive, effective, and popular alternative transportation mode network. Even though Seattle lost its extensive streetcar and cable car network during the rise of the automobile, as did many cities across the United States, it successfully restored and updated its transit systems with new technologies, new service patterns, and a regional focus that allow modern Puget Sound residents to take advantage of transit opportunities unavailable in other major American regions.

Much of Seattle's contemporary effectiveness is due to its ability to facilitate intermodal cooperation and to integrate transit systems across the region into a cohesive network. Seattle only attains its 33.7% alternative mode share for commuters due to the range of options it provides to individuals both within the city proper and in more distant fringe areas. Consolidation of local bus and streetcar services with longer range RapidRide express bus services under one operator (King County Metro) allows for easy transfer between mode types

for Seattle's transit users. While light rail, commuter rail, and long range bus services are operated by Sound Transit, an entity distinct from King County Metro, these services make use of the same facilities as King County Metro buses, allowing for easy transfers and direct integration between modes. An extensive state run ferry system adds further robustness to Seattle's transit network, allowing both passengers and vehicles to access downtown Seattle through waterways that take individuals off of crowded bridges and highways. This level of intermodal connectivity and institutional cooperation across the region is perhaps Seattle's greatest asset in the contemporary transit market.

Review of Seattle's contemporary transit network also reveals a system that provides a highly attractive and practical operational format to users. Many of the network's routes operate on short headways of fifteen minutes or less during peak hours, allowing commuters to come and go as they please and lessening the burden of scheduling time for individual riders. Short headways shorten wait times and reduce anxiety over missed or late vehicles, two factors notoriously unattractive for potential choice transit riders. This high frequency design, along with easy availability of routing information, intermodal connectivity, and unified payment technology allows the Seattle transit system to provide a critical level of convenience necessary to attract and retain choice riders who are more concerned with the lifestyle benefits than the monetary benefits of transit. While GIS analysis reveals that Seattle's contemporary transit network does not reach the level of high frequency transit population coverage once provided by the historic streetcar network, it also reveals that high frequency (fifteen minute or shorter headways) services reach 56.3% of the study area population, a figure that demonstrates a strong commitment to high quality regional transit service. In many other cities, only a small number of

premiere rail transit or express services provide the fifteen minute headway that is so critical to attracting choice riders.

All of these operational advantages revealed through mode share and spatial transportation analysis are only made possible through an institutional and public commitment to transit and alternative modes. Seattle's growth, like most major American cities, is sprawling in nature. While the city does retain a dense urban core and an effective gridded street network, many of the region's residents live in outlying communities with their own, smaller urban centers and associated suburban style communities. This American suburban development pattern is well known to facilitate a high degree of automobile travel wherever it forms.

Despite this, Seattle continues to operate and grow a well-used and complex alternative transportation mode infrastructure. Broad and enthusiastic commitment to this pattern of transportation development is the key to its continued success. Whereas other cities emphasize roadway capacity expansion, implementation of high occupancy and toll lanes on highways, and operational improvements to roadway signalization and intersection design as primary solutions in solving congestion problems, Seattle emphasizes transit, livability, walkability, and safe and efficient sharing of infrastructure across all travel modes. While both approaches are viable and capable of success, only the Seattle approach allows for the effective implementation of a convenient and attractive regional transit system which draws choice riders as well as captive riders. Language, strategies, and stated priorities in key transportation planning documents from Seattle are markedly different from those seen in more automobile-oriented cities, such as Houston, with similar physical potential for extensive transit networks. This transit-focused planning method extends to the fringe cities of Bellevue, Redmond, and others, as well as Seattle proper.

While planning documents may primarily reflect the attitudes of a core group of transportation and urban planning professionals whose motivations may push them towards a transit-friendly planning style, public involvement records offer insight into genuine resident attitudes towards transit. Review of a number of these sources indicates a resident culture which accepts transit as a primary mode of transportation. While residents remain wary of local impacts from large scale transportation projects, as they are in all cities, Seattle residents show no outright ideological rejection of transit as a viable and important mode of transportation. Further affirming the presence of a transit and alternative mode-friendly culture in the Puget Sound region is the presence of well-known and popular bicycle events which take place in Bellevue and Seattle. Bellevue is known throughout the country as a stronghold of bicycling culture. Perhaps the greatest evidence of the Puget Sound region's affinity for transit comes from its willingness to approve proposed sales and excise taxes to fund major transit projects. Even untested and fledgling transit systems, such as the Link Light Rail system, received enough public support to approve the tax hikes necessary for funding such large scale projects. While the Link Light Rail system created many controversies during its implementation process, regional voters came together to approve its construction through their direct tax contributions.

Pro-transit culture is, in many areas of the United States, a rare phenomenon with limited influence on local government activity. Even in major cities ripe for the development of new and effective transit systems, cultural and political obstacles prevent growth of alternative mode infrastructure at anything other than a crawling pace. An afterthought in many great American regions, transit, bicycling, and walkability are at the forefront of Seattle culture. This culture is the product of a history that embraced the natural environment and its resources, communal travel, and public-private partnerships with heavy public involvement from the city's earliest

days. Notable chroniclers of Seattle's early days note the importance of the region's ferry system to the vitality of the region, going so far as to jest about the region's lack of roadway access between early urban sites. More recent authors, such as Nard Jones, writing during the darkest decades for regional transit in the United States during the 1970s, remark often and with much regret over the loss of city's waterfront culture to a suburban, auto-driven world with little appreciation for the community once afforded by mass transportation.

This desire among Seattleites to be with their natural environment and with each other ultimately created a rebound from these desolate years of poor transit service and limited waterfront access, pushing the region to form effective regional transit authorities with critical power and support generated by massive public involvement efforts. Seattle's transit turnaround was always, from its beginning in the 1970s to its culmination in the large scale projects of the twenty-first century, a testament to the city's legacy of environmental respect, communal travel, and cooperative public effort. Without this legacy to sustain the pro-transit culture seen in the region today, Seattle would not achieve the level of success it demonstrates when compared to peer cities. This culture and the history which allowed it to survive the technological and social revolution of the automobile are the critical components missing from other cities which repeatedly fail to generate the support necessary for large-scale transit development.

Planners in cities which lack the transit-friendly culture of Seattle must be aware of the intensive shifts in community attitudes necessary to facilitate the development of effective transit systems. If these shifts cannot be fostered, traditional high quality transit services may not be a reasonable option; unique technological, political, and financial solutions must be sought in these regions that either work within the existing cultural and political climate, or seek to evolve it over time towards a more pro-transit position. Some lasting, universal recommendations can be

made in light of Seattle's success, however. Intermodal and interagency cooperation, efficient and adaptable technology, an awareness of local history and cultural values, and intensive public participation efforts are all ingredients of the Seattle formula which may be applied to significant effect elsewhere in the United States.

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