Center for Accessibility and Safety for an Aging Population

Florida State University

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RESEARCH FINAL REPORT

Transit Oriented Development for Aging Adults: An Evaluation of Recent Trends, Best Practices, and Future Prospects

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Transit Oriented Development for Aging Adults: An Evaluation of Recent Trends, Best Practices, and Future Prospects

Final Report

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16. Abstract

Fulfilling daily needs associated with successful aging portends many challenges. In particular, as their driving skills deteriorate, many aging adults will need to find alternative means of travel that will allow them to conduct basic out-of-home activities. One approach to addressing this problem is to create places that allow one to effectively reach a variety of activities without a car. Transit-oriented development (TOD) ostensibly provides this type of place. TOD is commonly defined as compact, walkable development immediately surrounding a major transit station. In this project, our key objective is to provide a nationwide examination of TOD from the perspective of how well it attracts and meets the needs of aging adults. Our research incorporates several intertwined tasks, including collection and analysis of data about the presence and growth of aging populations residing near transit stations, detailed cases studies of TODs that have successfully attracted aging adults, and regression models that predict the relative share of older adults living near a transit station. Further, to elucidate best practices with regard to TOD for the aging, we surveyed transit agencies and local governments about their efforts in this regard. Finally, calculated accessibility indices for TODs to determine how well they are providing high levels of non-auto access to the types of activities of import to older populations. This work will inform planning and policy initiatives aimed at creating places where older groups can transition away from driving without losing access to important out-of-home activities.

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Disclaimer

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Abstract

Fulfilling daily needs associated with successful aging portends many challenges. In particular, as their driving skills deteriorate, many aging adults will need to find alternative means of travel that will allow them to conduct basic out-of-home activities. One approach to addressing this problem is to create places that allow one to effectively reach a variety of activities without a car. Transit-oriented development (TOD) ostensibly provides this type of place. TOD is commonly defined as compact, walkable development immediately surrounding a major transit station. In this project, our key objective is to provide a nationwide examination of TOD from the perspective of how well it attracts and meets the needs of aging adults. Our research incorporates several intertwined tasks, including collection and analysis of data about the presence and growth of aging populations residing near transit stations, detailed cases studies of TODs that have successfully attracted aging adults, and regression models that predict the relative share of older adults living near a transit station. Further, to elucidate best practices with regard to TOD for the aging, we surveyed transit agencies and local governments about their efforts in this regard. Finally, calculated accessibility indices for TODs to determine how well they are providing high levels of non-auto access to the types of activities of import to older populations. This work will inform planning and policy initiatives aimed at creating places where older groups can transition away from driving without losing access to important out-of-home activities.

Chapter 1 Introduction

1.1 Literature Review

There are more adults age 65 or older than ever before, and the group is growing rapidly. It is estimated that by the year 2025, 20% of adults will be over the age of 65 (Rosenbloom, 2003). This translates to 83.7 million adults, almost double the current level (Cervero & Gorham, 1995). The baby boomer generation was part of the largest population growth in the United States history, and many of them are now entering this older adult/retirement category (Rosenbloom, 2003). The baby boomers were also the first generation to move in masse to the suburbs (DeGood et al 2011). This will be one of the largest challenges faced by transportation planners in the coming years (Kim et al, 2007). This trend will be felt disproportionately in Florida, currently the oldest state in the nation (Metz, 2003)

"Aging in place" or planning to live in your own, often suburban house, is frequently studied by researchers focusing on older adults. This concept assumes that most older adults will attempt to remain in their homes long after retirement rather than move somewhere else (Mercado & Newbold, 2010; Farber & Shinkle, 2011). In fact, only a small percentage of Americans move or buy a new house after they reach retirement age, and most will continue to live in suburban, car dependent neighborhoods (Kim 2011; DeGood et all, 2001; Alsnih & Hensher, 2006). A wide range of government policies has supported these suburban neighborhoods over the last 60 years. Because this creates challenges for an aging population, this will require change from a variety of actors (Rosenbloom, 2003). The baby boomers are currently approaching retirement age,

but many of them are not old enough to face serious mobility issues. As such, there is still time for communities to prepare for this demographic shift.

As people age they begin to lose mobility. They lose both the ability to operate privately owned vehicles and the ability to walk or bike long distances (Mercado & Newbold, 2010; Pisarski, 2003). This is a particular problem in the US where suburban, car-centered transport networks are widespread (Kim 2011; Metz, 2003). Older Americans make fewer trips as they age, and each trip is a shorter duration (Ortman et al, 2014). This raises critical question about how will older adults living in the suburbs who have lost mobility go out about everyday activities such as shopping, visiting friends, attending social events, and visiting medical facilities (DeGood et al, 2011).

Transit Oriented Development (TOD) aimed at older adults is one possible approach to addressing these issues. Someone living in a TOD is close to a transit stop, allowing for they travel that does not require walking a long distance or a personal vehicle. This transit stop presumably gives them access to a variety of activities to which they would otherwise need to drive (Knight & Trygg, 1997). Also, while a TOD is defined as a neighborhood that allows easy, walk-able access to a mass transit station, they are often characterized by a compact mixture of uses that provides easy access to recreation and services within the station area itself (Bailey, 2004). This “walkability”can be especially important for elderly adults (Lynott & Figueiredo, 2011). The combination of good transit and pedestrian accessibility can reduce dependence on driving (Dittmar & Ohland, 2004; Cervero et al, 2004; Stiffler & Nuworsoo, 2012) and promote sustainability (Schwanen & Paez, 2010; Rosenbloom, 2009, Cervero, 1998). The desire

to reduce car use is a key reason people choose to live in TODs (Kim et all, 2007; Cervero & Gorham, 1995). Though there has been a preponderance of research into TOD's and traffic congestion, TOD's and land development, TOD's and travel behavior, and the reasons people live in TODs (Knight & Trygg, 1997; Nasri & Zhang, 2014; Cervero et al, 2002; Bernick & Cervero, 1997), there how been relatively little effort put into understanding how TODs might benefit aging populations.

1.2 Project Tasks

The research project presented in this report seeks to address a set of key interrelated questions with regard to TOD and aging. This includes: How does the age profile of current TOD residents compare to the rest of the population? Are there certain TODs that are attracting older residents? Are there specific types of TOD characteristics (e.g., certain types of commercial activities, mixed land uses) that might attract older adults? Do the modal characteristics associated with the forms of transportation serving TODs influence their residential profile (i.e., light rail, heavy rail, bus rapid transit [BRT])? Are there ways in which transit agencies and local governments are actively promoting TODs for aging populations? Do TODs provide sufficient non-auto access to activities?

This project utilized a variety of tasks to address these questions. The first task was to examine the census data for 2000 and 2010 to look at areas of with high concentrations of older adults to see what factors correlated with older populations in the TOD than in the surrounding areas. This is covered in Chapters 2 and 3. We then identified a set of

station areas that had high concentrations of older adults and conducted detailed case studies to provide examples of what works and does not work to attract older adults to TODs. These case studies are presented in Chapter 4. We surveyed planning officials in major cities to see which cities had practices that attempted to attract older adults to TODs, what those practices were, and which practices were perceived to work best. The results of this survey are presented in Chapter 5. We computed accessibility scores for a set of station areas to assess the degree to which TODs provide an environment where older adults have more and easier opportunities for conducting activities. This analysis is presented in Chapter 6. Finally, we conducted a regression analysis that identifies specific station area characteristics that predict the presence of older adults.

Chapter 2 Aging Populations and Transit Oriented Development: Socioeconomic, Demographic, and Neighborhood Trends from 2000 and 2010

2.1 Introduction

To compare how the environment has changed in terms of socioeconomic characteristics, this chapter examined census attributes such as people's age, income by age, and the number of various activities performed in TODs. Also investigated were trends in TOD road infrastructure and activity locations. It was found that TODs and their adjacent areas in 2010 had a higher density of road network characteristics compared with TODs in 2000. It was also observed that aging populations (65 years and older) were a lower proportion of the population residing in TODs for 2000 and 2010. If TODs are a possible solution to meeting the accessibility needs of aging adults, more research is required to understand better how to attract aging populations to these communities.

2.2 Data and Methods

Location and status information on TODs are derived from the National TOD database (2011), which is a project of the Center for Transit-Oriented Development *(*2011*).* Included in the database are 4,417 existing stations in over 50 metropolitan areas, as depicted in Figure 2.1**.** Attribute information for each TOD provides details on whether transit is planned, existing, or proposed, as well as information on transit agency, station name, line name, and the year transit began (if transit began before the year 2000, database records year opened as pre-2000). There is a total of 3,535 current TOD's that existed pre-2000, which we analyze here.

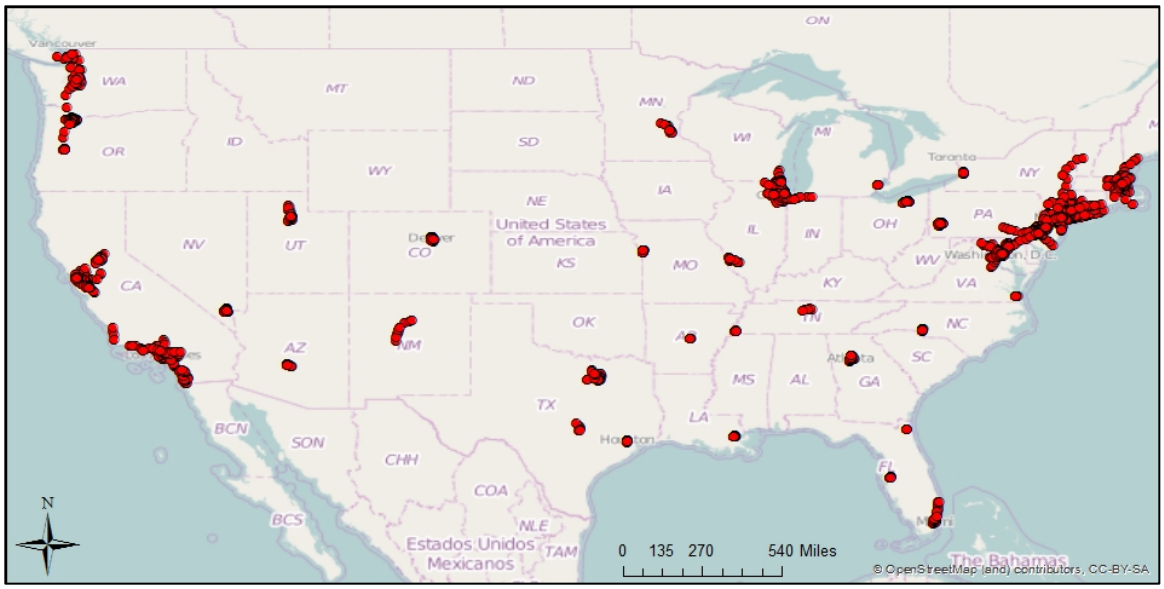

Figure 2.1 Existing Transit Oriented Developments within the United State

Census data is extracted from the National Historical Geographic Information System *(*Minnesota Population Center, 2011*)*. Census Block groups containing demographic information from the 2000 and 2010 Summary file 1 are used in this analysis. Additionally, supplemental demographic information from the 2000 Census Summary file 3 and the 5-year American Community Survey (ACS) for the years 2008-2012 was also extracted. This analysis is interested in examining changes in TOD demographic characteristics between the years 2000 and 2010. Unfortunately, detailed information on socio-economic data exists in two different formats for the years 2000 and 2010. For the year 2000, demographic data comes in the form of Summary file 3. For the year 2010, the ACS is taken as a comparable dataset. There are some notable differences between these datasets that do not allow for exact comparisons to be made. For example, the ACS used in this study is based on sample data over the period from 2008 to 2012,

which provides us with a five-year average, while the 2000 summary file 3 dataset samples the population during the census year. This limits our ability to conduct formal statistical tests for differences in this paper, but the descriptive statistics we provide should help to illuminate what is occurring around TODs.

The activity data is provided by Caliper Corporation in the form of NAVTEQ's HERE database, which is a national collection of the locations of a variety of goods and services from the year 2013 *(*Caplier Corporation, 2013*).* It contains activity locations such as restaurants, banks, shopping, etc. Additionally, streets data as represented by the number of nodes and line segments within the TOD boundaries are derived from Caliper's version of the street TIGER datasets from the years 2002 and 2010 (Caliper Corporation, 2002; Caliper Corporation 2010). TIGER street files for the year 2000 were not readily available for the entire contiguous United States so the 2002 streets are used as a substitute. All data collected for this analysis were chosen specifically based on its availability at the national level. While we are interested in datasets from the years 2000 and 2010, there are some instances where data was not available at the national level for one of the aforementioned years. To remedy this situation some datasets have been acquired that represent the environment one or two years after 2000 or 2010.

At a national scale, this study examines census attributes such as age, income by age, number of various activities within TODs. Specifically, we attempt to assess how a TOD's age profile compares to the national population. In other words, census data from the years 2000 and 2010 is used in order to examine whether the proportion of aging adults has changed over time in the context of TOD's.

For the year 2000, the TOD's that were in existence pre-2000 were extracted from the TOD database for a total of 3,535 TODs. In order to estimate the census characteristics surrounding these transit stops, buffers were created and overlaid with the census block group demographics in GIS. Based on previous studies, a buffer of 0.5 mile was chosen to represent the area directly surrounding a transit stop. It has been suggested that 0.5 miles is a reasonable distance for individuals who use transit to walk to the nearest stop (Nasri & Zhang, 2014). This standard may not apply to all older adults; some of whom could have physical constraints that do not allow them to walk 0.5 miles. Variable TOD service standards are a topic that can be explored in future research. A buffer of 2 miles has also been created around stops, which allows observations of trends beyond the areas directly surrounding the transit stop. The area included in the 0.5-mile buffer was subtracted from the 2-mile buffer so changes in the area immediately outside of the TOD can be analyzed and compared. We organized the extracted demographics into tables and the proportion of residents or households by the appropriate characteristic are displayed based on the total population in the U.S. as well as the total population within the assigned TOD buffers.

2.3 Results

2.3.1 Changes in Aging Population-Related TOD Characteristics (2000-2010)

The first set of attributes is depicted in **Table 2.1,** where the population by age group has been collected for each area for the years 2000 and 2010, respectively. In this table, the proportion of the total age group population has been calculated for each

geographic area as well as the proportion of the total age group within one of the two previously described TOD buffers. In this way, comparisons to the national age population groups as a whole can be made and also the proportion of the age groups residing within each buffer can be observed. In this way, we are able to examine changes in the greater area at large and also observe how the proportion of adults living within a 2-mile radius outside of the transit stop (excluding the 0.5-mile area) compares with the proportion of adults living within the 0.5-mile radius. This approach is also reproduced for other data items throughout the analysis.

Table 2.1 Total Population by Age for the Years 2000 and 2010

Total Population By Age																
	Total		Proportion of Total National Population		TOD Area		Proportion of Total National Population		Proportion of Total TOD Area		Area Outside the TOD (0.5-2 Miles)		Proportion of Total National Population		Proportion of Total Area Outside the TOD	
Age	2000	2010	2000	2010	2000	2010	2000	2010	2000	2010	2000	2010	2000	2010	2000	2010
Under 5	19,175,798	20,426,118	6.81%	6.54%	1,730,475	1,874,127	9.02%	9.18%	6.77%	6.38%	2,308,300	2,614,673	12.04%	12.80%	7.13%	6.73%
5 to 9	20,549,505	20,588,661	7.30%	6.59%	1,781,586	1,716,980	8.67%	8.34%	6.97%	5.85%	2,453,839	2,547,549	11.94%	12.37%	7.58%	6.55%
10 to 14	20,528,072	20,945,765	7.29%	6.70%	1,661,056	1,681,535	8.09%	8.03%	6.50%	5.73%	2,330,378	2,565,297	11.35%	12.25%	7.19%	6.60%
15 to 17	12,040,437	13,124,218	4.28%	4.20%	947,471	1,080,788	7.87%	8.24%	3.71%	3.68%	1,322,030	1,628,225	10.98%	12.41%	4.08%	4.19%
18 and 19	8,179,453	9,200,384	2.91%	2.94%	736,109	905,964	9.00%	9.85%	2.88%	3.09%	891,609	1,144,740	10.90%	12.44%	2.75%	2.94%
20	4,049,448	4,577,334	1.44%	1.46%	388,740	481,681	9.60%	10.52%	1.52%	1.64%	449,511	577,398	11.10%	12.61%	1.39%	1.49%
21	3,841,082	4,407,398	1.36%	1.41%	377,435	470,707	9.83%	10.68%	1.48%	1.60%	434,064	562,431	11.30%	12.76%	1.34%	1.45%
22 to 24	11,073,471	12,862,117	3.93%	4.12%	1,209,869	1,517,102	10.93%	11.80%	4.73%	5.17%	1,324,468	1,704,696	11.96%	13.25%	4.09%	4.38%
25 to 29	19,381,336	21,346,008	6.89%	6.83%	2,210,365	2,680,959	11.40%	12.56%	8.65%	9.13%	2,395,782	2,887,671	12.36%	13.53%	7.40%	7.43%
30 to 34	20,510,388	20,210,272	7.29%	6.47%	2,199,553	2,356,477	10.72%	11.66%	8.61%	8.03%	2,543,273	2,706,279	12.40%	13.39%	7.85%	6.96%
35 to 39	22,706,664	20,420,912	8.07%	6.54%	2,136,664	2,099,603	9.41%	10.28%	8.36%	7.15%	2,673,699	2,662,206	11.77%	13.04%	8.25%	6.85%
40 to 44	22,441,863	21,133,222	7.97%	6.76%	1,962,512	2,024,338	8.74%	9.58%	7.68%	6.89%	2,558,629	2,716,358	11.40%	12.85%	7.90%	6.99%
45 to 49	20,092,404	22,956,577	7.14%	7.35%	1,708,941	2,044,289	8.51%	8.91%	6.69%	6.96%	2,251,916	2,836,895	11.21%	12.36%	6.95%	7.30%
50 to 54	17,585,548	22,537,946	6.25%	7.21%	1,492,578	1,953,031	8.49%	8.67%	5.84%	6.65%	1,972,593	2,740,878	11.22%	12.16%	6.09%	7.05%
55 to 59	13,469,237	19,888,412	4.79%	6.36%	1,120,056	1,692,966	8.32%	8.51%	4.38%	5.77%	1,484,521	2,363,826	11.02%	11.89%	4.58%	6.08%
60 to 61	4,541,171	7,201,122	1.61%	2.30%	385,566	608,226	8.49%	8.45%	1.51%	2.07%	497,160	838,939	10.95%	11.65%	1.53%	2.16%
62 to 64	6,264,276	9,834,879	2.23%	3.15%	521,108	802,323	8.32%	8.16%	2.04%	2.73%	671,877	1,121,914	10.73%	11.41%	2.07%	2.89%
65 to 66	3,890,231	5,395,224	1.38%	1.73%	320,683	431,093	8.24%	7.99%	1.25%	1.47%	415,490	601,590	10.68%	11.15%	1.28%	1.55%
67 to 69	5,643,314	7,215,450	2.01%	2.31%	460,530	567,254	8.16%	7.86%	1.80%	1.93%	600,582	789,328	10.64%	10.94%	1.85%	2.03%
70 to 74	8,857,441	9,414,417	3.15%	3.01%	737,356	755,850	8.32%	8.03%	2.89%	2.57%	962,544	1,035,632	10.87%	11.00%	2.97%	2.66%
75 to 79	7,415,813	7,418,535	2.64%	2.37%	627,821	604,854	8.47%	8.15%	2.46%	2.06%	824,790	840,408	11.12%	11.33%	2.55%	2.16%
80 to 84	4,945,367	5,810,327	1.76%	1.86%	432,388	498,451	8.74%	8.58%	1.69%	1.70%	551,293	690,187	11.15%	11.88%	1.70%	1.78%
85 and up	4,239,587	5,556,029	1.51%	1.78%	404,865	511,182	9.55%	9.20%	1.58%	1.74%	471,840	700,254	11.13%	12.60%	1.46%	1.80%
Total	281,421,906	312,471,327			25,553,727	29,359,780	9.08%	9.40%			32,390,188	38,877,374	11.51%	12.44%		

For the national population, we see a steady decrease in individuals in the younger age groups, less than 17 years of age, from 2000 to 2010. In age groups 50 to 64 there is an increase of nearly 1% at every level. Adults aged 40-54 also makes up the highest proportion of the total national population in 2010, whereas in the year 2000 adults aged 30 to 44 make up the highest proportion of the total national population. In the year 2010 there was a higher proportion of adults over the age of 40 at the national level and these individuals will continue to age leading to the largest proportion of aged adults in history. Comparing the population within the TOD to the national population in the year 2010, individuals under the age of 17 and adults over the age of 65 make up a smaller proportion of the TODs than at the national level. This was also the case in the year 2000.

Examining trends inside the TODs for the year 2000, it appears that the proportion of the total national population in age groups 22 to 34 make up the largest proportion of adults residing within 0.5 miles of a stop. Compared with the year 2010, age groups 20 to 39 have the highest proportion of the total national population age groups. This is an interesting observation because it is a possible indication that young adults who initially were attracted to these areas in the year 2000 have chosen to stay as they have moved into the 35-39 age cohort, while at the same time the young adults of 2010 have also remained attracted to TOD communities. These age groups also make up the highest proportion of the population residing within the 0.5 mile(s) areas surrounding the TODs.

Looking at the aging populations groups (those 65+), there does appear to be a smaller proportion residing in TODs compared to the young to mid-adult population groups. The proportion of adults aged 65+residing within the TOD areas has also

decreased from the year 2000 to 2010, while the control areas immediately outside the TOD areas and the total national population show an increase in adults aged 65 and older. In the areas adjacent to the TODs, it appears there is greater proportion of adults aged 45 to 54 in the year 2010 compared to 2000. This is also the case for the TOD areas. This age group also increased by proportion at the national level.

Income by age of householder is examined in **Table 2.2**. Compared to the national level, all age groups have a higher proportion of householders earning $100,000 residing within a TOD for both years 2000 and 2010. This suggests that individuals residing in TODs are generally more affluent compared to the national population. There is an even higher proportion of adults at every age group earning more than $100,000 in the area outside the TOD compared to the national level. Of note, for the year 2010 the proportion of householders 65+with incomes less than $25,000 living within a 0.5 miles of a TOD has a higher population proportion (40.17%) than householders of the same age on the national level (35.11%). This is potentially important because it points to the idea that aging adults within TODs may have a higher proportion of residents receiving a lower income.

Table 2.2 Income by Age of Householder for the Years 2000 and 2010

Income by Age																	
	Income	Total		Proportion of Total National Population		TOD Area		Proportion of Total National Population		Proportion of Total TOD Population		Area Outside the TOD		Proportion of Total National Population		Proportion of Total Area Outside the TOD	
		2000	2010	2000	2010	2000	2010	2000	2010	2000	2010	2000	2010	2000	2010	2000	2010
Under 25 years	Less than $25,000	2,943,202	2,444,678	54.15%	48.56%	260,604	242,571	8.85%	9.92%	52.04%	46.79%	254,367	241,564	8.64%	9.88%	50.38%	45.45%
	$25,000-$39,000	1,250,689	1,030,931	23.01%	20.48%	98,989	89,125	7.91%	8.65%	19.77%	17.19%	109,912	101,923	8.79%	9.89%	21.77%	19.18%
	$40,000-$59,999	792,729	821,111	14.59%	16.31%	72,542	79,091	9.15%	9.63%	14.49%	15.25%	79,315	90,393	10.01%	11.01%	15.71%	17.01%
	$60,000-$99,999	360,317	569,188	6.63%	11.31%	50,164	71,918	13.92%	12.64%	10.02%	13.87%	47,089	71,178	13.07%	12.51%	9.33%	13.39%
	$100,000 or more	88,139	168,525	1.62%	3.35%	18,455	35,757	20.94%	21.22%	3.69%	6.90%	14,223	26,386	16.14%	15.66%	2.82%	4.96%
	Total	5,435,076	5,034,433			500,754	518,462	9.21%	10.30%			504,906	531,444	9.29%	10.56%		
25 to 44	Less than $25,000	9,392,256	7,569,716	22.14%	19.02%	1,061,393	859,698	11.30%	11.36%	24.97%	19.33%	1,013,256	910,120	10.79%	12.02%	20.87%	17.99%
	$25,000-$39,000	8,358,917	5,837,133	19.71%	14.67%	752,680	583,621	9.00%	10.00%	17.71%	13.12%	851,416	700,322	10.19%	12.00%	17.53%	13.85%
	$40,000-$59,999	9,667,763	7,223,290	22.79%	18.15%	814,089	717,621	8.42%	9.93%	19.15%	16.13%	992,511	856,391	10.27%	11.86%	20.44%	16.93%
	$60,000-$99,999	10,069,088	10,076,543	23.74%	25.32%	940,647	1,005,301	9.34%	9.98%	22.13%	22.60%	1,213,234	1,202,610	12.05%	11.93%	24.99%	23.78%
	$100,000 or more	4,926,460	9,086,284	11.62%	22.83%	682,189	1,282,388	13.85%	14.11%	16.05%	28.83%	785,240	1,388,753	15.94%	15.28%	16.17%	27.46%
	Total	42,414,484	39,792,966			4,250,998	4,448,629	10.02%	11.18%			4,855,657	5,058,196	11.45%	12.71%		
44 to 64	Less than $25,000	7,424,930	8,589,281	20.97%	18.63%	755,674	898,502	10.18%	10.46%	24.68%	22.04%	706,166	931,025	9.51%	10.84%	18.16%	16.90%
	$25,000-$39,000	5,584,173	5,734,072	15.77%	12.44%	453,054	477,815	8.11%	8.33%	14.79%	11.72%	531,622	607,644	9.52%	10.60%	13.67%	11.03%
	$40,000-$59,999	6,989,541	7,368,856	19.74%	15.98%	530,915	580,600	7.60%	7.88%	17.34%	14.24%	692,099	792,566	9.90%	10.76%	17.80%	14.39%
	$60,000-$99,999	8,928,390	11,043,657	25.21%	23.95%	677,093	855,796	7.58%	7.75%	22.11%	20.99%	1,000,686	1,249,311	11.21%	11.31%	25.73%	22.68%
	$100,000 or more	6,487,075	13,371,262	18.32%	29.00%	645,647	1,263,936	9.95%	9.45%	21.08%	31.00%	958,112	1,927,248	14.77%	14.41%	24.64%	34.99%
	Total	35,414,109	46,107,128			3,062,383	4,076,649	8.65%	8.84%			3,888,685	5,507,794	10.98%	11.95%		
65 and up	Less than $25,000	10,500,832	8,955,307	47.14%	35.11%	950,250	861,911	9.05%	9.62%	49.24%	40.17%	1,005,572	930,975	9.58%	10.40%	42.25%	32.82%
	$25,000-$39,000	4,561,655	5,014,462	20.48%	19.66%	325,383	346,417	7.13%	6.91%	16.86%	16.15%	449,084	497,198	9.84%	9.92%	18.87%	17.53%
	$40,000-$59,999	3,297,222	4,352,152	14.80%	17.06%	257,125	293,054	7.80%	6.73%	13.32%	13.66%	367,463	449,055	11.14%	10.32%	15.44%	15.83%
	$60,000-$99,999	2,444,879	4,143,021	10.98%	16.24%	227,319	315,432	9.30%	7.61%	11.78%	14.70%	330,779	494,866	13.53%	11.94%	13.90%	17.45%
	$100,000 or more	1,470,865	3,044,917	6.60%	11.94%	169,950	328,777	11.55%	10.80%	8.81%	15.32%	227,399	464,576	15.46%	15.26%	9.55%	16.38%
	Total	22,275,453	25,509,859			1,930,027	2,145,591	8.66%	8.41%			2,380,297	2,836,670	10.69%	11.12%		

The proportion of adults approaching retirement age (45 to 64) within a TOD and with an income of $100,000 or more, increased from 21.08% of the total TOD population in 2000 to 31.00% in 2010. The area outside the TOD and the national population also showed similar increases, indicating that this trend may not necessarily be TOD related, but rather a national population trend.

For adults aged 65+, those living within a TOD had a much lower proportion than other age groups with an income less than $25,000 for the year 2010 as compared with 2000. This is the same for adults residing in the area outside of the TOD, where the proportion of adults aged 65+ with an income less than $25,000 is lower for the year

2010 than the year 2000. Householders under 25 years old had a higher proportion within TODs with an income less than $25,000 compared to their middle-aged counterparts. For both years, 2000 and 2010, the proportion of householders living in the area outside the TOD with an income less than $25,000 is lower than the proportion of adults living within the TOD area, which indicates that lower income householders tend to live closer to the TOD center.

Next, we examine the proportion of households collecting social security income and retirement income in TOD areas in **Table 2.3**. Between years 2000 and 2010 there does appear to be an increase in the amount of households collecting both social security and retirement income. But these proportions appear to have remained the same across TOD and non-TOD areas and at the national level. Essentially, the amount of benefits collected has increased nationally overall, so one might expect there would be an increase around the 0.5 mile areas as well as the area surrounding the TOD.

Table 2.3 Social Security and Retirement Income for Households in years 2000

Social Security Income for Households							
		With Social Security Income	Proportion of Total National Population	Proportion of Total Buffer Population	No Social Security Income	Proportion of Total National Population	Proportion of Total Buffer Population
2000	Total	27,084,417		25.66%	78,454,705		74.34%
	TOD Area	2,433,335	8.98%	22.17%	8,540,325	10.89%	77.83%
	Area Outside TOD	2,550,319	9.42%	24.52%	7,849,728	10.01%	75.48%
2010	Total	33,170,504		28.49%	83,273,882		71.51%
	TOD Area	2,594,372	7.82%	23.19%	8,594,959	10.32%	76.81%
	Area Outside TOD	3,528,486	10.64%	24.37%	10,405,618	22.82%	75.63%
Retirement Income for Households							
		With Retirement	Proportion of Total National Population	Proportion of Total Buffer Population	No Retirement	Proportion of Total National Population	Proportion of Total Buffer Population
2000	Total	17,659,058		16.73%	87,880,064		83.27%
	TOD Area	1,467,267	8.31%	13.37%	9,506,393	10.82%	86.63%
	Area Outside TOD	1,692,429	9.58%	16.27%	8,707,618	9.91%	83.73%
2010	Total	20,460,879		17.57%	95,983,507		82.43%
	TOD Area	1,417,709	6.93%	12.67%	9,771,622	10.18%	87.33%
	Area Outside TOD	2,133,585	10.43%	14.14%	11,800,519	12.29%	85.86%

The proportion of households collecting these benefits within the area outside the TOD and TOD area is roughly consistent across time periods. There appears to be a slightly lower proportion of households collecting benefits within the TOD area for both time periods. Interestingly, at the national level the amount of households collecting social security increased from 25.66% to 28.49% from the year 2000 to 2010, yet in the area outside the TOD this proportions stayed roughly at 24% while the TOD area only increased by one percent in 2010 compared to 2000. Another observation of note is that the amount of retirement income collected by households decreased in both the TOD area and the area adjacent to TODs from the years 2000 to 2010. This may be possibly due to

aging residents of TODs choosing to retire later in life so they are not yet receiving a retirement income. Another possibility is that aging adults are choosing to retire in sunbelt areas without major transit systems.

Finally, we examine automobile ownership by age of householder for the years 2000 and 2010 in **Table 2.4.** Unsurprisingly, there is a much larger majority of households residing within a TOD area that do not own a vehicle. This number only appears to have increased slightly from 22.47% to 23.95% from the years 2000 to 2010. There is also a much lower proportion of households that own one or more vehicles residing within a TOD compared to the area outside the TOD, where in the year 2010 only 4.10% of households within a TOD owned a vehicle, while 10.03% of households outside the TOD owned a vehicle. Interestingly, adults 65+ make up the lowest proportion of households where no vehicle is available. From the years 2010 to 2000 this decreased from 25.16% to 22.99%, meaning vehicle availability for aging populations declined compared to the rest of age groups. Conversely, for the area outside the TOD, householders between ages 15 to 34 years of age have the lowest proportion of adults with no vehicle available. Examining households where there are one or more vehicles available it appears that the proportion of householders aged 65+ did not change much between the years 2000 and 2010, where these households make up the smallest proportion of households with no access to a vehicle within and without TOD areas.

Table 2.4 Automobile Ownership by Age of Householder in years 2000 and 2010

	Total		Proportion of Total National Population		TOD Area		Proportion of Total National Population		Proportion of Total TOD Population		Area Outside the TOD		Proportion of Total National Population		Proportion of Total Area Outside the TOD	
	2000	2010	2000	2010	2000	2010	2000	2010	2000	2010	2000	2010	2000	2010	2000	2010
No Vehicles Available by Age of Householder																
15 to 34 Years	2,440,860	2,325,360	22.47%	21.86%	671,467	728,864	6.18%	6.85%	27.51%	28.62%	430,943	424,261	3.97%	3.99%	22.69%	22.04%
35 to 64 years	4,460,446	4,729,324	41.07%	44.47%	1,155,019	1,232,527	10.63%	11.59%	47.33%	48.39%	812,025	880,153	7.48%	8.28%	42.75%	45.72%
65 years and up	3,959,761	3,581,303	36.46%	33.67%	613,997	585,603	5.65%	5.51%	25.16%	22.99%	656,380	620,614	6.04%	5.84%	34.56%	32.24%
Total	10,861,067	10,635,987			2,440,483	2,546,994	22.47%	23.95%			1,899,349	1,925,029	17.49%	18.10%		
1 or More Vehicles Available by Age of Householder																
15 to 34 Years	20,990,720	20,864,567	22.18%	19.72%	984,830	1,130,142	0.93%	1.07%	27.20%	25.97%	2,425,951	2,706,546	2.56%	2.29%	22.86%	20.93%
35 to 64 years	54,953,385	63,015,276	58.08%	59.56%	2,047,489	2,538,489	1.94%	2.40%	56.55%	58.34%	6,197,414	7,844,824	6.55%	5.86%	58.41%	60.66%
65 years and up	18,674,929	21,928,556	19.74%	20.72%	588,635	682,387	0.56%	0.64%	16.26%	15.68%	1,987,010	2,381,918	2.10%	1.88%	18.73%	18.42%
Total	94,619,034	105,808,399			3,620,955	4,351,017	3.42%	4.11%			10,610,375	12,933,288	11.21%	10.03%		

2.3.2 Changes in TOD-related Roadway Characteristics (2000-2010)

In order to assess density changes from 2000 and 2010, two road networks were obtained from the respective time periods and the number of line segments and intersections were calculated per acre for both the TOD area and the area outside the TOD. **Table 2.5** exhibits our findings where there is an overall increase in density from 2000 to 2010. It is important to note that, within the TOD area, density increases by .18 road segments per acre compared to the .057 increase in the area outside the TOD. This indicates that growth may have occurred at a faster rate closer to the TOD stop than at further distances from the TOD. Denser road networks could be positive in the context of an aging population because it could mean that there are more activities and opportunities in a given area inside a TOD that would allow individuals to reach locations without the use of a personal automobile. As the U.S. population continues to age, adults looking to downsize and relocate from suburban neighborhoods could choose to reside in TOD neighborhoods due to the attractiveness associated with a multitude of activities that are

relatively easy to access. This is especially true for aging adults who will no longer have the use of a personal vehicle.

Table 2.5 Road Network within Vicinity of TOD areas in the years 2002 and 2010

	Total	TOD Area	Per Acre	Area Outside of the TOD	Per Acre
2010 Road Segments	45,508,000	585,446	0.476	2,096,460	0.157
2010 Intersections	38,004,406	425,787	0.346	1,550,182	0.116
2000 Road Segments	36,597,668	370,940	0.301	1,341,499	0.100
2000 Intersections	26,357,366	263,276	0.214	971,970	0.073

2.3.3 Recent Activity Density for TOD and Nearby Areas

For the final part of our analysis, we examined the number of activities per acre within the TOD area and the area outside the TOD in order to get an idea of activity density and whether or not the areas closest to TODs would have enough or comparable levels of services beneficial to aging populations. Previous studies have indicated that the denser the area, the more likely individuals living in TODs are likely to walk and utilize public transit (Kim et al 2007). Therefore, we examined ten different types of activities thought to be of interest to aging populations based on a previous study (Horner et al. 2015). These activities include places such as restaurants, grocery stores, financial services, etc. **Table 2.6** shows that for all activities density increases in proximity to the TOD transit stop. The most notable increases are in restaurant, grocery store, and shopping opportunities where the number of activities per acre nearly doubles from the area outside of the TOD to the actual TOD area. Restaurants, shopping opportunities, and financial services are among the activities that have the greatest density across all other

activities. Also included is a measure of the diversity of activities within each geographic extent. We use the entropy index found in Cervero and Kockelman (1997), where activity entropy within TODs, areas outside of TODs, and the national level are compared*(27)*. Findings suggest that while TOD areas have a greater activity density than areas outside the TOD, the diversity of activities is somewhat smaller with an entropy index of 0.65 compared to 0.70 outside the TOD area.

Table 2.6 Number of Activities in TOD areas in 2012

Activities	Total	TOD Area	Actvities per Acre	Area Outside of the TOD	Actvities per Acre	Density Difference (Percent Change)
Financial Services	106,227	8,831	0.0072	11,215	0.0008	88.33%
Grocery Stores	64,181	7,642	0.0062	9,747	0.0007	88.28%
Libraries	14,840	1,166	0.0009	1,352	0.0001	89.34%
Parks	53,790	2,188	0.0018	6,864	0.0005	71.17%
Pharmacies	62,575	5,150	0.0042	7,503	0.0006	86.61%
Post Offices	27,252	1,283	0.0010	1,468	0.0001	89.48%
Restaurants	508,907	60,524	0.0492	70,027	0.0052	89.37%
Hospitals	9,744	500	0.0004	923	0.0001	83.03%
Shopping (Apparel)	53,042	7,680	0.0062	7,733	0.0006	90.75%
Shopping (misc.)	152,907	11,672	0.0095	19,504	0.0015	84.64%
Entropy Index	**0.74**	**0.65**		**0.70**		

2.4 Conclusion

With this analysis, we have produced the first known effort concerned with understanding the profiles of aging adults residing within and directly adjacent to TODs at a national level. While previous research centering on TODs has mostly examined travel behavior and how TOD reduces independence on automobile use *(*Nasri & Zhang,

2014), there has been no inquiry into the possible benefits TODs may provide aging populations. Overall, our study found that activities within TOD areas have higher densities than the area adjacent to TODs. We also noted of many demographic and socio-economic changes through our descriptive summaries of the various census and other statistics.

Key findings include: as of 2010 the proportion of individuals residing in TODs is young to middle aged adults. Trends indicate that adults are choosing to live in TODs at a younger age than in the year 2000, and are choosing to stay there as they approach middle age. The proportion of aging adults (aged 65+) appears to have remained steady from the years 2000 to 2010 or shown a minimal increase or decrease at some older age group levels. This indicates that older populations may not currently be attracted to the benefits of living in TOD communities compared to their younger counterparts. Another important finding is that adults aged 65+ had a higher proportion of householders with an income of $25,000 or less within a TOD. This could be construed as a positive, meaning that lower income aging adults are attracted to TODs because they do not have to expend as many finances on travel or a personal vehicle since studies have shown that most residents within TODs use transit and walk more than residents living outside TODs (Nasri & Zhang, 2014). This could also be an indication of aging in place, where older adults do not relocate after retirement age. Finally, our analysis on the road infrastructure and the density of activities within and adjacent to TODs shows that these communities have more opportunities that are closer in proximity to one another than to areas outside the TOD. Infrastructure density has also increased over time, which means, overall, TODs are seeing more development than the in the 0.5 to 2-mile control area. This means

that TODs are essentially becoming more walkable in terms of distance to opportunities and also have a greater number of opportunities per acre compared to the area outside the TOD. Residing in denser TOD communities could perhaps be beneficial to aging populations because they would need to travel shorter distances and would be able to rely less on a person vehicle.

Future work should concentrate on what could potentially attract older adults to TOD. Currently, demographic trends indicate that younger to middle aged adults make up the highest proportion of residents within TODs at the national level, and understanding the reasons for this are worth additional research. Future research could also further disaggregate TODs into separate geographies in order to investigate their demographic and socioeconomic differences across space. This would better elucidate TOD population conditions in specific metropolitan areas. Future explanatory work could examine the amount of activities within TODs and determine whether the number of opportunities affects the types of individuals who choose to live there. If TODs prove to be an effective at meeting the aging population's needs it would give those interested in aging populations a path to collaborate with transportation planners in order to focus on transitioning more communities to those that resemble existing TODs.

Chapter 3 Examining Metropolitan Statistical Areas for Environmental Factors Affecting TOD Use among Older Adults

3.1 Introduction

In this chapter, we aim to reveal important differences across TODs by disaggregating them in various Metropolitan Statistical Areas (MSA), and by the public transport mode(s) they offer to their residents. We analyze the population growth of aging adults for the years 2000 and 2010, and we examine whether MSA size, the number of public transit stops, and types of transit available have affected the proportion of aging adults that reside within TOD neighborhoods. Additionally, we look at the density and diversity of activities within each TOD area utilizing Walkscore data in order to assess the types of opportunities that might be attractive to the aging population. Results indicate that currently, TODs do not seem to be attracting aging adults but they do seem to be attracting adults nearing retirement age (55-64). In addition, transit systems with multiple stops and a variety of transit modes had an increase over time in adults aged 55-64 and a decrease in adults aged 85+ compared to the adjacent TOD areas. Since the 55-64 age cohort predominantly makes up the baby boomer population future work surrounding TODs should specifically examine their travel behavior within TODs.

3.2 Data and Methods

We compared data in a 0.5-mile radius from a transit stop with a control group, land .5-2 miles from the stop. The area inside .5 miles was identified as the TOD. .5 miles is one often used value as per previous studies (Cervero & Gorham, 1995; Arrington & Cervero, 2008; Kim, S. Ulfarsson et al, 2007). The control group is computed by

subtracting the .5 mile census data from the 2 mile census data. Using data from the 2010 and 2000 census we categorized TODs across 72 MSAs. We also classified each MSA: a small MSA was defined as having fewer than 500,000 people, a medium MSA had between 500,000 and one million people, a large MSA had between one million and three million people, while a very large MSA had more than three million people. This system of classification is close to the Census Bureau's and the Texas Institute of Technology's sizing for urbanized areas (Schrank et al. 2015). This was helpful because often TODs are located outside of what we would traditiional call an urban area and this especially holds true for TODs in the smallest category.

We took data from the National Historical Geographic Information System (NHGIS). This provided us with aggregate census data paired with geographic Information (GIS) boundary files for the United states during the years of our study. For population and demographic information including our age data we utilized the 2000 and 2010 census summary file 1 (Minnesota Population Center, 2011).

We also accessed the National Transit Oriented Development Database, (NTODD). All TOD station locations were obtained from the NTODD. The database is run and maintained by the Center for Transit-Oriented Development for the year 2011. The database includes all stations in the US, wether or not they would actually be defined as a TOD under the criteria outlined in the introduction. In this section we accepted this limitation and used TOD interchangably with "station area," but we understand that this is not the perfect definition of TOD. We classified each TOD by its primary transit mode and then looked at how many stops were avaliable on that mode within each MSA. The

TOD database includes a large nuber of different types of transit modes but we focused on commuter rail, light rail, rapid transit which included heavy rail, street car, and bus rapid transit (BRT). We did not include ferries, inclines, monorais, or tram stops because there were not enough instances of each station to provide neough data to usefully analyze. Even excluding these modes we were left with 4,308 TOD stations across 72 MSA.

Another important measure used in this study was the Walk Score (WS). WSs are propriety data that measure the closeness of grocery stores, schools, resteraunts, parks, and other shopping activities to an address using a patented system. The scores range from 0-100 with 0 as the least walkable and 100 as the most walkable. The scores are further broken down into catagories with 0-49 considred 'car dependant,' 50-69 as 'somewhat walkable,' 70-89 as 'very walkable,' and 90-100 as 'walker's paradise.' We requested the WS for all of our 4,308 TOD stations. We applied these scores to each MSA by averaging the WS and activity scores for each of the TODs within the MSA. This helped us to look at average city walkability and neighboorhood characteristics for the areas around TODs within the MSA, so we know how walking friendly, and thus have a rough estimate of which MSAs feature TODs as earlier defined rather than just stations.

3.3 Results

Table 3.1 Population growth rates of aging populations within those MSA's characterized as "Very Large" between the 2000 and 2010 censuses.

TOD grew more than 10% than areas outside TOD
TOD grew from 5% to 10% relative to areas outside TOD
TOD grew or shrank relative to control area +/- 5%
TOD shrank from 5% to 10% relative to areas outside TOD
TOD shrank more than 10% relative to areas outside TOD

		Population Growth Within .5 Miles of TOD Stop										Population Growth Area Outside of TOD Stop									
Metropolitan Statistical Area	Total Stops	Total Population		55 to 64		65 to 74		75 to 84		85 and up		Total Population		55 to 64		65 to 74		75 to 84		85 and up	
Detroit-Warren-Dearborn	12	-13.3%	-1,116	50.1%	454	14.4%	78	-5.7%	-18	5.9%	6	-10.9%	-5,591	47.0%	1,636	-4.8%	-246	-22.8%	-543	-7.4%	-68
Riverside-San Bernardino-Ontario	12	17.7%	5,852	56.1%	1,053	26.9%	352	8.0%	73	10.3%	40	13.2%	76,892	58.9%	19,289	19.3%	4,199	10.3%	1,454	23.4%	1,116
Houston-The Woodlands-Sugarland	16	25.9%	8,039	105.5%	1,815	35.9%	320	-8.8%	-51	8.1%	23	11.0%	20,086	66.8%	6,468	8.7%	397	-13.2%	-679	0.2%	-18
Minneapolis-St. Paul-Bloomington	25	9.2%	4,867	77.4%	2,460	20.5%	459	-13.5%	-253	-22.7%	-265	2.0%	7,435	50.9%	10,263	9.5%	1,202	-12.0%	-1,317	-5.1%	-21
Phoenix-Mesa-Scottsdale	33	1.1%	819	54.6%	2,085	-2.1%	-57	-27.4%	-563	-2.6%	-19	-5.7%	-23,719	33.1%	5,858	-2.8%	-419	-21.4%	-2,071	2.8%	142
Seattle-Tacoma-Bellevue	36	14.2%	14,838	57.5%	5,098	16.8%	1,099	-9.6%	-534	14.1%	345	8.1%	52,126	58.0%	25,341	18.8%	5,777	-12.8%	-3,255	23.5%	2,277
Atlanta-Sandy Springs-Roswell	41	5.1%	5,317	55.4%	3,477	1.5%	66	-25.1%	-858	-24.4%	-398	1.2%	7,213	41.0%	12,850	5.5%	1,448	-14.3%	-1,975	-0.7%	336
Miami-Fort Lauderdale-West Palm Beach	67	17.0%	28,903	35.1%	5,097	4.9%	614	0.9%	80	-0.2%	-7	3.9%	49,469	27.6%	26,915	0.4%	-226	-4.4%	-3,247	-0.2%	-42
San Diego-Carlsbad-San Marcos	78	7.1%	18,183	62.2%	9,760	5.8%	732	-5.7%	-522	25.9%	792	5.4%	77,125	56.0%	43,911	2.9%	1,607	-6.9%	-3,715	32.2%	5,865
Dallas-Fort Worth-Arlington	94	-0.1%	-177	39.3%	4,083	1.6%	112	-13.5%	-700	-12.2%	-313	0.1%	1,030	36.3%	28,698	11.9%	6,970	-0.5%	506	12.2%	2,114
Los Angeles-Long Beach-Anaheim	126	2.5%	23,143	49.9%	27,024	13.7%	5,460	6.5%	1,725	22.0%	2,200	2.1%	120,758	47.4%	151,190	14.6%	33,291	5.5%	7,834	31.6%	17,089
Washington-Arlington-Alexandria	130	13.6%	70,633	39.7%	16,471	14.3%	3,922	-11.8%	-2,290	8.6%	645	9.4%	221,727	43.2%	67,684	17.1%	17,314	-4.3%	-1,271	30.4%	8,090
Boston-Cambridge-Newton	282	4.4%	41,145	39.9%	27,372	4.9%	2,587	-7.4%	-2,862	7.2%	1,135	2.8%	79,356	40.6%	67,807	1.0%	-704	-8.1%	-8,334	14.4%	6,571
San Francisco-Oakland-Hayward	327	6.3%	52,877	53.7%	36,090	5.5%	2,945	-4.9%	-1,924	20.0%	3,137	3.2%	93,115	48.0%	77,755	9.4%	13,418	-4.9%	-4,367	26.8%	9,765
Chicago-Naperville-Elgin	410	-4.0%	-81,011	30.7%	45,343	-0.9%	-963	-11.3%	-8,183	6.3%	1,629	-2.2%	-135,654	33.3%	119,543	0.5%	2,674	-8.2%	-12,521	20.6%	16,225
Philadelphia-Camden-Wilmington	601	0.1%	885	34.7%	36,647	-11.4%	-10,259	-20.1%	-13,451	4.0%	929	1.0%	33,833	35.9%	63,892	-7.5%	-7,466	-14.6%	-12,102	18.5%	9,891
New York-Newark-Jersey City	891	2.2%	163,134	30.4%	187,424	6.0%	26,841	-1.8%	-5,294	11.9%	13,506	2.1%	317,271	31.2%	218,045	3.5%	7,156	-2.3%	-9,523	21.0%	35,889

Table 3.1 demonstrates the change in growth for older adults within Very Large MSAs between 2000 and 2010. The chart has 4 age catagories, 55-64, 65-74, 75 to 84, and finally 85+. Total population change is also shown. These MSAs are further sorted by the number of transit stops for all measured modes of transportation, in ascending order. We color-coded the cells to make them easier to read, please refer to the legend for more details.

Most of the TODs in our study fall into one of the Very Large MSAs. There are 3,181 TODs present in these MSAs out of a total 4,308. Detroit-Warren-Dearborn, MI and Riverside-San Bernadino-Ontario have the lowest number of TODs, 12 each, while

the New York-Newark-Jersey City have by far the highest, with 891. TOD areas experienced growth for the total population except for the Chicago, IL, Dallas, TX, and Detroit, MI MSAs. The Phoenix MSA showed a suprising population growth of 1.1% which was startling compared to the 5.7% population *decrease* outside of the TOD area. Because of the baby boomer generation most of the largest growth was in the 55-64 group. There seems to be a general decline amoung the 85+ group both inside and outside of TODs, though this decrease is more pronounced inside TOD neighborhoods. The two Californian MSAs, Riverside and Los Angeles, were the only TOD areas that had no reduction in their oldest populations growth, but the areas outside of these TODs followed the same pattern so this positive growth does not suggest that older adults were attracted to these areas.

When we looked at the population growth within TODs to the area outside TODs in Very Large MSAs it became obvious that our 55 to 64 cohorts had dramatically higher growth rates within TODs than outside of TODs. It would seem that pre-retirement baby boomers are more attracted to TOD areas or are aging in place in these areas more than they are in neighborhoods just outside these TODs. While the 85+ group showed a general decline both inside and outside the TOD areas the decline inside the TOD areas were greater. We are not exactly sure why this is, whether the oldest cohort is intentionally relocating outside of these areas or those 85+ are just not choosing to move to TOD areas.

Table 3.2 Transit type, Walk Score, and Activity Score for all TODs in the Very Large MSAs.

State	Metropolitan Statistical Area	% of Adults aged 65 +	Commuter Rail	Light Rail	Street Car	Rapid Transit	Rapid Bus Transit	**Total Stops**	Walk Score	Culture Score	Dining and Drinking Score	Errands Score	Grocery Score	Parks Score	Shopping Score
California	Riverside-San Bernardino-Ontario	7.9%	12	0	0	0	0	**12**	48.1	35.6	57.5	57.1	55.2	55.0	50.7
Minnesota	Minneapolis-St. Paul-Bloomington	9.1%	6	19	0	0	0	**25**	54.7	61.2	64.4	64.7	57.3	43.1	59.8
Maryland/Virginia/D.C.	Washington-Arlington-Alexandria	9.6%	44	0	0	86	0	**130**	62.1	56.3	66.3	66.1	66.0	68.5	62.9
Texas	Dallas-Fort Worth-Arlington	7.8%	13	57	24	0	0	**94**	63.1	51.6	71.5	69.9	66.6	64.5	67.9
Georgia	Atlanta-Sandy Springs-Roswell	7.6%	0	0	0	41	0	**41**	65.3	56.9	74.6	70.0	72.8	68.4	75.1
California	San Diego-Carlsbad-San Marcos	9.4%	9	15	54	0	0	**78**	65.4	49.8	74.2	71.6	76.0	66.3	72.7
Arizona	Phoenix-Mesa-Scottsdale	6.3%	0	33	0	0	0	**33**	68.2	60.5	79.6	74.4	69.7	68.1	70.3
Illinois/Wisconsin/Indiana	Chicago-Naperville-Elgin	10.4%	254	0	14	142	0	**410**	68.9	58.2	72.1	72.2	72.1	79.9	68.0
California	Los Angeles-Long Beach-Anaheim	9.2%	38	57	0	16	15	**126**	69.9	59.6	76.8	70.4	79.5	66.1	76.2
Massachusetts/New Hampshire	Boston-Cambridge-Newton	11.1%	127	72	0	49	34	**282**	71.8	63.0	76.4	77.2	76.3	90.2	68.8
Pennsylvania	Philadelphia-Camden-Wilmington	11.8%	183	17	316	85	0	**601**	74.1	63.6	76.1	73.9	81.2	72.1	72.6
Texas	Houston-The Woodlands-Sugarland	5.2%	0	16	0	0	0	**16**	74.1	76.0	81.9	84.4	67.6	84.4	72.8
Florida	Miami-Fort Lauderdale-West Palm Beach	12.8%	17	0	0	50	0	**67**	75.8	60.5	78.7	78.2	81.6	76.1	78.4
Washington	Seattle-Tacoma-Bellevue	13.0%	26	0	10	0	0	**36**	78.3	75.1	85.1	82.0	84.5	82.9	82.9
New York/New Jersey	New York-Newark-Jersey City	11.6%	350	41	0	500	0	**891**	81.2	70.3	83.6	85.0	87.0	78.4	80.4
California	San Francisco-Oakland-Hayward	12.6%	28	0	255	44	0	**327**	87.0	82.6	89.5	86.0	92.1	94.4	83.1
Michigan	Detroit-Warren-Dearborn	13.9%	0	12	0	0	0	**12**	92.3	97.9	98.0	95.4	94.5	98.6	93.8

In table 3.2, we see transit mode information, WSs, and activity scores. We took the average of WS and activity scores of all TODs within each MSA. The table is sorted by WS in ascending order, with Detroit-Warren-Darborn having the highest WS while Riverside-San Bernadino-Ontario has the lowest walk score. Only the Riverside-San Bernadino-Ontario system ranks in the lowest 'car dependant' WS category. The chart also contains information on the proportions of older adults 65+, that is retirement age adults, living inside the TOD. A few of the systems only have one sort of stop, but most of them contain multiple different types of transit.

The fact that most of these systems are fairly walkable suggests that these areas may be livable without an automobile because many important shopping, community, and health facilities can be reached without a car. MSAs with higher WS also on average have a higher percentage of retirement aged adults compared to those with poorer WS. The Riverside, CA MSA has the lowest walk score, is exclusively commuter rail, and has one of the lowest percentages of older adults. TODs in this MSA are most likely suburban developments where public transportation is primarily used to access work.

We performed a Chi-square statistical test looking at the modes of transit and WS and found that the mode of transit is statiscally dependent upon WS for Very Large MSAs (χ^2=956.2, p=.00). Thus, by looking at which transit modes are available within an area we should be able to predict whether the area is walk-able and active or not.

Table 3.3 Population growth rates within Large MSAs from the 2000 and 2010 census.

		Population Growth Within .5 Miles of TOD Stop										Population Growth Area Outside of TOD Stop									
Metropolitan Statistical Area	**Total Stops**	Total Population		55 to 64		65 to 74		75 to 84		85 and up		Total Population		55 to 64		65 to 74		75 to 84		85 and up	
Milwaukee-Waukesha-West Allis	**2**	56.7%	1,595	128.6%	196	11.8%	15	35.4%	21	-34.9%	-8	5.1%	6,155	40.1%	2,999	-6.3%	-420	-10.7%	-465	-4.3%	-56
Hartford-West Hartford-East Hartford	**3**	7.6%	158	48.4%	109	17.1%	35	-0.6%	-1	67.6%	31	0.1%	27	39.9%	898	21.8%	398	9.5%	136	35.9%	148
Providence-Warwick	**5**	1.7%	347	41.5%	609	-6.9%	-92	-13.4%	-137	24.7%	95	-0.3%	-728	38.0%	6,299	-9.1%	-1,345	-21.7%	-2,662	13.8%	559
Nashville-Davidson--Murfreesboro-Franklin	**6**	25.9%	1,520	91.8%	401	64.5%	192	33.2%	77	34.0%	46	6.9%	7,265	46.0%	3,134	9.5%	353	0.1%	-76	-4.2%	-120
Jacksonville	**8**	36.6%	1,628	104.3%	433	28.5%	144	-15.1%	-73	-13.5%	-34	-5.1%	-2,950	44.8%	1,519	-7.6%	-432	-30.6%	-926	-19.6%	-264
Austin-Round Rock-San Marcos	**9**	19.1%	3,312	77.8%	760	-19.7%	-183	-17.8%	-124	-4.6%	-13	10.0%	28,183	78.9%	9,855	12.7%	1,382	-7.0%	-336	12.4%	322
Virginia Beach-Norfolk-Newport	**11**	38.2%	9,160	51.7%	902	3.8%	57	-4.5%	-55	18.6%	85	16.0%	23,639	39.9%	3,421	-7.9%	-798	-9.8%	-571	16.5%	257
Tampa-St. Petersburg-Clearwater	**11**	51.0%	3,670	69.9%	375	-3.1%	-18	-17.1%	-62	-22.0%	-32	8.8%	5,535	39.7%	1,577	-4.0%	-147	-14.2%	-329	-9.2%	-64
Charlotte-Concord-Gastonia	**15**	27.3%	5,614	49.2%	701	-6.0%	-66	-12.1%	-82	38.4%	64	7.6%	9,168	36.1%	2,441	-1.0%	2	-11.7%	-454	46.7%	602
Buffalo-Cheektowaga-Niagara Falls	**16**	-5.5%	-2,449	38.1%	1,262	-21.8%	-698	-24.2%	-588	-13.9%	-149	-10.5%	-25,631	31.3%	4,627	-21.5%	-2,990	-26.8%	-2,795	-12.7%	-424
Memphis	**23**	5.0%	789	63.1%	760	-11.0%	-101	-50.4%	-332	-46.8%	-136	-10.8%	-9,210	46.9%	2,181	-9.7%	-370	-28.8%	-649	-23.8%	-190
St. Louis	**37**	2.6%	1,920	46.6%	2,631	-6.1%	-283	-17.9%	-602	-20.1%	-278	-4.9%	-23,830	41.2%	12,760	-13.9%	-4,274	-20.1%	-4,342	-8.3%	-558
Salt Lake City	**41**	13.2%	9,740	51.0%	2,250	22.2%	707	-9.8%	-243	6.9%	65	10.7%	48,685	56.7%	14,051	25.1%	4,141	-1.2%	81	19.4%	895
Las Vegas-Henderson-Paradise	**47**	4.8%	5,961	28.6%	3,083	4.2%	317	-10.7%	-452	1.3%	13	5.7%	26,394	25.6%	7,146	4.0%	835	-6.5%	-596	13.6%	512
Denver-Aurora-Lakewood	**54**	16.6%	11,961	64.6%	3,490	4.4%	178	-14.3%	-438	3.6%	45	3.5%	18,413	52.0%	17,812	8.8%	2,415	-8.6%	-1,515	23.7%	1,987
Kansas City	**55**	0.1%	64	66.2%	2,044	-1.3%	-28	-29.7%	-523	-31.0%	-231	-7.1%	-11,945	42.1%	3,310	-9.6%	-916	-24.1%	-1,275	-13.2%	-140
Sacramento--Roseville--Arden-Arcade	**61**	-1.3%	-1,502	45.3%	4,097	-1.1%	-76	-13.8%	-702	5.4%	106	3.5%	22,141	48.9%	20,346	3.9%	1,623	-7.0%	-1,328	35.1%	3,364
Baltimore-Columbia-Towson	**66**	-2.2%	-3,917	25.2%	3,882	-12.1%	-1,551	-20.0%	-1,751	11.4%	309	2.3%	20,888	32.5%	20,798	-7.4%	-3,040	-10.2%	-2,576	32.8%	4,013
Pittsburgh	**82**	-9.3%	-15,904	36.1%	5,075	-22.1%	-3,079	-21.5%	-2,399	9.8%	351	-7.0%	-39,779	32.4%	10,883	-20.0%	-6,499	-20.3%	-5,243	17.3%	1,743
San Jose-Sunnyvale-Santa Clara	**83**	13.6%	33,548	49.4%	8,505	30.2%	3,302	13.1%	981	41.6%	1,140	6.0%	70,507	40.7%	27,282	21.4%	8,770	9.0%	2,303	44.2%	4,243
Cleveland-Elyria	**90**	-12.7%	-18,989	32.4%	3,634	-17.4%	-1,673	-18.8%	-1,236	-8.0%	-209	-15.4%	-91,284	24.2%	7,750	-19.4%	-6,302	-16.4%	-3,324	0.1%	216
New Orleans-Metairie	**97**	-16.4%	-16,974	24.0%	2,032	-10.1%	-623	-31.7%	-1,342	-31.7%	-642	-24.8%	-77,772	13.3%	1,305	-23.2%	-3,945	-37.0%	-3,873	-25.3%	-731
Portland-Vancouver-Hillsborough	**137**	18.1%	33,965	73.2%	9,700	25.4%	2,301	-11.0%	-844	22.7%	727	12.2%	111,753	71.9%	39,567	25.6%	9,396	-9.2%	-2,588	29.0%	3,368

Table 3.3 demonstrates dramatically fewer TOD stops, 959 total. Again though there is a large amount of varation within the category where Portland, OR has 137 stops compared to Milwaukee, WI's 2. Milwaukee though has the largest percentage growth increase around TODs (56.7) while San Jose has the largest real numbers population increase at 33,548. Two areas had population declines, New Orelans, LA (-16.7) and Cleveland, OH (-12.1%) though new Orleans' decline can at least partially be explained by hurrican Katrina in 2005.

Again, generally TODs grew more than the surrounding area for total population. Milwaukee again had the highest inside vs. outside the TOD growth, growing at least 10% more than the control area. Baltimore, MD and Salt Lake City, UT were the TODs within this cohort who saw higher growth outside the TOD area than inside. Over all the 55-64 cohort incrased within TODs faster than in the control area. Again like the Very Large TODs there was an over all decline in the 85+ group, and again the decline was more noticible within TODs than outside them. There were though a few areas that had an increase in this demographic, Hartford, CT, Providence, RI, and Nashville, TN. These MSAs have few transit stops and all of those transit stops are commuter rail, so this might suggest that our oldest cohort may rside on the outskirts of the city near commuter rail TODs.

Large MSAs tend to have a lower variety of transit options avaliable when compared to Very Large MSAs, which is intuitive. Only Baltimore, MD, Leveland, OH,

and Portland, OR have more than three different transit options. These cities also have dramatic splits in their walk scores, where Milwaukee, Wi and Hartford, CT's transit systems consist of a few commuter stops which serve those living outside the urban core. This cmpoares to places like New Orleans, LA and Memphis TN which have large numbers of street car TODs that exclusively serve the urban core. Again backing up our transit/WS Chi-square these cities with street cars have vastly higher walking scores than cities with mostly or exclusively commuter rail. New Orleans and Memphis are also the areas that saw an overall or realitive decline in the 65+ demographic, which might suggest that denser, more urban areas are not as attractive to older adults who might prefer more suburban communities (DeGood et al. 2010; Kim, 2011). Again though, to be fair, New Orleans was hit by the incredibly serious hurrican Katrina which most likely displaced many older adults. The percentage of those over the age of 65 in New Orleans is low compared to other MSAs in this group (9.0%).

Table 3.4 Number of different types of transit stops, Walk Scores, and Activity Scores for various TODs in Large MSAs.

State	Metropolitan Statistical Area	% of Adults aged 65 +	Commuter Rail	Light Rail	Street Car	Rapid Transit	Rapid Bus Transit	Total Stops	Walk Score	Culture Score	Dining and Drinking Score	Errands Score	Grocery Score	Parks Score	Shopping Score
Tennessee	Nashville-Davidson--Murfreesboro-Franklin	7.1%	6	0	0	0	0	**6**	36.3	39.4	51.2	60.0	48.5	16.3	46.7
Connecticut	Hartford-West Hartford-East Hartford	12.1%	3	0	0	0	0	**3**	38.7	44.7	57.7	56.9	40.2	53.0	72.2
Missouri/Illinois	St. Louis	5.5%	0	37	0	0	0	**37**	47.7	54.4	57.9	55.2	46.0	42.9	50.5
Wisconsin	Milwaukee-Waukesha-West Allis	7.8%	2	0	0	0	0	**2**	49.5	40.8	51.1	67.7	41.9	93.6	63.5
Utah	Salt Lake City	13.3%	41	0	0	0	0	**41**	51.5	51.9	59.0	65.0	53.0	44.7	60.7
Pennsylvania	Pittsburgh	8.6%	0	60	0	0	22	**82**	51.9	46.6	60.1	61.9	49.9	31.2	51.7
Texas	Austin-Round Rock-San Marcos	9.7%	9	0	0	0	0	**9**	53.6	37.8	68.1	63.2	61.7	45.4	58.4
Maryland	Baltimore-Columbia-Towson	11.7%	14	35	0	14	3	**66**	55.4	45.9	65.5	63.4	59.9	52.7	59.6
California	San Jose-Sunnyvale-Santa Clara	9.5%	18	65	0	0	0	**83**	57.8	43.7	70.8	61.1	66.2	60.5	56.8
Virginia	Virginia Beach-Norfolk-Newport	21.0%	0	11	0	0	0	**11**	60.0	54.6	61.5	66.1	60.2	52.4	65.9
Nevada	Las Vegas-Henderson-Paradise	11.3%	0	0	0	0	47	**47**	60.7	36.8	73.5	63.3	65.2	64.6	59.3
Massachusetts/Rhode Island	Providence-Warwick	12.4%	5	0	0	0	0	**5**	63.2	46.6	77.1	74.9	56.5	37.7	66.6
Ohio	Cleveland-Elyria	10.8%	0	31	0	18	41	**90**	63.4	66.5	65.8	61.9	70.3	72.3	62.3
California	Sacramento--Roseville--Arden-Arcade	12.4%	4	57	0	0	0	**61**	64.4	53.4	71.0	66.1	73.6	82.7	62.3
Florida	Jacksonville	12.0%	0	8	0	0	0	**8**	65.6	83.8	81.0	82.2	62.9	68.0	75.8
North Carolina	Charlotte-Concord-Gastonia	9.2%	0	15	0	0	0	**15**	66.8	50.6	81.6	78.1	76.2	44.9	76.8
Colorado	Denver-Aurora-Lakewood	15.2%	0	54	0	0	0	**54**	72.0	70.3	81.4	76.6	68.0	76.5	75.6
Florida	Tampa-St. Petersburg-Clearwater	22.0%	0	0	11	0	0	**11**	72.8	92.4	86.3	80.4	55.3	86.9	71.9
Missouri	Kansas City	10.0%	0	0	0	0	55	**55**	78.6	75.8	83.0	81.2	73.8	88.2	83.8
Oregon/Washington	Portland-Vancouver-Hillsborough	9.8%	10	85	42	0	0	**137**	78.8	69.0	84.6	81.3	81.4	88.2	78.7
New York	Buffalo-Cheektowaga-Niagara Falls	9.8%	0	16	0	0	0	**16**	79.4	83.7	85.3	85.1	70.8	92.6	79.0
Tennessee	Memphis	7.9%	0	0	23	0	0	**23**	83.7	96.0	90.4	87.8	83.6	98.0	81.4
Louisiana	New Orleans-Metairie	9.0%	0	0	97	0	0	**97**	83.9	79.9	86.4	82.3	89.3	82.3	83.3

There are many Large MSA's that have a plethora of transit stops (30+) while still having WS in the lowest, 'car dependant' category. This means that while there are many transit stops located in these MSAs people would still need a car to function in most areas of these cities. This could have negative consequences for seniors who lose their ability to drive. Pittsburg has 60 light rail stops and 22 RBT stops and yet it score on the edge of 'car dependant; at 51.9. This is not the worst walk score, but it is unexpected given the

diverse and pleantiful transit options. Jacksonville and Tampa, FL have realitively high walk scores (65.3 and 72.8) even though they have few traffic stops and even less variety than most of the other Large MSAs in the study. Both of these systems are located in the cities down town and have large numbers of the baby boomer, pre-retirement (55-64) age group. These adults appear to flock to these TODs more than the nearby control groups, but it is unclear if they will continue to live in these neighborhoods after retirement. We could not find a pattern with adults over the age of 65 living in TODS in our Large MSA category.

Table 3.5 Population growth among the 55+ within Medium MSAs between the 2000 and 2010 censuses.

			Population Growth Within .5 Miles of TOD Stop										Population Growth Area Outside of TOD Stop									
State	Metropolitan Statistical Area	Total Stops	Total Population		55 to 64		65 to 74		75 to 84		85 and up		Total Population		55 to 64		65 to 74		75 to 84		85 and up	
New Jersey	Allentown-Bethlehem-Easton	1	-13.1%	-326	36.1%	63	-3.1%	-4	-5.0%	-4	-12.7%	-4	5.8%	927	43.5%	516	23.6%	209	11.3%	72	34.8%	110
California	Stockton-Lodi	3	9.6%	669	37.1%	150	-14.9%	-52	-12.4%	-25	-9.5%	-6	13.0%	12,740	58.1%	3,353	8.2%	432	-1.9%	-34	3.9%	50
Maine	Portland-South Portland	4	2.9%	233	56.8%	350	-4.1%	-20	-18.7%	-72	10.6%	16	0.3%	228	55.3%	2,940	-0.5%	-4	-12.6%	-417	6.8%	89
New York	Albany-Schenectady-Troy	6	1.7%	145	67.0%	390	2.0%	10	-29.1%	-115	-20.3%	-32	4.9%	5,897	53.5%	4,297	-4.5%	-336	-27.2%	-1,559	-8.4%	-198
Massachusetts	Worcester	6	0.1%	19	50.0%	429	-5.0%	-35	-32.1%	-202	-5.5%	-15	2.6%	4,501	42.9%	4,708	-7.7%	-738	-24.0%	-1,817	4.0%	147
California	Oxnard-Thousand Oaks-Ventura	6	11.8%	2,537	57.6%	754	15.6%	148	6.2%	41	50.1%	106	17.2%	41,022	65.4%	10,221	24.6%	2,701	16.4%	1,232	57.9%	1,315
New Mexico	Albuquerque	10	4.2%	431	74.8%	561	28.5%	147	-13.2%	-49	30.3%	31	8.5%	8,828	66.0%	4,885	26.6%	1,462	5.7%	278	16.8%	224
Connecticut	New Haven-Milford	13	2.8%	917	43.6%	1,012	10.3%	183	-22.3%	-369	3.1%	23	3.5%	11,016	39.8%	8,793	4.2%	630	-18.0%	-2,503	19.4%	1,115
Arkansas	Little Rock-North Little Rock	13	10.4%	293	78.5%	197	-2.7%	-6	-16.3%	-23	-8.2%	-5	-12.6%	-4,481	55.0%	1,256	-13.5%	-286	-38.3%	-682	-17.2%	-124
Connecticut	Bridgeport-Stamford-Norwalk	27	2.5%	1,802	26.5%	1,624	-0.9%	-41	-2.5%	-83	16.0%	207	3.8%	19,899	29.7%	11,462	-0.3%	-67	-9.9%	-2,318	19.4%	1,552

Table 3.5 depicts population growth in Medium MSAs for aging adults from the years 2000 to 2010 and is also organized according to the number of transit stops located within each MSA. Compared to other MSA sizes, there are fewer medium sized MSAs that have transit systems available to their residents. These systems vary in size but tend to contain less than 10 stops overall. Within TOD neighborhoods population growth increased for all MSAs except for Allentown, NJ/PA which decreased at a rate of -13.1%. This is interesting because the Allentown MSA as a whole has experienced steady

population growth. Examining population growth across age cohorts, again the 55 to 64 age brackets experienced the most growth overall, while the other age brackets have a mixture of both population growth and decline. Looking at the absolute population counts, the greatest decrease was -202 people among the cities, so while the growth rates may seem high in relative terms, Medium MSAs do not appear to be adding or losing large groups of people around TODs. For the most part, there is not a consistent pattern of growth or decline across age cohorts within TOD areas.

Little Rock's aging populations decreased at a lower rate than areas adjacent to TODs. Albuquerque, NM had the highest growth in individuals aged 85 and up within TOD areas and also had a higher growth rate than areas outside TODs. Generally, growth declines within TODs compared to areas outside TODs.

Table 3.6 contains information on WSs and related metrics of M-MSA TOD neighborhoods. Also included is information on the proportion of adults over age 65. Within TOD neighborhoods in Medium MSAs there appears to be a similar proportion of aging adults residing in TOD neighborhoods across all cities. One exception is New Haven, which has a smaller proportion (~6%) of older adults than the other Medium MSAs. All stops tend to be commuter rail with Little Rock, AK being the one exception. Little Rock, AK contains 13 streetcar stops and has the highest WS of any M-MSA. It also experienced the least population decline compared to areas outside TODs. This may not be surprising since street car systems tend to be located in the center of cities where development tends to be denser with greater activities within the vicinity *(*Walker, 2010*)*. Albuquerque, NM has the lowest WSs and related metrics. This could be due to the fact that Albuquerque's commuter rail system was developed in the last ten years and is

intended to serve the population commuting to Santa Fe, NM *(*Dittmar & Ohland, 2004*)*. Many of the stops are located outside of the city center and are predominantly park and ride facilities. With regards to attracting aging populations, even though Albuquerque has the lowest WS, it also had a higher increase in adults aged 55 to 64 as compared with the other Medium MSAs.

Table 3.6 Number of Transit Stops by Type, WS, and Activity Scores for TODs in Medium MSAs.

State	Metropolitan Statistical Area	**% of Adults aged 65 +**	Commuter Rail	Light Rail	Street Car	Rapid Transit	Rapid Bus Transit	Total Stops	Walk Score	Culture Score	Dining and Drinking Score	Errands Score	Grocery Score	Parks Score	Shopping Score
New Mexico	Albuquerque	8.8%	10	0	0	0	0	**10**	26.0	27.4	33.1	29.7	21.9	29.6	26.0
California	Stockton-Lodi	10.5%	3	0	0	0	0	**3**	39.7	20.5	27.2	40.0	77.2	39.7	33.8
Massachusetts	Worcester	11.9%	6	0	0	0	0	**6**	41.2	35.1	51.6	48.6	49.5	52.8	30.5
Maine	Portland-South Portland	10.5%	4	0	0	0	0	**4**	45.5	37.3	58.5	49.9	41.7	54.2	51.7
Connecticut	Bridgeport-Stamford-Norwalk	9.5%	27	0	0	0	0	**27**	54.5	54.7	65.4	65.0	64.5	54.7	58.4
New York	Albany-Schenectady-Troy	12.6%	6	0	0	0	0	**6**	58.7	61.9	68.7	66.3	65.3	49.4	53.3
Connecticut	New Haven-Milford	7.0%	13	0	0	0	0	**13**	64.5	70.9	69.3	66.9	77.3	75.7	66.7
New Jersey	Allentown-Bethlehem-Easton	10.8%	1	0	0	0	0	**1**	72.0	87.3	71.0	81.3	84.3	0.0	84.2
California	Oxnard-Thousand Oaks-Ventura	12.0%	6	0	0	0	0	**6**	72.0	65.1	73.5	74.0	84.4	84.8	74.3
Arkansas	Little Rock-North Little Rock	11.6%	0	0	13	0	0	**13**	73.8	94.2	86.8	84.7	93.6	84.1	71.8

For Medium MSAs we were unable to perform a Chi-Square statistical test because the number of stops within some categories was too small. At the same time, the characteristics of transit within Medium MSAs may not be ideal for older adults who could possibly relocate or age in place within TOD neighborhoods. The majority of

transit stops within Medium MSAs are assigned lower WSs. This could point to the fact that these neighborhoods do not offer accessible amenities that are typically found in traditional TOD neighborhoods.

3.3.1 Transit Oriented Development in Small MSAs

Table 3.7 shows the population growth rates from 2000-2010 in Small MSAs. The first observation is that generally, overall population increased within the half-mile TOD area. On a percentage basis, the largest gainer was Racine, WI at about 73%, while in absolute terms Ogden-Clearfield added the most people with about 2,574 total. Six of the smaller MSAs lost population during this time period, with half of those (3) being single-stop systems. When population growth is examined in the districts just outside of the TODs (a half-mile to 2 miles), we note that virtually all areas gained population. This might be expected as these locations span larger geographical areas. Only South Bend-Mishawaka and Atlantic City-Hammonton lost population over the time period in their adjacent TOD areas.

Comparing the areas outside of TODs to the TOD service area, it appears that there isn't a consistent increase or decrease in population growth across age cohorts within TOD areas compared to adjacent neighborhoods. Eugene, OR added more pre-retirement people (those aged 55-64) in absolute terms than any other MSA under consideration (1,317), and was one of the larger percent gainers (~72%) of any of the MSAs. On the other hand, adults 85 and up had some of the lowest gains where over half of the MSAs grew less than 10% compared to their adjacent neighborhoods. At the same

time, Glenn Falls, Longview, Santa Maria, and some other MSAs had TODs that grew at least 10% more than their adjacent neighborhoods.

Table 3.7 Population Growth Rate across Aging Populations within Small MSAs' from 2000 to 2010

		Population Growth Within .5 Miles of TOD Stop										Population Growth Area Outside of TOD Stop									
Metropolitan Statistical Area	Total Stops	Total Population		55 to 64		65 to 74		75 to 84		85 and up		Total Population		55 to 64		65 to 74		75 to 84		85 and up	
Mount Vernon-Anacortes	1	1.0%	27	66.1%	113	2.1%	2	-34.2%	-38	-5.5%	-2	17.9%	4,532	72.3%	1,244	34.9%	522	-1.7%	15	55.1%	316
Salem	1	-1.1%	-39	93.5%	167	19.2%	24	-22.0%	-21	-60.9%	-32	0.6%	280	71.8%	1,989	17.1%	325	-26.6%	-480	-17.8%	-126
Olympia-Tumwater	1	-2.7%	-282	39.2%	327	-4.4%	-29	-21.7%	-114	-3.1%	-7	9.4%	5,904	58.2%	2,799	10.6%	486	-9.9%	-242	24.9%	327
Albany	1	8.0%	227	111.0%	193	56.9%	58	-36.1%	-39	-13.7%	-6	13.5%	3,977	71.0%	1,418	39.7%	549	-15.4%	-185	13.4%	83
Norwich-New London	1	20.9%	517	72.7%	130	21.8%	32	-1.0%	-1	-8.6%	-3	5.5%	1,955	54.9%	1,134	-3.6%	-102	-20.8%	-337	11.6%	77
Vallejo-Fairfield	1	-6.6%	-492	64.4%	265	3.8%	15	-2.0%	-6	0.2%	0	0.3%	255	53.1%	2,883	3.0%	117	-10.8%	-336	12.2%	122
Hagerstown-Martinsburg	1	-5.6%	-162	59.1%	135	-9.8%	-17	-42.9%	-56	28.1%	9	22.1%	4,360	72.7%	1,117	7.6%	134	-4.1%	11	28.0%	84
Bellingham	1	13.3%	148	91.1%	108	40.0%	37	-2.0%	-1	19.5%	4	10.3%	1,792	88.0%	851	36.3%	294	-3.2%	-25	11.8%	46
Glens Falls	1	13.6%	86	45.1%	25	-6.3%	-3	18.5%	7	84.1%	13	13.1%	954	39.8%	230	-4.1%	-20	11.5%	40	68.4%	101
Racine	1	73.1%	276	131.3%	34	49.6%	10	51.0%	8	73.0%	5	22.0%	1,663	43.5%	282	25.4%	113	6.6%	18	47.1%	66
Longview	1	2.2%	66	46.7%	100	-2.5%	-5	-5.6%	-8	56.2%	47	2.9%	705	49.2%	928	5.8%	109	-3.5%	-45	24.8%	145
South Bend-Mishawaka	1	-3.2%	-16	20.4%	9	-33.6%	-19	4.0%	1	93.0%	5	-2.6%	-479	44.9%	594	-26.4%	-352	-18.4%	-196	38.7%	109
Harrisburg-Carlisle	2	0.0%	2	43.0%	239	-13.5%	-65	-14.1%	-46	-14.4%	-17	1.0%	683	45.2%	2,149	-10.1%	-367	-22.0%	-630	4.7%	70
San Luis Obispo-Paso Robles	2	-11.6%	-709	62.8%	240	-1.1%	-3	-2.2%	-4	22.9%	19	3.3%	1,883	61.8%	2,040	7.1%	232	-12.6%	-359	25.0%	286
Lancaster	3	2.4%	194	46.5%	259	-10.7%	-55	-40.3%	-223	-52.1%	-194	7.1%	6,546	52.5%	3,281	0.1%	63	-12.2%	-378	-5.4%	80
Michigan City-La Porte	3	-17.3%	-1,041	26.6%	119	-10.9%	-37	-35.3%	-94	-12.3%	-10	0.2%	56	38.7%	973	-5.2%	-92	-17.6%	-249	15.5%	115
Santa Fe	3	-9.3%	-542	74.6%	411	19.8%	85	-0.4%	-1	4.8%	11	-0.8%	-286	65.3%	2,091	30.3%	760	10.9%	216	24.7%	198
Atlantic City-Hammonton	4	2.2%	220	26.0%	212	-15.1%	-101	-21.6%	-102	3.6%	5	-2.1%	-1,504	32.3%	1,827	-8.1%	-341	-12.9%	-387	2.3%	24
Santa Maria-Santa Barbara	5	2.9%	321	67.9%	488	7.0%	40	9.0%	34	59.0%	69	2.0%	2,196	55.3%	3,338	8.1%	398	1.1%	8	29.2%	378
Ogden-Clearfield	7	29.4%	2,574	57.3%	329	45.3%	164	45.7%	88	62.4%	36	22.1%	37,173	59.4%	5,717	21.2%	1,433	10.0%	431	43.1%	682
Trenton-Ewing	10	8.9%	2,510	21.1%	402	-29.3%	-486	-41.5%	-567	-28.5%	-154	1.6%	3,005	35.6%	4,744	-10.9%	-788	-23.2%	-1,538	8.1%	405
Eugene	28	5.8%	1,952	71.9%	1,317	26.2%	363	-13.8%	-187	6.7%	47	5.1%	5,687	75.7%	4,628	23.7%	968	-13.5%	-504	23.0%	452

Similar to prior tables, Table 3.8 shows several characteristics of Small MSAs with various types of TODs, all sorted by their "WS". Generally, systems at this scale tend to consist of a few commuter rail stops (<7), with several systems having only 1 stop. A good example of one of these 'one stop' systems is Glen Falls MSA where the one stop serves the commuting population and provides access to many of the surrounding cities with more robust transit systems (New York City, Boston, etc.). Eugene, OR is the notable exception among these Small MSAs as it contains several BRT

stops (Cervero & Kockelman, 1997) in addition to a single commuter rail stop. Light rail is not a part of any of these smaller MSAs with the exception of Trenton-Ewing, NJ, and no smaller MSAs consist of systems with rapid transit or streetcars. In terms of possibly attracting older adults, TODs located in smaller MSAs tend to be associated with commuter rail. Therefore, we might expect that older adults could have a preference for smaller suburban communities that may have lower costs of living compared to TODs located in larger MSAs *(*Rosenbloom, 2003*)*.

Table 3.8 Number of Transit Stops by Type, WS, and Activity Score TODs in Small MSAs

State	Metropolitan Statistical Area	% of Adults aged 65 +	Commuter Rail	Light Rail	Street Car	Rapid Transit	Rapid Bus Transit	Total Stops	Walk Score	Culture Score	Dining and Drinking Score	Errands Score	Grocery Score	Parks Score	Shopping Score
Indiana	South Bend-Mishawaka	8.7%	1	0	0	0	0	1	16.0	22.5	35.1	26.7	0.0	31.2	35.3
Wisconsin	Racine	10.6%	1	0	0	0	0	1	17.0	67.6	27.9	38.2	0.0	0.0	21.2
Washington	Olympia-Tumwater	17.7%	1	0	0	0	0	1	20.0	0.0	36.1	4.9	2.2	6.6	50.2
Utah	Ogden-Clearfield	10.2%	7	0	0	0	0	7	28.6	20.5	34.0	45.0	37.5	43.8	41.7
Indiana	Michigan City-La Porte	16.1%	3	0	0	0	0	3	33.3	23.1	36.3	28.4	31.8	56.7	31.1
New York	Glens Falls	10.1%	1	0	0	0	0	1	37.0	84.3	50.5	63.5	0.0	68.5	47.2
California	Santa Maria-Santa Barbara	11.1%	5	0	0	0	0	5	46.8	44.4	48.4	53.4	61.8	60.9	43.0
New Mexico	Santa Fe	11.6%	3	0	0	0	0	3	54.3	43.8	63.9	55.1	61.0	65.7	56.5
New Jersey	Trenton-Ewing	14.5%	5	5	0	0	0	10	59.9	59.1	70.5	62.0	69.0	25.3	59.1
Pennsylvania	Lancaster	11.0%	3	0	0	0	0	3	60.0	55.9	70.0	73.7	52.5	34.2	72.2
Oregon	Eugene	8.2%	1	0	0	0	27	28	62.1	51.2	66.5	75.7	66.2	77.7	66.6
California	Vallejo-Fairfield	9.9%	1	0	0	0	0	1	63.0	1.3	74.7	23.8	96.6	80.7	67.6
New Jersey	Atlantic City-Hammonton	7.9%	4	0	0	0	0	4	65.0	77.5	68.6	65.8	85.0	37.3	69.4
Oregon	Albany	12.2%	1	0	0	0	0	1	66.0	69.3	77.4	72.3	40.1	34.6	72.3
Washington	Bellingham	9.9%	1	0	0	0	0	1	66.0	64.5	82.5	73.2	84.0	96.8	83.0
California	San Luis Obispo-Paso Robles	7.2%	2	0	0	0	0	2	66.0	58.9	76.7	71.9	55.5	84.6	70.1
Washington	Longview	11.0%	1	0	0	0	0	1	68.0	90.3	67.9	76.4	70.8	15.0	66.9
West Virginia	Hagerstown-Martinsburg	21.2%	1	0	0	0	0	1	74.0	98.2	67.1	74.4	66.0	99.5	79.3
Oregon	Salem	10.7%	1	0	0	0	0	1	76.0	99.5	74.9	82.4	72.5	94.0	70.1
Pennsylvania	Harrisburg-Carlisle	16.9%	2	0	0	0	0	2	79.5	99.0	82.4	84.3	87.5	40.6	69.2
Washington	Mount Vernon-Anacortes	7.7%	1	0	0	0	0	1	82.0	95.9	82.1	73.3	91.5	44.8	83.5
Connecticut	Norwich-New London	11.3%	1	0	0	0	0	1	88.0	98.5	91.1	81.0	96.2	100.0	84.4

Places with fewer stops tend to have higher WSs (and related metrics), as in general there appears to be correlations across metrics (places with higher WSs tend to have higher shopping scores). This is most likely because these very small systems

feature TODs where the single or few stops are key focal points of development for their local communities. Comparing these WS to the WSs from larger MSAs we see that smaller MSAs have lower average WSs than their larger counterparts.

At two different ends of the spectrum, there is Norwich-New London CT that performed very well on the WS metrics, while South Bend-Mishawaka IN tended to perform near the bottom on all metrics. Interestingly both are single-stop systems. This is mostly due to Norwich's station placement in a more developed location with a substantial range of activities near the central part of the city, while South Bend's commuter rail stop is located in a less diverse section of town where there are few activities. Norwich also has a high proportion of adults over age 65 (11.3%) compared to South Bend (8.7%). This suggests that even though these systems may be similar size, there is a great deal of diversity in their activity offerings. We wonder at how successful they have been at attracting older adults and if these single stop communities should be prioritized as potential places for older adults.

3.4 Conclusion

3.4.1 MSA Size

The number, variety, and availability of all transit modes vary by MSA size. Very large and Large MSAs had more options within respective MSAs because multiple types of transit are offered. Medium and Small MSAs were largely made up of commuter rail stops with typically only one stop offered per MSA. One notable finding is that, compared to the adjacent TOD areas across all types of MSAs, a decline in aging populations for the majority of older age cohorts was observed. This may suggest that older adults are moving away from TODs as they age or that older adults who relocate choose to forego relocating to TOD areas. Still, another important finding is that adults nearing retirement age (55-64) were more attracted to TODs than areas outside TODs in very large and Large MSAs. It is unclear whether these are adults who chose to age in place or they are relocating from other areas. The TODs in very large and Large MSAs had higher WSs and related metrics than TODs in smaller MSAs. One possibility is that the 55-64 age cohort prefers to reside in TODs where they have access to many activities and are able to travel without a personal vehicle.

3.4.2 Transit Modes and Walk Scores

Our findings have uncovered that the makeup of an MSA's TODs have different characteristics depending on the type and number of transit stops available within a city. Commuter rail is meant to service commuting populations and may or may not be located in a city's urban core but rather on the periphery where commuters can park and ride in

order to commute to and from work. As such commuter rail stops may not be ideal locations to further develop TOD urban concepts. As stated previously, very large and Large MSAs had a large variety and number of transit stops available. Stops within large and very Large MSAs were also very walkable or somewhat walkable and also had higher activity scores compared to medium and Small MSAs. Another finding is that transit systems with multiple stops and a variety of transit modes had an increase in adults aged 55-64 and a decrease in adults aged 85 and up compared to the adjacent TOD areas. This is an interesting observation because it shows that pre-retirement adults are attracted to TOD areas more than adjacent TOD areas, and they have chosen to live within areas where they have access to a number of amenities without the need for a personal vehicle. If TODs prove to be a possible solution to aging populations' transportation needs, it should be a priority to maintain the needs of the current pre-retirement age cohort that seems to be already residing within TOD neighborhoods.

Chapter 4 Case Studies on TODs that Attracted Older Adults between 2000-2010

4.1 Introduction and Methodology

While the previous chapters seek to provide a broad quantitative overview of TODs from the perspective of older adults, this chapter provides a qualitative exploration a few stations areas. The resulting findings (as discussed below) provide a more detailed and nuanced understanding of the specific station area characteristics that seem to provide an attractive environment for older adults.

Using the same data that was used in prior chapters, we applied a series of filters to selection stations for more detailed study. We first looked at TODs whose percentage growth of older adults (those over 65 in 2000) minus the percentage growth of older adults in the surrounding area (Those over 55 in 2010) was 5% or higher. This left us with 1,314 stations, or around 1/4th of our initial sample. We then looked at stations that had real growth above 20 older adults. This brought the number down precipitously, to 60. We further narrowed our list of case studies by focusing on those stations built after 2000 and before 2005, which might suggest that growth in both the total number of older adults and as a percentage of the population between 2000 and 2010 might have been spurred by transit investment. This led us to 14 stations in 4 areas.

We had some trouble acquiring data on one set of stations (in Northern Las Vegas), which led us to 12 stations in 3 areas: The Pearl District built around the Portland Streetcar in Portland, Oregon; The Kenosha Historic Downtown serviced by the Kenosha

Historic Streetcar in Kenosha, Washington; and Tampa's Downtown area built around the TECO Line Streetcar System in Tampa, Florida.

Because wanted more depth to our analysis that just three streetcar systems, we revisited the stations that met our growth and percentage growth criteria, but were not built between 2000 and 2005. We looked for stations that seemed to illustrate certain planning challenges or opportunities and selected the following: Downtown Miami in Miami, FL, which has seen a growth of older adults even as it has been the sight of renewal and an increase in their Millennial population; Eisenhower East in Alexandria VA which was built along a commuter line and which the planners did not intend for older adults; Boyle Heights which was dramatically lower income than any of our other stations; and South East Portland where a station was put in near a clump of retirement communities providing older adults access to the rest of the city.

Table 4.1 presents the station selected as case studies, along with the information used to select those stations.

Table 4.1 Station Selected for Case Studies

Name of Area	*Name of Station*	*Percentage Growth Inside – Percentage Growth Outside*	*Real Number Growth*	*Year Built*
The Pearl District	NW 10th and Marshall	10%	192	2001
The Pearl District	NW 12 and Northrup	10%	166	2001
The Pearl District	NW 11th and Johnson	8%	135	2001
The Pearl District	NW 10th and Johnson	7%	128	2001
The Pearl District	NW Lovejoy and 13th	9%	124	2001
The Pearl District	NW Northrup and 14th	9%	119	2001
Downtown Miami	NE 8th St. and NE 2nd Ave	8%	51	Pre-2000
Downtown Miami	College and Bayside	10%	72	Pre-2000
Downtown Miami	NE 4 St. and NE 2nd Ave	10%	72	Pre-2000
Eisenhower East	Eisenhower Ave Station	8%	43	Pre-2000
Kenosha Historic District	6th and 54th	12%	54	2001
Kenosha Historic District	8th and 54th	17%	42	2001
Kenosha Historic District	4th and 54th	7%	29	2001
Boyle Heights	Pico/Aliso Station	6%	66	2009
South East Portland	SE Main Street Max Station	16%	53	2009
Downtown Tampa	HSBC Station	6%	37	2002
Downtown Tampa	Dick Greco Plaza	6%	30	2002
Downtown Tampa	Whiting Station	8%	30	2002

For each of the selection study areas, we constructed a profile of the TOD area by looking at zoning maps, Google Maps, local government websites, local government planning documents, historical preservation websites, activist group websites, and various other resources. Once we had information about the age of the area, its history, the

number of retirement communities in the area, the night, civic and art life of the area, and other factors, we directly contacted local planners and business owners with additional question and clarifications. Normally we started with the government official that was tasked with TOD planning or elder affairs, and then worked our way down to managers at individual retirement homes in the area.

4.2 Case Studies

Table 4.2 provides a summary of our findings in each of the case study areas. The subsequent sub-sections present a more detailed description of each of study areas.

Table 4.2 Case studies summation table

	The Pearl District	Downtown Miami	Eisenhower East	Kenosha Historic District	Boyle Heights/Aliso Village	South East Portland	Downtown Tampa
Art and Museums	The Pearl District is an art district and Has a plethora of galleries and studios	There are several nearby art museums, including the Perez art Museum, Museum park, as well as several galleries and studios	There are several history museums but no art buildings	The entire area is a historic district and is filled with historical buildings and museums. There are several galleries and art studios nearby	There is a nearby warehouse district that houses several artist galleries and studios	There are no museums or art galleries	There are many museums in the area
Hospitals and Health Services	There is a hospital accessible via transit and Doctor's offices within the neighborhood	There is a hospital accessible via transit and Doctor's offices within the neighborhood	There is a hospital accessible via transit and Doctor's offices within the neighborhood	There is a hospital and medical plaza a few blocks south of the historic district	There are several hospitals easily accessible via transit	There is a religious medical plaza nearby as well as a hospital a few stations down from the area accessible via transit	There is a hospital and health plaza nearby
Wealth	The area is extremely wealthy	The area is wealthy	The area is wealthy	The area is lower-middle class	The area is fairly poor	The area is middle class	The area is fairly wealthy
Retirement Communities	There are no nearby retirement communities	There are no nearby retirement communities	There are no retirement communities in the area	There are apartment complexes for older adults	There are 2 retirement communities in the area	There are many retirement communities in the area	There are no retirement communities but there are age restricted apartments
Shopping and Dining	Dense shopping district	Dense shopping district	Limited	Main street shopping	Limited	There is a mall	Dense shopping district
Civic Buildings	Limited	Many	Limited	Many	Limited	Limited	Many
Religious Buildings	Few	Many	Few	Many	Many	Few	Man
Plans	There is an area, a transportation, and a city-wide older adults plan	There is an area plan and a county-wide age plan	There is an area plan	There are area plans	There is an area plan	There are citywide transportation and older adult plans	There is an area plan and one with sections on the streetcar
Type of Transit	Street Car	Elevated Rail System	Metro Rail	Street Car	Light Rail	Light Rail	Street car

4.2.1 NW 10th & Marshall, NW 12th & Northrup, NW 11th & Johnson, NW 10th & Johnson, NW Lovejoy & 13th, and NW Northrup & 14th–Pearl District, Portland, OR

History

Originally, the Pearl District was home to blue-collar industry and blue-collar workers. The warehouses, rail yards and factories were built on the intersection of several railways with the Columbia River. While quite prosperous for most of the early 20th century, industry slowly drained from the Pearl District between the 1920s and 1970s. From the 1970s until the late mid-1980s, the Pearl District was covered with abandoned factories, rail yards, and warehouses. In the 1980s, the area became a haven for artists and small businesses looking for cheap space in the middle of Portland. By the early 1990s, city planners and developers had begun to notice the districts potential. The area has been built up into one of Portland's trendiest and most expensive areas (Museum of the City).

General and Local Planning

Portland as a whole has focused on planning for older adults. In 2010 Portland adopted the "Toward an Age Friendly Portland" plan. The plan focuses on helping older adults access transportation, public spaces, and on building housing that is accessible for older adults (Ocra Planning, 2010). While the Age Friendly Portland Plan was adopted after time of our study period, it was drafted during it. Many of the recommendations concerning transportation, street design, and outdoor spaces mirror language from the 2001 Pearl District Area Plan. Transportation for older adults, accessible housing design, and hospital accessibility are central to both plans (Portland Development Commission, 2001). The Pearl District is a model for older

adult planning in these areas. They were the first city in the United States to receive the special recognition “Age-Friendly City” from the World Health Organization.

While there have been some concerns about the speed of the streetcars, according to Christ Smith at Portland Transit, a transit advocacy group, the streetcars average around 6.5 miles per hour along the length of its line. This is about double average walking speed, and so while they are geared primarily towards circulation rather than commuting they can act as a way for older adults to access services (Smith, 2005).

In 2001 The Pearl District Development Plan was approved by the Portland Planning Department. The plan focuses on preserving historic buildings while the area continues to grow and promoting mixed use/mixed transit development. It also has sections that look at promoting civic buildings and a public school in the area, along with parks and “pocket parks (Portland Development Commission, 2001).”

Type of Transit, Year Installed

The Portland Street Car services the Pearl District and the surrounding areas of downtown Portland. All of the stations we looked at were completed in 2001, though there was an expansion of the project after the time period of our study in 2012 (Portland Street Car).

Amenities:

Bars, clubs, and artists galleries are all within easy walking or transit distance from the stations. These included several breweries and the iconic Powell’s City Books, which claims to be the “World’s Largest Independent Bookstore.” There are several groceries near the stations, which is different than the other case studies where most of the food options were restaurants.

Two hospitals are accessible by streetcar, along with a plethora of medical and doctor's facilities. The Pearl District as a whole has incredibly high Walk Scores (90+) but the area contained within the stations areas was even higher, with the lowest score around 95 and most in the 97-99 range (Walk Score).

Types of Housing, Housing Costs:

Unlike some of the other case studies, there were no age-restricted or retirement communities in the Pearl District. All of the older adults living around the Pearl District TOD stations are living in regular apartments and homes. There is no housing specifically geared towards older adults.

According to Jamie Dunphy, the policy advisor for the commissioner focusing on older adults, the Pearl district was built with features that appeal to "The Gray Tsunami," retirees who, after their children moved out of their house, were looking for something smaller downtown. Part of the district is on the National Register of Historic Places, with a state of the art transit system. Many of the buildings that used to be factories, tenement and working-class housing, and warehouses have been converted into housing and art galleries. In a move that he said spurred growth among older adults, planners put a particular focus on mixed-income housing and smaller apartments and condos that work well for people without children.

According to Zillow, the median residential price in the Pearl District is nearly double the cost of Portland as a whole, $540 per square foot compared to $295 per square foot. The Pearl District is, like many of our case studies, a dramatically more expensive place to live than most other places in the United States (Zillow).

4.2.2 NE 8th St. by NE 2nd Ave., 7th St. by NE 2nd Ave., College and Bayside Station, NE 2 AV@NE 4 ST – Downtown Miami --Miami, FL

History:

Miami is a fairly late settlement; in the Florida State Census of 1895, there were only 8 people in the area. However, a year later, with the advent of the railroad, Downtown Miami began to form. Miami attracted settlers from the rest of Florida, the Bahamas, Cuba, and South America. Miami continued to grow even through the great depression, when many of its famous art deco buildings were constructed. The quarter reached its zenith in the 1950s with huge hotels, movie theaters, nightclubs and churches. Downtown Miami declined from the 1950s through the 1970s because of highway construction and a move towards the suburbs.

Miami has recently seen a rebirth in its downtown, particularly spurred by millennial urban professionals. However, they have also seemed to find a way to make room for older adults looking for a dense, walkable place to live (George, ND).

City and Area Planning:

There is an informational website, agefriendlymiami.org, that lobbies for the needs of older adults in Miami (Miami Dade Age Friendly Initiative). The Miami-Dade plan was completed in 2011, but planning started in 2005, which coincides with our study period. The plan specifically focuses on the transportation needs of older adults like walkability, transit, and open spaces. They have also done studies that focus on more pedestrian friendly communities in areas with a high percentage of older adults.

Miami offers special transportation services for seniors. If you are a permanent resident of Miami and over 65 you can acquire a “Golden Pass” and ride all area transit for free (Miami Date Transportation and Public Works Department, 2016a). For people who cannot ride Metrobus, Metrorail, or Metromover, free or reduced cost taxis, vans, and busses are provided. The Miami Downtown area plan does not have a section focusing on older adults, but much of the planning focuses on transportation oriented development and walkability (Downtown Development Authority, 2010).

Types of Transit and Year Built:

Both stations are along the Miami Rapid Transit elevated rail system. The system services 25 miles of rail and trains stop every 10-20 minutes from 5am to 12:30 pm. The system was built over several years from the late 1970s until the late 1980s (Miami-Dade Transportation and Public Works Department, 2016b). However downtown, and thus the Rapid Transit System, has seen increased growth and use over the last 10 years.

Amenities:

Over the last few years Downtown Miami has been seeing a comeback as new housing has been built and businesses are returning to the area (George, ND). Miami has begun focusing on its transit options along with its pedestrian and bicycle infrastructure (Downtown Development Authority, 2010). Downtown Miami has seen a 150% population increase since 2000 (Greater Downtown Miami Demographics Survey, 2016). While Miami ranks as one of the least walkable large cities in the United States (at 22 out of the largest 30), there have been several changes to housing policy and development that have been pushing transit and

walkability, including within TOD areas (Delagadillo, 2016). The Miami downtown area as a whole has a Walk Score of 78, but the TOD areas have walk scores of 95 and up.

The 8th and 7th street stops are close to several museums, art galleries, civic buildings and parks. This includes the nearby Museum Park, Perez Art Museum, American Airlines Arena, The Artisan Lounge gallery, the Dimension Variable gallery, and the New World School of the Arts. A few stops down, in the densest part of Downtown Miami, many more museums, art opportunities, restaurants and bars are easily accessible.

The stations are fairly far away from medical facilities, but the Miami Rapid Transit system allows easy access to the Jackson Memorial Hospital. Like the Pearl District, there are no age restricted/assisted living facilities within the .25-mile area.

Types of Housing, Housing Costs:

These stations are located in and near the wealthiest parts of Downtown Miami. The average income in the area exceeds $110,000 (Greater Downtown Miami Demographics Survey, 2016). Most housing units in Downtown Miami are small condos and apartments. Downtown Miami has high average housing costs at $2,000 for a one bedroom apartment. While this is high, it is lower than several surrounding neighborhoods and much lower than several of the neighborhoods on Miami Beach (Munzenrieder, 2015).

4.2.3 Eisenhower East- Eisenhower Ave Station- Alexandria, VA

History:

Alexandria was settled by Europeans as early as 1695 and was incorporated in 1749 where it grew up with its neighbor, Washington D.C. It was an important slave port for the South

and had numerous plantations, alongside several large free black communities. Because of its historic character and connection to important events large parts of Alexandria's downtown were preserved (City of Alexandria, 2016a). Alexandria is home to many historic landmarks, museums, and sites.

This station illustrates how planners might inadvertently spur growth among older adults. The city as a whole is young. Mary Catherine Collins, the Planning Departments demographer, said that only about 10% of the city's population is older than 55. The growth in Eisenhower East illustrates how TODs can provide an attraction for older adults with or without intentional planning.

City and Area Planning:

The city of Alexandria's comprehensive plan mentions consulting with the Commission on Aging along with other special interest commissions to ensure the transportation needs of older adults. Ensuring reliable and safe transportation for older and disabled citizens is mentioned as one of its key principles of transportation. Older adults are mentioned several times throughout the plan, always in relation to their transportation needs (City of Alexandria, 1992).

"Alexandria will ensure accessible, reliable and safe transportation for older and disabled citizens" is the 7th "Guiding Transportation Principle" in Alexandria's Transportation Master Plan. The desire to serve older adults along with the disabled is given as the impetuous for a continuous and accessible sidewalk and transit network. They are also cited as the reason for improving cross walks. There is also a focus on transit-oriented development around the subway

and light rail stations. However, there is nothing in the plan about encouraging older adult to live in these transportation oriented developments (City of Alexandria, 1992).

The Eisenhower Avenue Station is located in Eisenhower East, a TOD and dense development area first planned in 2003. This plan pushed dense development, walkability, and traffic calming, but does not mention older adults or disabled persons (City of Alexandria, 2003).

According to Jose Ayala, the area planner for Eisenhower East, the area is not aimed at attracting older adults. Much development is still occurring around the station. There is some Federal Government housing which might explain the older population. Jose Ayala said that older adults moving to the area was not their intended result, and seemed disappointed that it was attracting older adults. He reiterated that in the future, as the development continued to be built up, these trends would reverse.

Mary Catherine Collins says that the area currently contains mostly single-family homes and the Eisenhower Tower Apartments, along with the Patent Office and a few businesses. She is not sure why the area itself has grown because much of the new development has not been put in, and seemed vaguely doubtful. She proposed that the area just south of the station, in Fairfax county, might be responsible for the growth, though we could not see anything that might be responsible. She also seemed mildly disappointed by the idea that the Eisenhower East development was attracting older adults.

Every other planner we talked to seemed interested in the build-up of older adults around their stations. The Alexandria Planning Department did not intend for this growth among older

adults, the area was primarily planned to attract younger, working people who would commute into Washington D.C. and Alexandria.

Types of Transit:

The station is part of the Washington-Arlington-Alexandria Rapid Transit train system. This system primarily serves as a commuter system to move people into Washington D.C. It was the second most used metro system after New York City in 2008 (American Public Transportation Association, 2008).

Amenities:

The Eisenhower Ave Station is located on the southern edge of Alexandria, VA. It provides easy access into Alexandria, Virginia's historic "Old Town" which boasts hundreds of restaurants and boutiques. The train also connects to Washington, D.C., where many Alexandrians live, as well as Eisenhower West, a hipper part of Alexandria to the west of the city that is also a TOD (City of Alexandria, 2003). The Eisenhower station TOD area has an average Walk Score in the low 70s, which means some amenities can be reached by walking. That is fairly low compared to most of our other TODs (Walk Score).

One of the main draws of the Eisenhower TOD area seems to be that it is within walking distance of several medical facilities. There are no age restricted/assisted living facilities within the .25-mile buffer, either within Eisenhower East or on the other side of the county border. While the Pearl District and Downtown Miami are places to live, work, and fraternize in their own right, Eisenhower Station seems to be a convenient and cheaper place to live with access to Washington, D.C. and downtown Alexandria. While it does have a few shops, museums, and

historic buildings: Eisenhower Station acts as a commuter hub for people who work in Washington.

Eisenhower Station is close to the Hoffman Town Center, a large outdoor shopping mall. The shopping mall has a movie theater, grocery store, and a plethora of restaurants. The station is near a park, the African American Heritage Park, as well as the Alexandria Memorial Cemetery and the George Washington Masonic National Memorial.

Types of Housing, Housing Costs:

The median household income for the city as a whole is $86,775, which is much higher than the $62,666 median household income in Virginia. Most of the living units in the area are apartments (according to Zillow).

4.2.4 Kenosha Historic District- Kenosha, IL - 6th and 54th, 8th and 54th, 4th and 54th

History:

Kenosha, Wisconsin was originally settled by Potawatomi Indians who gave the area its name, meaning “place of the pike (fish)”. The Potawatomi were forced from the area in 1833 by the federal government, but there are still several burial mounds dotting the region. Kenosha was, like many other cities in the region, based upon manufacturing. It was located on Lake Michigan and connected by rail to other regional cities. Throughout the 20th century Kenosha was influential in the automotive industry. The first mass-produced seat belt and the first mass-produced steering wheels were produced in Kenosha (WHS Library-Archives Staff, 2009).

General and Local Planning:

The Kenosha County government has recently released a plan looking at older adults with a chapter on their transportation needs. This plan was published after the timeframe for our study, but might suggest that area planners have noticed the growth among older adults (Kenosha County Division of Aging and Disability Services, 2016). The county has an Ageing and Disability Resource center that provides an exhaustive resource list for older adults which includes sections on transportation. Adults over the age of 65 receive discounted transit fair along with access to special cabs, vans and medical transportation meant to help older people access services.

Kenosha has several historical districts that fall near our three transit stations. These areas, along with downtown as a whole, have planning documents that argue for better walkability. The Downtown Plan notes that downtown Kenosha has mostly smaller, apartment style living and attracts people without children, like many of our other case studies (Downtown Kenosha, 2012).

Type of Transit, Year Installed:

All three of our transit stops in Kenosha are on the Kenosha Streetcar line, a historic electric streetcar that was re-launched in 2001. The line services the downtown and connects to the Joseph McCarthy Transit center to access city buses, and are located few blocks for the nearby Metra Station with provides train access to other cities in the region (Google Maps).

Amenities:

The area that the Kenosha Streetcar circumnavigates has four separate historical districts, and is interspersed with historical architecture, museums, parks, and markets. Kenosha as a whole has a very poor Walk Score of 41 meaning you need a car to access basic amenities, but the Historic District where the streetcar is located is much higher at a respectable 81.

As with the Pearl District and Downtown Miami, the Kenosha downtown is filled with shopping and dining establishments. There is a brewery and several restaurants within walking distance or accessible via the streetcar, along with a plethora of parks. There are several historical churches in the area, along with an American Legion building, and the Kenosha Area Convention Center. Downtown Kenosha has seen a development boom for the last decade and a half in the streetcar corridor. There has been a decided effort to draw both tourists and new residents back into the downtown area. Jake Hoey, who works for Visit Kenosha, pointed towards special rates on transit offered by the Kenosha transit authority and the new, denser neighborhoods being designed around the street car as key factors encouraging older adults into the area.

There are two medical complexes within three blocks. There is a rehab facility and a clinic, which are three blocks walk after a ride on the streetcar. Hospitals are farther away and not directly accessible via the streetcar.

Types of Housing, Housing Costs:

Jake Hoey pointed to several age restricted apartment complexes built around the streetcar stops as one of the main reason for the influx of seniors. Housing in the area is on the

lower end, with one-bedroom rentals in the area running under $750 (according to Zillow), though the city as a whole has a mildly higher median income than Wisconsin as a whole (Kenosha County Division of Aging and Disability Services, 2016).

4.2.5 Boyle Heights/Aliso Village – Los Angeles, CA – Pico/Aliso Station

History:

The area is named after a former housing project, Aliso Village. The original Aliso Village replaced "the Flats", a shantytown just outside downtown Los Angeles. Planned by Lloyd Wright, the son of the famous architect Frank Lloyd Wright, Aliso Village's courtyard and blank space design allowed gangs to flourish. Its location was ideal for gangs attempting to operate in downtown Los Angeles, and at least ten separate gangs were operating in 1999 when the original Aliso Village was destroyed (California Planning and Development Report, 2003). The new housing project, Pueblo del Sol, offers more stand-alone homes, more homes for sale rather than just rental, fewer empty spaces between buildings, and is based on New-Urbanist ideas (Ohland, 2004).

This area is very different than the other places on our list because of the nearby public housing areas. It serves an interesting case study of the type of development that might work to grant lower income seniors the access to amenities and services enjoyed by richer seniors in places like the Pearl District and Downtown Miami.

General and Local Planning:

The 1998 area plan for Boyle Heights, the larger area Aliso Village falls under, focused on community oriented development and industrial jobs in the area that is now a mixture of

industrial and creative warehouses. It also put a focus on the Pico/Aliso Station as a center for commerce and housing in the area (Los Angeles City Planning Department, 1998).

Type of Transit, Year Installed:

The Pico/Aliso Station is serviced by the Los Angeles Metro Rail, a light rail system on the Los Angeles Gold Line. The station also connects to a bus route. The station was built in 2009, towards the end of our study period.

Amenities:

There is a shopping/warehouse district close to the station with an eclectic mix of light manufacturing, art, and specialty foods. There are a few small parks and an elementary school in the close proximity. When Pueblo del Sol was built some public batting cages were built near the elementary school (California Planning and Development Report, 2003). The area has several churches. The Walk Score for the area is 75.

Types of Housing, Housing Costs:

There is a collection of medium density residential homes near the station, some of which are part of the Pueblo del Sol and Pico housing projects. This is the only TOD area we have looked at that contains a housing project and where many of the people are poor. However, with the new Pueblo del Sol, houses in the $200,000 to $300,000 range are mixed with the lower income/subsidized houses. Gang violence has gone down precipitously (Ohland, 2004).

Within the TOD there is also a Japanese retirement community that draws residents from the nearby “Little Japan (Ohland, 2004).” It was first built in 1961 as a Jewish retirement home, then bought and converted to a Japanese retirement home in 1974. It was destroyed in the 1987

earthquake and rebuilt in 1989. This occurred long enough before the 2000 census that it is unrelated to the growth among the 55+ cohort.

4.2.6 South East Portland – Portland, OR – SE Main Street Max Station

History:

The South East Main Street Max Station TOD area falls into several neighborhoods in South East Portland. The area is middle to low density with many historic suburban homes (Montavilla Neighborhood Association).

The marked growth among older adults in this station area relates to the numerous retirement homes and age restricted communities in the area. Building such communities close to a transit station, or building transit stations near groups of these communities, allows older adults who have lost the ability to drive access to the rest of the city. The station was built after many of the retirement communities and illustrates an option for city planners who would like to connect older adults to safe transit. This may create a positive feedback loop where more retirement communities move into the area to be near the other communities and the transit station.

General and Local Planning:

The neighborhoods around the city all have local neighborhood planning groups supervised by the East Portland Neighborhood Office. This group helps coordinate neighborhood meetings and groups as well as provides information on crime prevention. They also dispense small grants for various community level initiatives. Most of the retirement homes fall into Mill Park to the east of the station and Mountvilla to the west.

According to Trevor Hopper, who runs the Mill Park Neighborhood Association, the Mill Park retirement homes were mostly built before the station. The area is close to the hospital and so several retirement homes were built and then more were added when the station was constructed. The Mill Park Neighborhood was originally an unincorporated area where land was quite cheap and was only later incorporated into the City of Portland. He also said that other hospitals in the area are surrounded by retirement communities, so this may be standard for Portland. There is a bus that runs through the neighborhood that stops at the retirement communities and can help people get to the MAX Station.

When we contacted Jamie Dunphy, the Portland official in the Office of the Commissioner tasked with older adult initiatives, he did not know anything about the project, though he did point to the general older adult plan that makes access to transit services a priority for older adults.

Type of Transit, Year Installed:

The SE Main Street Max Station services the Max Green Line light rail. The Station was built in 2009, near the end of our projects study period.

Amenities:

The station is located next to the highway. There is a mall very near the station and within walking distance of most of the retirement communities. Many of the retirement communities are less than a block from the East Portland Community center, as well as several neighborhood parks. Because of the mall and a nearby shopping center it is fairly walkable, with a walk score of 82. Moving away from the mall, the area becomes much less walkable.

Types of Housing, Housing Costs:

There are several age-restricted communities/retirement communities within .25 miles. Most of the other housing is medium density single family and town houses. Most of the growth among older adults between 2000 and 2010 seems to be from the age restricted communities.

4.2.7 Downtown Tampa- Tampa, FL - HSBC Station, Dick Greco Plaza, Whiting Station

History:

All three stations in Downtown Tampa are located along the southern tip of the area. The site that would become Tampa was originally discovered by Ponce de Leon in 1513. Most of the major development for the city started after Florida became part of the USA in 1845, and accelerated in 1884 when the rail line was extended to the area. Tampa, like many of Florida's cities, was built around the conjunction of a port and the rail line. With the founding of Ybor City, the Cuban district of Tampa, major cigar industry and Cuban culture became deeply imbedded in Tampa's ethos (City of Tampa).

Tampa originally installed electric streetcar lines in 1892. In the 1920s, they had around 24 million passengers a year. Sadly, use dwindled with the advent of the car and the streetcars were closed in 1946. They were re-opened in the early 2000s.

City and Area Planning:

The Hillsborough County government provides senior centers and adult day care centers around the city and there is one located close to the TOD areas. Elder Services for the county provide assessments and caregiver assistance as well (County Website).

The streetcar has a special discount for children, the disabled, and seniors with half off fair. It also provides annual streetcar passes for $200 which help people who live in the city use the streetcar. Street car ridership has remained low with between 15,000 and 45,000 riders per month between its construction in 2002 and 2016. Ridership has also not gone up and may even have gone down slightly over that time frame (Go Hart, 2017). The streetcar only runs between noon and 10pm on weekdays, which makes it nearly impossible to use to commute (TECO Line Streetcar System).

In the City of Tampa "Center City Plan" under issues identified through community surveys "Transit is not seen as a viable transportation option by "choice" riders (p.45)" is the number one problem facing the city's transit system. The third problem facing the system, and the one most pertinent to our TODs: "the streetcar functions more as a tourist attraction that does not effectively serve the local population (p.45)." This means that most of the riders on the streetcar are non-local, and may suggest that while there has been strong growth among older adults compared to the surrounding areas, this may be unrelated to the streetcar.

Types of Transit and Year Built:

The stations are serviced by the TECO Line Streetcar, which was built in 2002 on the route of a historic streetcar. It primarily services people who work in the downtown. There are also bus connections at several stations along the line that allow access to the rest of the city. Planners are currently reassessing its operations in light of the findings of the City Center Plan (TECO Line Streetcar System).

Amenities:

Tampa General Hospital and its surrounding medical plazas are accessible by bus or a short car ride, though not via the streetcar. There are also several other medical centers accessible via bus. There are also several specialty hospitals outside of the area, but accessible via transit.

There are several convention centers and the Amalie Arena within the 0.25-mile buffer. The area also has several parks and a water front walking path. Downtown Tampa contains many museums, both for art and history. There are no retirement communities in the area, although the county website did list a few HUD developments with apartments reserved for older adults near the edge of the area. There are several churches in the area, but most of the churches are located across the bridge in Courier City in the 0.25 to 2-mile buffer. The area contains an older adult day care center. The Walk Score for the area is 86, as would be expected from a downtown location.

Types of Housing, Housing Costs:

Most of the housing in downtown Tampa is made up of apartments and townhomes. Downtown Tampa is fairly expensive with one bedroom apartments costing above $1,500 a month to rent (according to Zillow).

4.3 Conclusions

These case studies illustrate the kinds of places that draw older adults to live near transit stations. Some of the specific characteristics that seem to be important is at least a few of the studies station areas. include:

- Art districts: These were present in or near many of our TOD case studies, with about the same number of TODs having art districts within walking distance as community centers or churches. If you include museums as well as art districts, most of the areas we studied had one or both within the .25-mile buffer.
- Hospitals and Health Services: Not all of the TODs that met our criteria had hospitals or other health services, but most had a hospital that was easily accessible via transit. This might suggest that older adults do not necessarily want to live in the shadow of a hospital, but being connected to one via transit is a positive.
- Wealth: With the exception of Aliso Village, all of these areas had much higher incomes than the surrounding areas. People who live in TODs tend to be wealthy, and older adults who live in TODs are also wealthy.
- Retirement Communities: Several of the areas with the largest growth had no retirement communities. However, retirement communities did seem to provide a mechanism to bring older adults to TODs that were not as amenity rich, such as Aliso Village or South Portland. By zoning the area around transit stations for retirement and care facilities older adults have easy access to the outside world and important services like medical treatment and civic events. This is perhaps the easiest way planners could change older adult behavior to promote transit use.
- Shopping and Dining: Those case studies that did not seem primarily driven by retirement communities did seem to be denser and more shopping rich than many of the other station areas around the country that did not see the same growth in older adult populations.

- Churches and Civic Buildings: Several of our TODs are near churches and civic buildings. However many are not. Such buildings may not be as important to creating a concentration of older adults as art districts, museums, or shopping and dining.
- Planning: Several of our case studies, particularly those set in Portland, were covered by various plans, incentives, and governmental departments intended to help older adults. Portland had by far our highest growth of any TOD area in the Pearl District. Further study would need to be done to find out if there is a causal link between older adult planning and older adults moving into TODs. All the stations except for the SE Portland have areas plan.

Chapter 5 Promoting Transit Oriented Development for Older Adults: A Survey of Current Practices Among Transit Agencies and Local Governments in The U.S.

5.1 Introduction

The purpose of this chapter is to obtain current information on the ways in which transit agencies and local governments are actively promoting TOD for older adults. To obtain the data, surveys with representatives from transit agencies and local governments were conducted. The results show that a notable percentage of agencies and municipalities have practices to improve transportation options for older adult sand to promote TODs. However, a smaller percentage of them see TOD as an opportunity to meet older adults' needs. The main barriers to promote TOD for older adults are the cost of development, market forces, and the lack of specific amenities focused on older adults. However, there are some TOD station areas with high concentrations of older adults. These stations often have aging related services, such as senior housing and hospitals within a walking distance. This analysis provides a better understanding of the degree to which practitioners see TOD as a way to enhance accessibility for the older population. This can ultimately be useful for scholars, DOTs, community leaders and other entities interested in better meeting the transportation needs of older adults.

5.2 Research Design

This study focuses on three specific research questions:

1. In what ways are transit agencies and local governments actively promoting TOD for older adults?

2. What are the main barriers perceived by transit agencies and local governments to promote TOD for older adults?
3. Are there stations within transit systems that have performed well in attracting older residents?

To answer these questions, surveys were conducted with representatives from transit agencies that operate fixed-guideways systems and local governments that have fixed-guideway systems within their municipal boundaries. Fixed-guideways were selected because previous research indicated that the majority of TODs are located in large rail-served cities (Cervero, 2001).

Transit agencies and local governments are the primary stakeholders in the implementation of TOD projects. Transit agencies are important because, ultimately, they control the delivery of the transit systems around which TOD is built. In addition, properties adjacent to stations, which can be used for TOD implementation, are often owned by transit agencies. Finally, TOD has potential benefits for transit agencies such as generating increases in ridership and the associated revenue gains (Cervero, 2001).

Local governments play a large role in the creation of TOD through their ability to regulate and control land use and development around stations that fall within their jurisdictions (Cervero, 2001). In addition, TOD may contribute to economic productivity, which can directly benefit local governments (Cervero, 2015). More specifically, revitalization of declining neighborhoods, increased affordable housing, and monetary gains derived from joint development opportunities, and tax revenue generation are some of the potential benefits of TOD that might appeal to local governments (Brooks, 2010) (Cervero, 2001).

5.3 Survey Description

5.3.1 Sample Selection

Transit agencies that operate fixed-guideways systems and local governments that have a fixed-guideway system within their boundaries were identified using the National TOD database generated by the Center for Transit Oriented Development (CTOD, 2016). This database provides the location for every existing fixed-guideway transit station in the US. To focus on larger transit systems that provide significant accessibility improvements for nearby residents, stations that are part of smaller transit systems, such as BRT, ferries, streetcars, people movers, shuttles, and trolleys, were excluded from the analysis. Based on the criteria mentioned above, 46 *transit agencies* that operate a fixed-guideways system were identified, and all of them were invited to participate in the survey.

There were 622 cities identified with at least one fixed-guideway station. Sixty-three percent of the cities (n=392) had only one station within their municipal boundaries. The rest of the cities (n=230) had between 2 and 535 stations. To maintain a reasonably sized sample, a stratified two-stage design was used in which two cities were selected from each Combined Statistical Area (CSA) in the US. This was done to assure full geographic coverage across US metropolitan areas.

In the first stage of this sampling process, the city with the highest number of stations in each CSA was selected. There were some cities with fixed-guideway stations that did not belong to a CSA. These were grouped by state (Arizona, California and Texas) and treated as three independent CSAs for sampling purposes. This process selected 30 cities. In the second stage,

one city was randomly selected from each CSA, resulting in 27 additional cities being chosen for a total of 57 cities that were invited to participate in the survey. This sampling approach provided representation of major cities with a large quantity of stations and cities with a few stations within their municipal boundaries, thus providing diversity of municipalities to the overall sample.

Once the transit agencies and local governments were selected, we consulted their websites to find out if they had resources focused on TOD. For those that had a TOD department, a representative from that department was selected. If the agency or local government did not have a TOD-focused office, calls were made to the planning department, development department, or administrative department to obtain information about who would be the best person to survey.

The survey was conducted from November 2015 through April 2016. Table 5.1 shows the list of transit agencies and local governments that responded the survey. The transit agency response rate was 28% (n=13) and the municipality response rate was 52% response rate (n=30).

5.3.2 Survey Instrument

The survey instrument was a self-administered questionnaire sent by email to representatives from transit agencies and local governments. The survey was divided into three sections, with each section relating to one of the specific research questions listed above.

Section A had the objective of obtaining information about the ways in which transit agencies and local governments are actively promoting TODs for the older population. The first set of questions in this section aimed to obtain information about current practices implemented

by transit agencies and local governments to improve transportation options for older adults. A second set of questions sought information about current practices to promote TOD without relating them to practices focused on older adults. A final set of questions focused on information about any current practices aimed specifically at promoting TOD for older adults. These questions can be summarized as follows:

- Does your agency/municipality currently have any practices that are specifically aimed at improving transit options for older adults? Describe the practices used.

- Does your agency/municipality currently have any practices that are specifically aimed at promoting Transit Oriented Development? Describe the practices used.
- Does your agency/municipality currently have any practices that are specifically aimed at promoting TOD that attracts and serves the needs of older adults? Describe the practices used.

Section B obtained information about the main barriers to promoting TOD for older adults (as perceived by the survey respondents). Previous studies have identified the major barriers to building housing and mixed-use development around stations such as increased traffic, parking reduction, land-use policies, and NIMBY forces (Cervero, 2001; Chatman & DiPetrillo, 2010). However, this set of questions went further by seeking to obtain information about the principal barriers to the creation of TODs *for older adults*. This section had only one question:

- What do you see as the biggest barriers to promoting TOD that attracts and serves the needs of older adults?

The last section (Section C) sought to identify stations that have performed well in attracting older residents and specific TOD projects that have made explicit effort to attract older adults. This is important since it can provide information about the main characteristics found in those stations that can be used by DOTs, municipal governments, community leaders and other entities interested in replicating them at other stations. Some of the questions asked were:

- Please identify the three top station areas that have a high concentration of older adults, and why do you believe they have a high concentration of older adults?
- Please identify the top three TOD projects (by name and station) that have made an effort to attract or cater to older adults.

With the first question, we did not provide a definition of *high concentration* because of differing station area contexts. We left this open to the interpretation of the respondent.

5.4 Findings

5.4.1 Improving Transit Options for Older Adults

When asking *transit agencies* if they currently have any practices specifically aimed at improving transit options for older adults, 67 percent indicated that they do. A follow-up question was asked to obtain information about the main practices implemented for this purpose. The main answers provided were (Figure 5.1):

- Discounted rates or free rides for older adults (n=8),
- Safe pedestrian infrastructure around stations (n=5),
- Specialized transit or dial-a-ride service (n=4),

- Outreach programs to promote education and training programs for older riders (n=1).

Surprisingly, only one agency mentioned training programs, as previous studies have shown that well trained staff are as important as good quality infrastructure for aging transit users (Ling Suen & Lalitia, 1999).

Despite concerns about public transportation for older adults, 20 percent of the transit agencies (n=3) responded they did not have any practices aimed at improving transportation options for older adults, and13 percent did not answer the question (n=2) (Figure 5.1).

56 percent of *local governments* indicated they had practices aimed at improving transit for the older population. The main practices mentioned were:

- Transportation assistance programs to provide information about benefits, ride demonstrations and other services (n=7),
- Partnerships with transit agencies to provide free or discounted rides and dial-a ride services (n=3),
- Planning to improve older adults' mobility (n=2),
- Discounted or free rides (n=9),
- Dial-a-ride services (n=7).

Most of the practices mentioned are focused on providing affordable mobility without considering other needs such as safety, security and physical strains that prevent older individuals from using transit. It is noteworthy that about 9 municipalities mentioned discounted or free rides and 7 municipalities mentioned dial-a ride-services as practices they provided. In this case, respondents may have thought the question was about services available in, but not

necessarily provided by, the municipality. More than 30 percent of *local governments* did not mention having any practices designed to improve transportation options for older adults and 12 percent did not respond to the question.

5.4.2 Promoting TOD (in general)

When asking *transit agencies* about practices to promote TOD, slightly more than fifty percent (n=8) indicated they have such practices (Figure 5.1). When asked to describe these practices, the following were mentioned:

- Creation of TOD research/work group to implement new projects (n=5),
- Acquisition of available parcels around transit stations (n=2),
- Joint ventures with private developers to create TOD projects near major transit facilities (n=2),
- Implementation of TOD strategic plans (n=1),
- Implementation of TOD guidelines (n=1),
- Streetscape and pedestrian improvements (n=1).

About 20 percent (n=2) are not doing anything to promote TOD and 27 percent (n=3) did not answer the question (Figure 5.1).

When asking *local governments* about their practices to promote TOD, 68 percent (n=23) indicated they currently have such practices. Those mentioned were:

- Increasing density around transit stations (n=9),
- Implementation of parking tools such as parking reduction (n=7),
- Implementation of mixed uses (n=4),

- Streetscape and pedestrian improvements (n=4),
- Implementation of zoning overlaid to allow different uses around stations (n=4),
- Implementation of Tax Increment Financing (TIF).

5.4.3 Promoting TOD Specifically for Older Adults

As seen in 27 percent of transit agencies (n=4) indicated having practices that they believe promote TOD for older adults (Figure 5.1). In a follow-up question, respondents were asked to provide a brief description of these practices. Although the response rate was low, the main outcomes were:

- Implementation of TOD guidelines are heavily oriented to pedestrian and ADA access (n=3)
- Promoting the presence of assisted living facilities near stations (n=2)

Even among the few that indicated they were doing something to promote TOD for older adults, their descriptions of these practices were relatively vague. For instance, providing ADA access is required by law and may not be a good indicator of whether any special effort is being made to accommodate older adults. Further, two respondents mentioned that they promote the presence of nearby assisted living facilities, but failed to mention anything specific about *how* they go about this.

More than fifty percent of *transit agencies* answered that they were not doing anything to promote TODs for older adults, and about 20 percent did not answer the question.

About 15 percent of local governments mentioned having practices to promote TOD for older adults (n=5) (Figure 5.1). The remaining 75 percent responded either that they did not have

practices to promote TOD for older adults (50 percent) or did not provide a response (35 percent). The practices implemented by those who indicated they promoted TOD for older adults were:

- Implementation of ordinances supportive of senior housing and affordable housing (n=4).
- Improving transportation access for seniors (n=2)

Those representatives from transit agencies and local governments that responded they currently have practices to promote TOD for older adults were also asked their opinion about additional practices (not currently being undertaken) that they believe could be undertaken to better promote TOD that attracts and serves older adults. However, none of them responded this question.

Transit agencies and local governments who did not indicate having any practices to promote TODs for older adults were asked their opinion of what practices they could undertake to promote TODs that attracts and serves the needs of older adults. 53 percent of transit agencies (n=7) provided potential practices that could be implemented to promote TODs to older adults as follows:

- Promoting the presence of affordable and senior housing (n=3),
- Design for walkability including universal design (n=1),
- Providing a mix of uses and services (n=1),
- Long term service planning focus instead of short term planning (n=1).

55 percent of local governments (n=19) mentioned practices that could potentially promote TODs for older adults. These include:

- Promoting senior living facilities and affordable housing near transit stations (n=11),
- Designing facilities for walkability including universal design (n=4),
- Improving older adults' education and access to transit (n=6),
- Modifying zoning ordinances to allow more residential and commercial density (n=2)

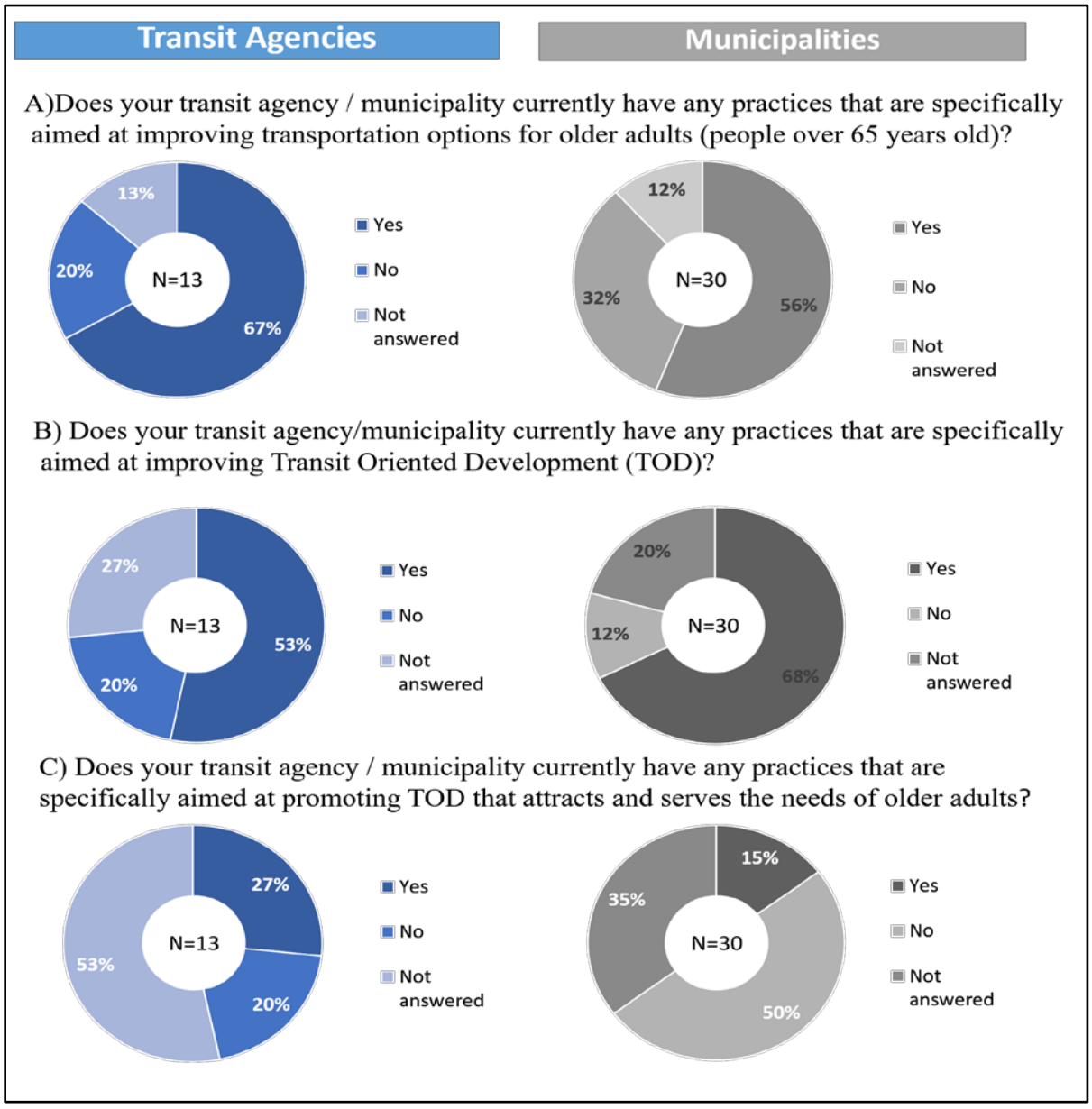

Figure 5.1 Percentage of transit agencies and local governments that have practices to improve transportation options for older adults.

5.4.4 Summary of Current Practices

In summary, the survey showed 67 percent of *transit agencies* (n=10) and 57 percent of *local governments* (n=19) mentioned having practices that are specifically aimed at improving transportation options for older adults. Further, 53 percent of *transit agencies* and 68 percent of *local governments* mentioned having practices aimed at improving TOD. However, only 27 percent of *transit agencies* and 15 percent of *local governments* indicated they had practices to promote TOD for older adults (Table 5.1). Those few respondents that indicated they had such practices could only provide limited and/or vague examples.

While many of the respondents have an interest in better serving older adults and facilitating TOD, few of them are considering these in concert. Facilitating TODs for the aging population appears not be a priority. Thus, it seems that very few (if any) of the relevant stakeholder are taking full advantage of the benefits that TOD can provide to older adults (as previously outlined). This means there is ample opportunity for agencies with concern for their older constituents to pursue creative policies that can better facilitate TOD for older adults.

Table 5.1 Transit agencies and municipalities that mentioned having practices to promote transit for older adults, TODs, and TODs for older adults

	Respondents	*Currently has practices to promote*		
		Transit for older adults	*TOD*	*TODs for Older adults*
Transit Agencies	DART	No	Yes	N/A
	Denver RTD	Yes	Yes	No
	GCRTA	Yes	N/A	N/A
	Massachusetts Bay Transportation Authority	Yes	Yes	Yes
	MTA - MD	Yes	Yes	Yes
	PATCO	Yes	No	N/A
	Regional Transportation Authority of Northeastern Illinois	Yes	N/A	N/A
	San Diego MTS	No	No	N/A
	SFMTA	Yes	Yes	Yes
	SunRail/Florida Department of Transportation	Yes	Yes	Yes
	Utah Transit Authority	Yes	Yes	No
	Valley Metro	Yes	Yes	No
	VRE	No	No	N/A
Local Governments	Atlanta	No	Yes	No
	Boston	Yes	N/A	N/A
	Brentwood	Yes	Yes	No
	Brookhaven	No	Yes	No
	Charlotte	Yes	Yes	No
	Chicago	No	Yes	No
	Dallas	Yes	Yes	Yes
	DeBary	No	Yes	No
	Denver	Yes	Yes	Yes
	District of Columbia	Yes	Yes	Yes
	East Cleveland	Yes	Yes	N/A
	Garland	Yes	N/A	N/A
	Kent	No	Yes	No
	Leander	No	Yes	No
	Lone Tree	Yes	Yes	No
	Los Angeles	Yes	Yes	Yes
	Miami	Yes	Yes	No
	Minneapolis	No	Yes	No
	Norfolk	Yes	N/A	N/A
	Orlando	Yes	Yes	No
	Philadelphia	Yes	Yes	No
	Phoenix	Yes	Yes	Yes
	Pittsburgh	No	No	N/A
	Rancho Cordoba	Yes	No	N/A
	Salt Lake City	No	Yes	No
	San Diego	No	Yes	No
	San Francisco	Yes	Yes	No
	Santa Fe	Yes	No	N/A
	South Miami	No	Yes	No
	St. Louis City	Yes	No	N/A

*N/A: Not answered

5.4.5 Barriers to Promoting TOD for Older Adults

61 percent of transit agency respondents (n=7) listed possible barriers to TODs for older adults. Some of the barriers mentioned were:

- The cost of development (n=3),
- Low density development (n=2),
- A lack of nearby amenities for older adults (n=1),
- TOD is usually not affordable for older adults (n=1).

Some of the barriers identified in this part of the survey apply to TOD in general (e.g., cost, density, affordability), and they are well documented in the broader literature (Cervero, 2001; Chatman & DiPetrillo, 2010). This lack of specificity regarding older adults is an additional indicator of the lack of thought these agencies give to promoting TOD for older adults. Lack of nearby amenities for older adults, while only mentioned by one agency, is one barrier that specifically pertains to older adults. The lack of nearby hospitals, senior centers, sporting events, and shopping malls could be one of the most important factors preventing older adults from moving to TOD neighborhoods. Additionally, while the high cost of housing within many TODs applies to all age cohorts, it may be a particularly important barrier for older adults on fixed incomes.

66 percent of local governments' representatives (n=20) provided their opinion regarding what could be the main barriers for TOD for older adults:

- The market dictates the population segments for new housing and currently the housing market focuses to "non-traditional households" or Millennials (n=7),

- Senior facilities compete with more lucrative developments (n=1),
- Not enough fixed transit stops (n=1),
- Cost of housing around stations (n=1),
- Lack of nearby amenities for older adults (n=1),
- Housing preferences (n=1).

The most cited barriers were related to the high cost of development and housing market issues. Regarding cost of development, some private investors see TOD as risky due to the high cost of land assemblage, environmental cleanup, and infrastructure finance (Cervero, 2001). This barrier pertains to TOD in general, but high development costs result in TOD projects that are often targeted to higher income residents, leaving low income older adults with no possibilities to move near transit stations (Loukaitou-Sideris & Banerjee, 1996).

In regards to market issues, several respondents mentioned that currently the housing market is targeted to Millennials or non-traditional households, such as “Dual income no kids” or the “Creative professionals” (n=7). Therefore, senior facilities compete with more lucrative developments (n=1). To overcome these barriers, governmental aid could reduce the risk (real or perceived) and promote TOD with affordable housing for older adults by providing developers incentives such as pricing, taxes and charges, subsidies, rebates, grants and loans, rewards, or bonds (Cervero, 2001).

5.4.6 Existing TOD for Older Adults

Stations Areas with High Concentrations of Older Adults

Figure 5.2 shows that 33 percent of *transit agencies* indicate having stations areas with high concentrations of older adults (n=5). A follow up question asked them to identify the three main stations by name and the reason(s) they believed those stations have a high concentration of older adults. However, only two agencies responded to this follow-up (as described below).

The Utah Transit Authority (UTA) identified high concentrations of older adults at their (1) Midvale station (Blue Line), (2) Meadowbrook station (Blue Line), and (3) Roy station (FrontRunner). The UTA representative saw the presence of more than a dozen senior living residences near these stations as the key to attracting older residents to live there. It is important to note that the majority of these senior housing projects opened after the light rail began operations. In fact, some of them opened in the past year or are about to open in future months.

The respondent from San Diego Metropolitan Transit System (MTA) identified the H Street Station from the Trolley Blue Line as the only station with a high concentration of older adults. According to the MTA representative, the main characteristic that attracted older populations to this station is the presence of high-rise apartments. These apartments attract a higher concentration of people overall and it may be that the existence of luxury-style apartments may suit higher income older adults.

30 percent of local governments say they have stations areas within their municipal boundaries with high concentrations of older adults (n=10) (Figure 5.2). The main reasons given by respondents were:

- The presence of affordable housing (n=4)
- The presence of age-restricted housing (n= 2)
- Proximity to specific neighborhoods, such as Chinatown (n=2),
- The presence of mixed-uses (n=1)

Local governments believed that the presence of affordable housing near stations (n=4) is one of the most important reasons why there is a high concentration of older adults. For instance, the city of Philadelphia has several senior housing buildings located within a walking distance to the Suburban, Market East and Lombard South stations. Likewise, there are more than 25 hospitals located in the city, and many of them are located near transit stations. This suggests that the presence of hospitals and health facilities are key elements in attracting older residents to live in TOD neighborhoods. While it is impossible that a hospital can be placed at more than a few stations, transit operators interested in creating TOD for older adults may have success by putting a high priority on locating stations near existing hospitals.

Respondents from Pennsylvania and San Francisco mentioned that being near specific neighborhoods, such as Chinatown, is a reason that a station might have a high concentration of older adults. Chinatowns in the U.S. are characterized by having a large concentration of multi-generational households, immigrants, and low-income housing which includes seniors (Li, Leong, Vitiello, & Acoca, 2013). Moreover, Chinatowns usually have restaurants, shops, galleries and markets combined with residential units. This coincides with the literature that indicates mixed uses, walkable places, and small alleys, provide a safe place for the aging population [JCHS, 2014, Kihl, 2005]. As with hospitals, transit operators that place a higher

priority on locating their stations near such neighborhoods may have greater success in promoting TOD for older adults.

Table 5.2 Population change of adults 65+ at different stations from 2000 to 2010

State	*Agency*	*Station name*	*2000*			*2010*			*2010-2000*
			Total	**65+**		**Total**	**65+**		
CA	BART	Montgomery St.	13149	3148	24%	15146	3292	22%	5%
CA	BART	Powell St.	34220	5802	17%	38255	6240	16%	8%
CA	Metro	Chinatown Station	8644	1422	16%	9238	1270	14%	-11%
CA	Metro	Little Tokyo / Arts District Station	6113	838	14%	7810	1111	14%	33%
CA	MTS	H Street Station	5815	819	14%	6024	845	14%	3%
CA	MTS	25th/Commercial St Station	14017	816	6%	12561	798	6%	-2%
NM	NMDOT	Santa Fe Depot	2774	493	18%	2345	466	20%	-5%
NM	NMDOT	South Capitol	2910	528	18%	2686	637	24%	20%
PA	PATCO	Market St. Station	12310	1512	12%	16697	2101	13%	39%
PA	SEPTA	Lombard-South Station	25939	2810	11%	28752	2769	10%	-1%
PA	SEPTA	Suburban Station	17923	3950	22%	20170	3667	18%	-7%
TX	Capital Metro	Leander Station	172	10	6%	823	30	4%	211%
UT	UTA	Roy Station	1900	211	11%	2834	320	11%	51%
UT	UTA	Meadowbrook Station	1543	111	7%	1662	134	8%	20%
UT	UTA	Midvale Fort Union	3578	268	7%	3223	291	9%	9%

Upon further investigation, we found that most of the stations that respondents indicated had high concentrations of older adults really did have a larger than average population of older adults. Table 5.2 presents a list of the stations that were indicated by the various respondents to have high concentration of older adults and the actual population of older adults from 2000 and 2010. By 2010 most have an older adult population of more than 13%, which is what one finds in the US population as whole [Carrie, 2011]. Further, most of these stations (n = 7) have seen an increase in the percentage of older adults between 2000 and 2020. For those stations that do not reach the national percentage of older population (n=5), we found that three of them (Leander Station at Capital Metro, Meadowbrook Station and Midvale Fort Union at UTA) had experienced older adult's population growth from 2000 to 2010.

5.4.7 TOD Projects Aimed at Older Adults

Figure 5.2 shows that 27 percent of transit agencies identified specific TOD projects that have the explicit objective to attract older adults (n=8). When looking at the identified projects, we found that the majority of them focused on providing senior housing and none of them seems to provide other relevant activities, such as social connectivity, medical services and shopping, which have been shown to be important services for older adults.

SunRail in Florida (Orlando) has several examples of TOD projects focused on older adults. For example, the Uptown Maitland Senior Living facility is a 55+ apartment community located within a walking distance of the Maitland Station. Another project is the Heritage Village Common, which is senior affordable housing located less than quarter-mile from the Longwood

rail station north of Orlando. Both projects had a waiting list before their opening, indicating that there may be unmet demand for affordable senior housing near transit stations.

32 percent of *local governments* identified TOD projects within their municipal boundaries that have made an explicit effort to attract older adults to live near stations (Figure 5.2). Some of the projects mentioned by local governments share similar characteristics to those mentioned by transit agencies. However, some municipalities listed projects that are not focused on attracting older residents, which again suggests a lack of thought as to how TOD can serve older adults. For instance, the city of Miami mentioned Vista Grande, Brickell and West Brickell Apartments as TOD projects located near the stations. However, these are low-income housing projects for the general population not specifically geared towards older adults.

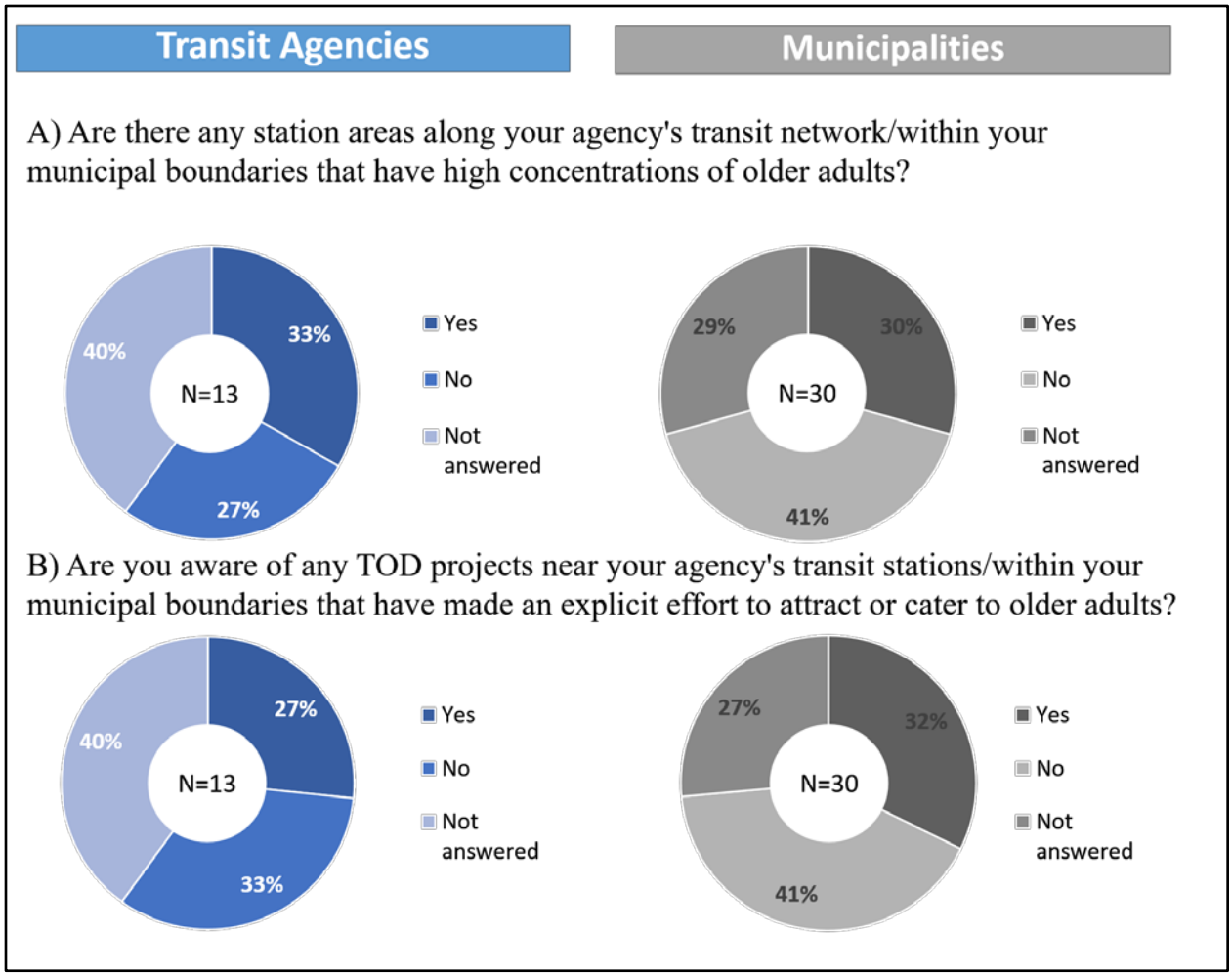

Figure 5.2 Percentage of transit agencies and local governments that identified: A) stations areas with high concentration of older adults and B) TOD projects focus to attract older adults.

5.5 Summary and Policy Implications

Now that the U.S. population is already the oldest in its history [20], it is important to have places where the aging population can safely get around without a car, enjoy public spaces and find the services they need. Nevertheless, cities are unprepared to meet the escalating needs for affordability, accessibility, social connectivity and supportive services (JCHS, 2014).

Different studies suggest that TOD could be a good means of providing adults with everyday activities [20, 21]. Therefore, there is a potential opportunity for transit agencies and local governments to promote TODs with walkable places, access to cultural activities, safe and affordable transportation, adequate housing, and a range of services for current generations of older adults as well as generations to come.

This study found that notwithstanding that many transit agencies and *local governments* mentioned having practices aimed at improving TOD options, much fewer indicated any kind of specific focus on promoting TOD for older adults. Thus, unfortunately, this study does not provide a successful policy blueprint in this regard. However, this also means that there are significant opportunities to implement creative practices that can make TOD a more relevant strategy in helping older adults stay active and engaged with needing to drive.

As indicated by our survey, the main barriers to promoting TOD for older adults are financial feasibility, market issues, and lack of nearby amenities for older adults. As a result, the highest proportions individuals living in TODs are young to middle-aged adults 20 to 39 [Wood, 2016]. There is a need to attract relevant services and amenities to TODs or to build stations near such amenities, which may promote a more supportive climate for older individuals. Therefore, policymakers should consider providing incentives for developers and for older adults to promote aging-focused TOD through mechanisms such as pricing, taxes and charges, subsidies, rebates, grants and loans, rewards and bonds. More research is needed to determine which approaches are the most effective at attracting older individuals to this type of development.

Finally, there are some stations and projects that have been successful in attracting older adults. Our survey reveals that they have a variety of aging-focused destinations and services, such as senior centers, senior housing, hospitals and health care services within a walking distance from stations. Future work should look more closely at the physical, political and local characteristics around those stations to obtain information about what attracts aging population to live near them, and to determine whether these places have naturally occurred or if they are the result of policy interventions.

Chapter 6 Do Transit Oriented Developments Provide Greater Local Neighborhood Access to Activities for Older Adults?

6.1 Introduction

The purpose of this chapter is to examine the accessibility to activities within TOD neighborhood boundaries (typically defined as a half mile in the literature) of a set of U.S. municipalities and transit agencies sampled that reported that they are working to attract aging populations to TOD neighborhoods in their jurisdictions. We examine the number of various activities that are of interest to older adults and compute accessibility scores across each city/agency. Computing accessibility scores within TOD neighborhoods allows us to examine whether cities/agencies who actively promote TOD for aging adults are actually seeing better access to opportunities for their older adults than the younger age cohorts. Our results show that even though transit agencies/municipalities report that they are engaged in promoting TOD for older adults, they have very different accessibility levels across age groups.

6.2 Methods and Data

The survey described in Chapter 5 identified a total of 8 transit agencies and municipalities indicated that they currently have practices aimed at attracting older adults to TOD. These cities vary in geographical scale and population size and are relatively dispersed across the U.S. From these agencies/municipalities 7 were selected from a total of 43 in order to examine the accessibility to a range of opportunities across age groups. SunRail, located in Orlando, FL, was excluded because it is a relatively new transit system.

Station locations for each transit system were extracted from the National TOD database, which is updated to the year 2011(Center for Transit Oriented Development, 2011). Typically, TOD is defined as a community with mixed-use development surrounding a transit stop. Here we define all stops from the selected transit agencies as potential TOD neighborhoods. As such, stations may not meet the typical criteria used when describing TOD. Transit modes included in this study are only those operated on a fixed-guide way system and include, light rail, commuter rail, streetcar, and heavy rail.

Demographic information on the ages of those residing within TOD boundaries was extracted from the National Historical Geographic Information System (NHGIS)*(*Minnesota Population Center, 2011*)*. Census blocks from the 2010 summary file 1 are the geographical unit utilized for this study. Age cohorts are grouped for individuals 18-49, 50-64, and 65 and older. We further disaggregate the older adult cohort into groups, 65-74, 75-84, and 85 and older. Activity data is taken from the NAVTEQ HERE database, which includes the locations of a number of opportunities from the year 2013*(*Caliper Corporation, 2013*)*. We chose to measure access to opportunities that might be of interest to older adults such as shopping, grocery stores, post offices, banks, etc., which follows from the types of locations analyzed in previous research *(*Alsnih & Hensher, 2006*)*.

We chose to examine the number of opportunities available within the neighborhood boundaries of the TOD neighborhood relative to the location of the transit stops. In other words, TOD neighborhood boundaries are defined as a half-mile radius surrounding a transit stop. These boundaries have been used throughout the literature as an appropriate neighborhood boundary for individuals to access opportunities by foot *(*Cervero et al. 2002;, Cervero &Gorham, 1995).

We calculated these areas in a GIS environment by creating half-mile buffers around each transit stop. We calculate accessibility scores by taking the number of activities within each TOD neighborhood across a single transit agency or municipality and weight it by the number of individuals in each age group.

More broadly then, the goal of this research is to examine the accessibility of different age cohorts to a number of opportunities exclusively within TOD neighborhood boundaries that can be reached on foot. We chose to examine transit agencies/municipalities who indicated that they have practices engaged in attracting older adults to TOD neighborhoods in order to identify whether these transit systems are affective at providing access to opportunities for older adults specifically within TOD neighborhoods. We compute accessibility scores across each transit agency/municipality and age group to a variety of activities and then observe which agencies/municipalities provide better access to older adults compared to younger age cohorts.

6.3 Results

This study computes accessibility scores within a half mile of each transit stop across the seven transit agencies/municipalities who, when surveyed, indicated that they have practices aimed at attracting older adults to TODs (Valdez-Torres et al, 2016). We organize our results so that access to opportunities may be examined across age cohorts in order to identify how well these transit agencies provide access to older adults compared to younger adults. Higher accessibility scores are highlighted green in order to easily identify which age cohorts have the highest accessibility.

We present our results in Table 6.1. Of the transit systems that we have chosen to examine, each one has a different system than the others. The Massachusetts Bay Transportation Authority (MBTA) is a relatively large system with 288 stops and operates transit for the greater Boston area. The San Francisco Transportation Authority is also relatively large with 255 stops covering a large metropolitan statistical area. On the other end of the spectrum, we examine transit systems like Phoenix and Dallas, with relatively fewer stops (33 and 55, respectively). Phoenix is a city known for its urban sprawl and outreaching suburban neighborhoods, while the greater Boston area is known for its dense urban areas and many citizens rely on public transit daily. As such, each transit system varies in size and coverage, which allows us to examine the opportunities available within TOD across contrasting systems.

Table 6.1 Accessibility to opportunities for residents across age groups 18-49, 49-50, and 65 and older who live within TOD (half-mile radius of a transit stops)

	# of stops	Age Groups	Financial	Grocery Stores	Libraries	Parks	Pharmacies	Post Offices	Restaurants	Hospitals	Shopping (Apparel)	Shopping (misc.)
Maryland Transit Authority	92	18-49	7.31	2.36	0.89	0.35	4.08	0.78	63.18	1.05	6.20	4.95
		50-64	5.16	2.08	0.65	0.39	3.49	0.64	46.77	0.75	4.46	4.40
		65 and up	5.56	2.16	0.68	0.37	3.66	0.62	49.48	0.84	4.75	4.59
Massachussettes Bay Transit Authority	288	18-49	13.10	6.13	1.38	3.86	4.26	1.60	98.69	0.78	11.51	9.43
		50-64	13.00	5.87	1.17	3.71	3.87	1.52	91.51	0.76	11.45	9.39
		65 and up	13.84	5.88	1.23	3.83	4.02	1.56	96.42	0.81	11.98	9.75
San Francisco Municipal Transportation Agency	255	18-49	20.79	21.91	1.41	2.38	8.04	1.64	214.62	1.39	30.14	18.22
		50-64	22.53	21.90	1.46	2.48	8.16	1.73	220.90	1.31	31.97	18.62
		65 and up	26.26	23.40	1.48	2.65	8.83	1.83	244.26	1.44	35.27	19.80
Dallas	94	18-49	8.20	1.67	0.08	3.74	2.29	0.30	51.50	0.82	5.99	2.42
		50-64	6.25	1.49	0.10	3.10	2.04	0.31	39.80	0.69	5.02	2.36
		65 and up	4.81	1.48	0.12	2.30	2.08	0.28	32.02	0.70	5.03	2.43
Denver	55	18-49	27.16	2.35	0.76	1.96	1.47	1.35	125.89	0.00	9.55	7.48
		50-64	26.00	2.25	0.70	1.92	1.41	1.27	122.52	0.00	9.20	7.44
		65 and up	26.88	2.13	0.67	1.84	1.40	1.28	129.96	0.00	9.55	7.76
Phoenix	33	18-49	4.50	0.98	0.15	1.24	1.07	0.50	34.26	0.11	1.65	2.46
		50-64	4.81	0.90	0.22	1.19	1.41	0.36	30.24	0.21	1.49	2.43
		65 and up	4.43	0.87	0.23	1.09	1.41	0.30	26.87	0.25	1.47	2.48
Washington DC	130	18-49	12.41	3.42	0.80	1.87	3.79	1.19	78.28	0.17	5.47	6.75
		50-64	9.22	2.93	0.69	1.53	2.93	0.93	59.49	0.11	4.47	5.76
		65 and up	10.08	3.02	0.73	1.56	3.14	0.99	62.64	0.12	4.83	6.25

Our results indicated that some transit agencies/municipalities are better at providing relative access to opportunities than other transit agencies/municipalities. Maryland, MBTA, and San Francisco Municipal Transportation Agency are the three transit agencies that answered in

the affirmative that they are currently trying to attract older adults to TOD. Among the activity types, all age cohorts have the greatest access to restaurants. All age groups have access to at least 25 restaurants within the half-mile radius of a TOD. San Francisco's transportation agency has the highest access to restaurants for all age groups, with adults 65 and older having access to the most, 244.26 within TOD neighborhoods. San Francisco also has the most transit stops of any transit agency or municipality so it is to be expected that they would have more activities, since they have more TODs within their system. Hospitals have the lowest accessibility score across all agencies/municipalities. Denver appears to have no hospitals within a half-mile radius of a TOD. Financial services, or banks appear to be very abundant within TOD boundaries as evidenced by there being at least 4 across all age groups and transit agencies/municipalities. Additionally, shopping for both apparel and miscellaneous appears to be a very popular activity within TOD neighborhoods.

When examining the accessibility scores across age groups, we come across some interesting insights into the relative access each transit system offers aging adults. It is relevant to note that the numbers in the table represent empirically observed differences that exist in accessibility rather than statistically estimated differences. We use full enumeration data from the 2010 Census to inform our population counts and as far as the activity data are reliable, we have a full count for the number of each activity available across TODs. Thus, differences in accessibility should be perceived as such.

Looking at our results, it appears that there are differences in the accessibility to opportunities across age groups within each transit system/municipality. The San Francisco Transportation Agency seems to provide the greatest access to older adults, ages 65 and up,

across all activity categories. Adults aged 50-64 appear to have the next best access within TOD neighborhoods. It appears that the San Francisco Transit Agency is provides a high level of opportunities within walking distance of their transit stops. Restaurants and shopping opportunities are the activities with the highest scores. There also appears to be an abundance of grocery stores and financial opportunities within walking distance of a transit stop. For those interested in attracting older adults to TOD, they may wish to examine this agency's strategies for appealing to older adults. Additionally, San Francisco may use these findings to leverage the appeal to those approaching retirement that wish to relocate. If there already exists an older adult population within existing TODs, and they have sufficient access to a plethora of opportunities, this may be a good selling point when trying to convince older adults who choose to downsize after retirement.

On the other end of the spectrum, the municipality of Washington D.C. provides the greatest access to adults 18 to 49 and the lowest access to adults 50 to 64 across all categories. Similar to the San Francisco Transit Agency, Washington D.C. provides the greatest access to restaurants overall. It also provides access to financial and some shopping opportunities. Unlike San Francisco, Washington D.C. has lower scores overall for accessibility to grocery stores. If Washington D.C. hopes to attract more aging adults to TODs they may have to work to provide more amenities and opportunities within TOD neighborhoods. Having a grocery store within walking distance could be a high selling point for older adults since it would mean not having to use transit in order to buy food and household items. Maryland Transit Agency is similar to Washington DC in that it also has the highest accessibility scores for younger adults. For one activity category, Parks, adults 50 to 64 have the highest accessibility score. Unlike, Washington

DC there is some variation between adults 50-64 and 65 and older concerning who has the lowest accessibility to activities.

The Massachusetts Bay Transit Authority offers higher access to shopping and financial opportunities to older adults, while for the remaining activities, younger adults aged 18-49 have higher accessibility scores. The municipality of Dallas has higher access scores for older adults for some shopping opportunities and libraries, yet the remaining activities are more accessible to younger adults. Denver also offers greater access to some activities for older adults, but younger adults have greater access to opportunities overall. Finally, Phoenix has higher accessibility scores for activities such as, libraries, pharmacies, hospitals, and some shopping opportunities. Phoenix also provides greater access to financial opportunities for adults aged 50-64.

For the most part, out of all the municipalities and transit agencies examined only one offers consistent greater accessibility to opportunities for older adults who live within a half-mile from a transit stop. A key finding is that even when older adults aged 65 and older have greater access, adults 50-64 who live in TOD neighborhoods usually have the least access to opportunities. Since this age cohort makes up the majority of baby boomers, more information needs to be garnered towards what would attract this generation to TODs. If these transit agencies and municipalities wish to build and implement successful practices geared towards older adults, perhaps they should focus on making TODs attractive to baby boomers who wish to downsize and relocate from the suburbs after retirement.

Table 6.2 reports the accessibility of aging adults 65 and older broken down into smaller age groups: 65-74, 75-84, and 85 and older. Once again, the highest accessibility scores across

each transit system are highlighted green. Comparing the older subgroups, there appears to be variation across each transit system has to who has the greatest access to opportunities. Interestingly, while Washington DC had the lowest access to opportunities for older adults as a whole, adults aged 85 and up have the highest accessibility among older adults. This age cohort is probably the most vulnerable to driving cessation or being unable to operate a personal vehicle. While, Washington DC may have lower scores for aging adults overall, it is interesting that they provide the greatest access to the older adults who may benefit the most from TOD.

The Massachusetts Bay Transit Authority and Denver both appear to have the highest accessibility scores for adults aged 65-74 and the lowest accessibility scores for adults 85 and older. While the San Francisco Municipal Transportation Authority had the highest accessibility scores for older adults overall compared to younger age cohorts, when examining older adult subgroups, adults aged 75 to 84 have the highest accessibility to all opportunities, excluding hospitals. Adults aged 85 and older have the highest access to hospitals within this transit system. Phoenix, Dallas, and the Maryland Transit Authority both vary in their accessibility scores across older adult subgroups. Higher access scores are split across various activities, where no subgroup appears to have greater or lower access overall.

Table 6.2 Accessibility to opportunities for residents across age groups 65-74, 75-84, and 85 and older who live within TOD (half-mile radius of a transit stops)

	# of stops	Age Groups	Financial	Grocery Stores	Libraries	Parks	Pharmacies	Post Offices	Restaurants	Hospitals	Shopping (Apparel)	Shopping (misc.)
Maryland Transit Authority	92	65-74	5.59	2.12	0.70	0.36	3.73	0.62	50.39	0.86	4.79	4.55
		75-84	5.66	2.15	0.68	0.37	3.64	0.63	49.60	0.86	4.85	4.64
		85 and up	5.25	2.32	0.62	0.42	3.44	0.63	45.66	0.75	4.36	4.68
Massachussettes Bay Transit Authority	288	65-74	13.77	6.02	1.24	3.88	4.07	1.59	97.33	0.82	12.55	9.87
		75-84	14.18	5.84	1.23	3.82	4.03	1.57	97.65	0.82	11.88	9.89
		85 and up	13.36	5.49	1.15	3.70	3.86	1.45	90.67	0.78	10.29	9.06
San Francisco Municipal Transportation Agency	255	65-74	24.97	22.70	1.47	2.61	8.55	1.79	235.42	1.38	34.01	19.29
		75-84	27.60	24.08	1.50	2.70	9.12	1.88	253.79	1.48	36.86	20.41
		85 and up	27.17	24.02	1.45	2.64	9.00	1.83	249.60	1.53	35.55	19.95
Dallas	94	65-74	5.37	1.51	0.11	2.56	2.11	0.27	35.12	0.74	5.26	2.32
		75-84	4.28	1.43	0.13	2.08	2.01	0.28	29.12	0.67	4.76	2.42
		85 and up	3.56	1.44	0.14	1.70	2.05	0.33	25.29	0.60	4.60	2.91
Denver	55	65-74	28.28	2.15	0.70	1.89	1.45	1.33	136.08	0.00	10.04	7.95
		75-84	26.29	2.08	0.64	1.82	1.37	1.25	127.75	0.00	9.34	7.66
		85 and up	20.70	2.10	0.52	1.60	1.20	1.07	101.72	0.00	7.39	6.96
Phoenix	33	65-74	4.64	0.89	0.22	1.16	1.40	0.34	28.81	0.22	1.46	2.44
		75-84	4.35	0.86	0.22	1.08	1.38	0.29	26.08	0.26	1.45	2.45
		85 and up	3.77	0.80	0.23	0.85	1.51	0.15	20.56	0.39	1.55	2.72
Washington DC	130	65-74	9.73	2.94	0.72	1.56	3.12	0.96	61.89	0.12	4.70	5.97
		75-84	9.88	3.05	0.73	1.48	3.07	0.98	61.00	0.12	4.84	6.32
		85 and up	11.83	3.23	0.78	1.74	3.33	1.12	68.84	0.11	5.31	7.14

6.4 Conclusion

This paper explored older people's accessibility to various activities across age groups living within a half-mile of a transit stop for municipalities/transit systems who reported that they have practices aimed at attracting older adults to TOD neighborhoods. The goal of this paper was to discern differences across age cohorts in order to understand how these transit agencies/municipalities perform in providing access to activities within a half-mile radius of a transit stop. We believe that knowing the level of access to activities available to older adults within walking distance of their residence near a TOD could inform those interested in promoting TODs.

Our results show that even though transit agencies/municipalities report that they are engaged in promoting TOD for older adults, they have very different accessibility levels across age groups. The San Francisco Transit Authority was the only municipality/transit agency that

had the highest accessibility scores for older adults overall. At the same time, while Washington DC had the lowest accessibility scores for older adults overall, when examining subgroups of aging populations, adults 85 and older had the highest accessibility scores. These adults may be the most in need of activities within walking distance since they are more likely to have stopped driving than adults aged 65-84. These findings are informative in that assumptions cannot be made about how well these transit agencies/municipalities perform in attracting aging adults as a whole, since aging adults may have very different and diverse needs depending on the level of aging advancement.

Another key finding is that adults 50-64 had the lowest accessibility scores overall across all activities and transit agencies/municipalities. This age cohort represents the bulk of the baby boomer population, who are set to become the oldest generation in history. While these municipalities/transit agencies answered that they are engaged in promoting TOD for older adults, perhaps there should be some practices geared towards attracting pre-retirement adults. Making TOD attractive places for pre-retirement adults to resettle and downsize after adult children have left the family home could be a viable way to get more of this population to relocate to a TOD.

Future research opportunities are quite plentiful on this topic. One limitation of this study is that it focuses on the opportunities available within TOD neighborhoods and does not take into account what can also be accessed via the transit system. Future research then could include the activities that are also accessible by the transit system from the TOD. Clearly while knowing all of the opportunities that can be accessed by foot within a TOD is important it would be interesting to examine the accessibility to opportunities via the constituent transit systems, and

how this might vary across cities. New research could also look to expand the set of cities considered to include some test or control cases that do not seem to be actively promoting TOD as a means of attracting older adults. Taking this approach could help get a better understanding of the effectiveness of particular policies at promoting TOD.

Chapter 7 Modelling the Attractiveness of TOD for older adults

7.1 Introduction

In this chapter, we apply statistical models to make inferences about station area characteristics that might be more suitable for older adults. The characteristics examined mirror those explored in previous chapters, including median income, number of housing units, number of intersections, types of nearby activities, types of transportation systems, year the stations started to operate, and the size of the metropolitan area where the station is located.

7.2 Data and Methods

We use linear regression models to find a relationship between percentage of older adults and station area characteristics. The unit of analysis of the study is a station area, which is defined as an area with a 0.25-mile network distance buffer around the station. We again use the National Transit Oriented Development Database (CTOD, 2016) to identify station areas across the US.

7.2.1 Cross-sectional Analysis

We first conducted a cross-sectional study to find a relationship in the percentage of older adults living in the station area in 2010 and a set of independent, control and dummy variables that reflect different relevant characteristics of the stations areas. These variables are described in a subsequent section. All data collected for this analysis were chosen specifically based on its availability at the national level. While we were interested in modeling the change in older adults

between 2000 and 2010, there were some instances where data was not available at the national level for the year 2000. While the cross-sectional analysis allows us to analyze the influence of more variables (particularly in terms of specific station area activities), it must be acknowledged that this weaken our ability to make causal inferences.

7.2.2 Dependent Variables

For this study, we used the percentage of older adults in the station as dependent variable. To gain insight of the differences among older groups, we split them into six subgroups:

1) people 55 years and older,
2) people 65 years and older,
3) people between 55 and 64,
4) people between 65 and 74,
5) people between 75 and 84,
6) and finally, people 85 years and older.

Models were then estimated for each subgroup. Breaking older adults into these subgroups allows for a better assessment of how attractive the station area might be for older adults depending on the different levels of cognitive and physical functional capacity.

7.2.3 Independent Variables

Table 7.1 shows the list of independent variables used in this study. The table provides a small description of the variable, the year, and the source of the information..

Table 7.1 Independent Variables

Variable	Description	Year	Source
	Economic Variables		
Income	Household Median Income in the Station Area (Tens of thousands)	2000 and 2010	NHGIS based on 2000 Census SF 3b and 2010 American Community Survey 5 -year Data
Housing Units	Total Housing Units in the Station Area (Thousands)	2000 and 2010	NHGIS based on 2000 Census SF 1B and 2010 SF1a
Intersections	Number of intersections per acre	2010	2010 Census TIGER/Lines (roads)
Banks	Number of banks	2013	NAVTEQ HERE from Caliper Corporation
Grocery	Number of grocery stores	2013	
Hospital	Number of hospitals	2013	
Library	Number of libraries	2013	
Parks	Number of parks	2013	
Pharmacy	Number of pharmacies	2013	
Restaurants	Number of restaurants	2013	
Shopping	Number of shopping areas	2013	
	Control Factors		
%Population CA	Percentage of older adults in the control area	2000 and 2010	
Small	Stations located in small MSAs	2000 and 2010	
Medium	Stations located in medium MSAs	2000 and 2010	
Large	Stations located in large MSAs	2000 and 2010	
Very Large	Stations located at very large MSAs	2000 and 2010	
RT	Rapid transit	2000 and 2010	Center for Transit-Oriented Development
CR	Commuter Rail	2000 and 2010	
SC	Street Car	2000 and 2010	
LR	Light Rail	2000 and 2010	
BRT	Bus Rapid Transit	2000 and 2010	
Y1	Stations opened before 2000	Before 2000	
Y2	Stations opened between 2001 and 2005	2001-2005	
Y3	Stations opened between 2006 and 2010	2006-2010	

Median Income

Earlier chapters have shown that income level at station areas is an important determinant of the presence of older adults (Chapter 4). Therefore, we included *median income* as independent variable. We used *median income* by census blocks, the smallest geographic entity from which income information can be found. During data extraction, we observed that station areas and block groups do not share the same spatial limits. Some stations areas included portions of one or more census blocks (See example in Figure 7.1). Consequently, we calculated an income weighted average based on the number of total households per census block and the percentage of the block group included in the station area as follow:

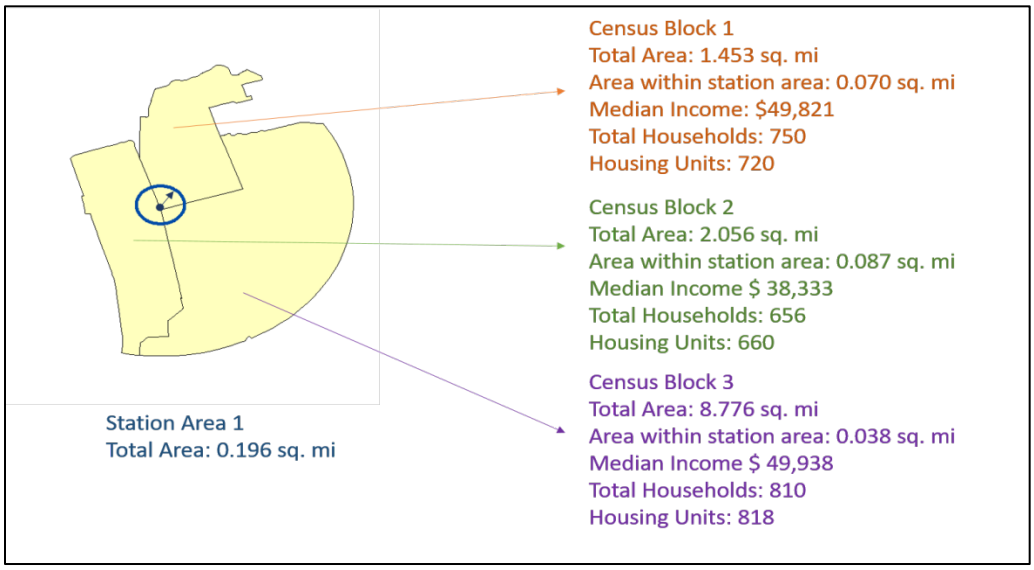

Figure 7.1 Example of a station area with census blocks

$$Station\ Area\ Income_1 = \frac{\sum_{i=1}^{n} HH_i \times Income_i \times \%BGSA_i}{\sum_{i=1}^{n} HH_i \times \%BGSA_i}$$

Where:

HH → Total Households

Income→ Median Household Income

%BGSA→ Percentage of the block group within the station area

As an example, we used the information provided in Figure 7.1 to calculate Station Area 1 Income:

$$SA_1 Income = \frac{\sum (750 \times 49{,}821 \times \%BGSA_1) + (656 \times 38{,}333 \times \%BGSA_2)\,(810 \times 49{,}938 \times \%BGSA_3)}{\sum (750 \times \%BGSA_1) + (656 \times \%BGSA_2) + (818 \times \%BGSA_3)}$$

$SA_1\ Income = \$45{,}178$

Housing Units

Housing units is a way to measure the density of the stations area. We expect to find a positive correlation between percentage of older adults and the number of housing units per station area since a dense layout discourages driving dependence (Dittmar & Ohland, 2004; Cervero et al, 2004; Stiffler & Nuworsoo, 2012). Similar to *median income*, *housing units* by census block do not share spatial limits with station areas. Therefore, we calculated the number of housing units within each station area using an area-weighted housing units as follows:

$$Station\ Area\ HU_1 = \sum_{i=1}^{n} \%BGA\ within\ SA_i \times HU$$

Where:

%BGA within SA → Percentage of the Block Group Area within the Station Area

HU → Block Group Housing Units

As an example, we used the information provided in Figure 7.1 to calculate the number of housing units in station area 1:

$$SAHU_1 = \sum_{i=1}^{n} (0.070 \times 720) + (0.087 \times 660) + (0.038 \times 818)$$

$$SAHU_1 = 140$$

Street Intersections per Acre

Denser road networks could be a positive factor for aging populations because accessibility increases as the number of intersection increases. We expect to find a positive correlation between the number of intersections per acre and the percentage of older adults in the station areas. We calculated the number of street intersecion within each station area using the method proposed by Honeycutt (Honeycutt, 2013).

Number of activities

The number of activities includes the location of several destination opportunities located within the station area. Information about these activities come from the 2013 NAVTEKS Here database (Caliper Corporation, 2013). From a range of activities found in the database, we included only those that might be of interest to older adults such as banks, grocery stores, hospitals, libraries, parks, pharmacies, restaurant and shopping. Our selection was based on findings from Chapters 2 and 4, and activities that have been identified to be important for older adults in previous research (Alsnih & Hensher, 2006).

7.2.4 Control Factors

To control for the underlying trends independent of the influence of the transit station, we calculated the percentage of older adults in the area between .25 miles and 2 miles of a station. This was then included as an independent variable in the model.

7.2.5 Dummy Variables

We used three sets of dummy variables to capture differences in the MSA size, the transit modes available and the year of operation of the station as follow:

Metropolitan Statistical Area Size (MSA)

Chapter 3 shows that the size of the MSA influences housing markets, extensiveness of transit networks, and preferences of older adults. For instance, adults nearing retirement age (55-64) seem to be more attracted to live in station areas in very large MSAs. To control variation in MSA size and to capture different spatial dynamics we used the same MSA system of classification used in Chapter 3: 1) a small MSA was defined as having fewer than 500,000 people, 2) a medium MSA had between 500,000 and one million people, 3) a large MSA had between one million and three million people, 4) while a very large MSA had more than three million people.

Transit Modes

In Chapter 3, we found that station areas have different characteristics depending on the transit mode available. While the literature does not speak much to this, we have the theoretical

expectation that different types of transit might or might not be suitable for older adults. For instance, older adults are probably more attracted to transit modes that serve shorter distance, with multiple stops, and higher frequency of service such as rapid transit, light rail and street cars. On the other hand, we expected to find older adults are less likely to use transit modes that serve longer distances with lower frequency of service such as commuter rail. We also expect to find that older adults are not attracted to bus rapid transit because research has found that older adults are afraid to use buses since they perceived this mode of transit as not safe and less attractive because it is difficult to getting on and off the vehicle (AARP Public Policy Institute, 2001). To control for the presence of different transit modes in the station area, we created five dummy variables 1) *rapid transit (RT), commuter rail (CR), street car (SC), light rail (LR),* and *bus rapid transit (BRT).*

Station Year

Finally, we also included a set of three dummy variables to identify a correlation between the age of the transit system. Although we could not find information about older adult's preferences for old or new systems, it seemed pertinent to examine whether new or more established systems correlate with concentration of older adults.

7.3 Regression Model Development

7.3.1 Attractiveness and effectiveness of TOD from the perspective of aging population for 2010 (Cross-sectional Analysis)

The cross-sectional analysis model summary can be found in Table 7.2. The summary shows that the explanatory power of the model decreases as age increases. For instance, the set of predictors in the model for older adults 55+ explains 40 percent of the variation in the percentage of older adults in the station area ($R^2 = 0.409$). Using the same set of variables, the 65+ model explains about 36 percent of the variation in the percentage of older adults in the station area ($R^2 = 0.369$). Consider now the results obtained for older 85+ model, where only 26 percent of the variation in the percentage of older is explained by the predictor ($R^2 = 0.263$). The explanatory power of the 85+ model is 14 percentage points less than for the 55+ model. Since the explanatory variables are constant across the six models, this result can be interpreted as indicating that the model has a better explanatory power for the younger subgroups for older adults.

Table 7.2 Cross-sectional Model Summary

Model	*55+*		*65+*		*55-64*		*65-74*		*75-84*		*85+*	
R square	0.412		0.372		0.405		0.335		0.376		0.266	
Adjusted R square	0.409		0.369		0.402		0.332		0.373		0.263	
Std. error of the estimate	6.189		4.456		2.480		1.958		1.711		1.426	
Coefficients												
(Constant)	-3.7130	*	-1.5575	*	-1.6983	*	-0.6128	*	-0.5604	*	-0.3054	*
%Population	1.0544	*	1.0652	*	1.0491	*	0.9990	*	1.0477	*	1.1344	*
Median Income	-0.0081		-0.0092	*	0.0484	*	-0.0046		-0.0376	*	-0.0294	*
Number of Housing Units	0.2371	*	0.2382	*	-0.0136		0.1069	*	0.0875	*	0.0533	*
Intersections	0.2612		-0.0084	*	0.8110	*	-0.3331		-0.2569		-0.2460	
Banks	0.0586		0.0735	*	-0.0167		0.0201	*	0.0340	*	0.0207	*
Grocery	0.1133	*	0.0383		0.0653	*	0.0080		0.0271		0.0068	
Hospital	0.0616		0.2961	*	-0.2357	*	0.0098		0.1484	*	0.1317	*
Library	-0.5317	*	-0.2469		-0.2909	*	-0.1655	*	-0.0749		-0.0044	
Parks	0.7967	*	0.4994	*	0.2998	*	0.3063	*	0.1526	*	0.0336	
Pharmacy	0.0796		0.0798		-0.0032		0.0261		0.0248		0.0317	*
Restaurants	-0.0074		-0.0092		0.0036		-0.0029		-0.0033		-0.0039	*
Shopping	-0.0813	*	-0.0879	*	0.0012		-0.0265	*	-0.0337	*	-0.0248	*
Small	0.4694		0.4403		-0.0614		0.3218		0.0545		0.0848	
Medium	0.8508		0.5257		0.1875		0.1875		0.1790		0.2298	
Large	0.3795		0.3253		0.0574		0.2298	*	0.0573		0.0490	
Commuter Rail	1.5063	*	1.0919	*	0.3174	*	0.4102	*	0.5029	*	0.2454	*
Street Car	1.5113	*	0.7627	*	0.6362	*	0.5193	*	0.2570	*	0.0451	
Light Rail	1.6579	*	0.9990	*	0.4702	*	0.3041	*	0.4182	*	0.3513	*
Bus Rapid Transit	0.5619		0.2209		0.1263		-0.0239		0.1463		0.2123	
Y2	0.4526		0.2634		0.2547		0.0652		0.1118		0.0308	
Y3	0.2677		0.0330		0.1912		0.0091		0.0496		-0.0232	

* Significant □ <0.05

Excluded Variables: Very Large, Rapid Transit, Y1

Median Income

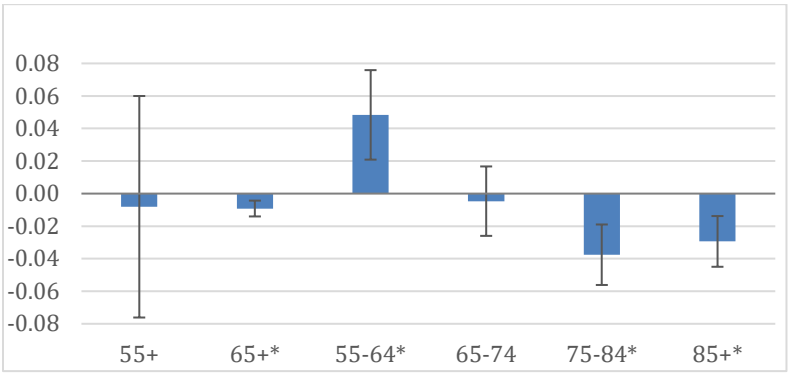

Figure 7.2 Coefficients for median income

Table 7.2 and Figure 7.2 show that an increase of ten thousand dollars in m*edian income* would predict a 0.038 percentage point decrease in older adults between 75 and 84 years living in the station area (β= -0.0376). The results suggest that as *median income* increases in station areas, the percentage of older adults slightly decreases. In other words, high *median income* might discourage older adults to live in station areas. This finding reinforces Chapter 2 conclusion, which indicates that station areas have much higher incomes than the control areas, which could be a detriment for older adults to live near in them. The oldest subgroups (65-74, 75-84 and 85+) might be less likely to live in station areas as income increases. The above could be explained by fact that most people in these subgroups are formed mainly by retired individuals. On the other hand, Figure 7.2 also shows that m*edian income* has a positive influence for the younger subgroup (55-64 years), which could be related with the fact that this group remains in the labor market. The results show that *median income* seems to be positive related to percentage of older adults between 55 and 64 years.

Number of Housing Units

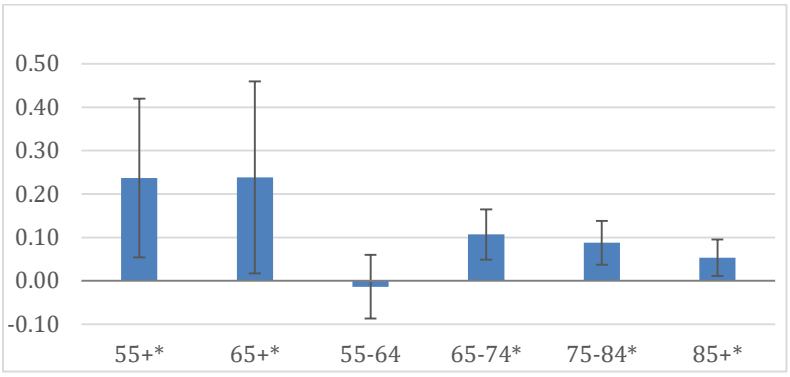

Figure 7.3 Coefficients for housing units

Table 7.2 and Figure 7.3 show that, controlling for the rest of the independent variables, an increase of a thousand *housing units* in the station area might produce a total increase in older adults of 0.24 percentage points (55+ β= 0.237) (65+β= 0.238). In the same way, as the number of housing units in the station area increases it is more likely that older adults live in station areas. This could be explained by the fact that the more housing units in a community people are in closer in proximity to different services.

Intersections per Acre

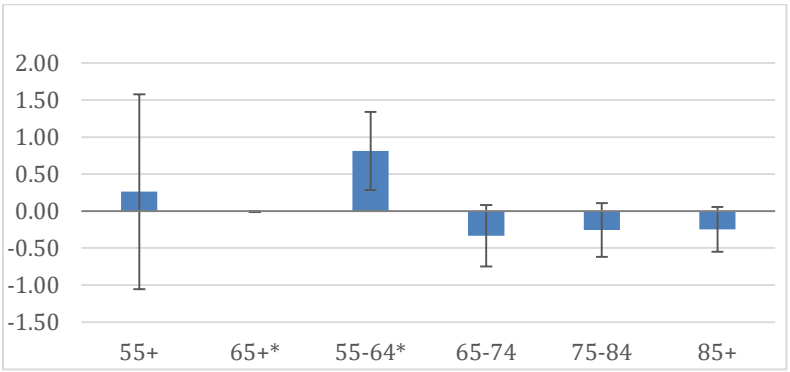

Figure 7.4 Coefficients for Intersections per Acre

Contrary to what we expected, Table 7.2 and Figure 7.4 show that as the number of intersections increases the less likely for the oldest subgroups to be attracted to the station area (65-74, 75-84, 85+). The above could be related to the fact that a high density of intersections might correlate to busy streets, which might deter older adults. In contrast, the younger subgroup of older adults (55-64 years) might be more likely to live in station areas with more intersection per acre.

Number of Activities

Number of banks in the station area

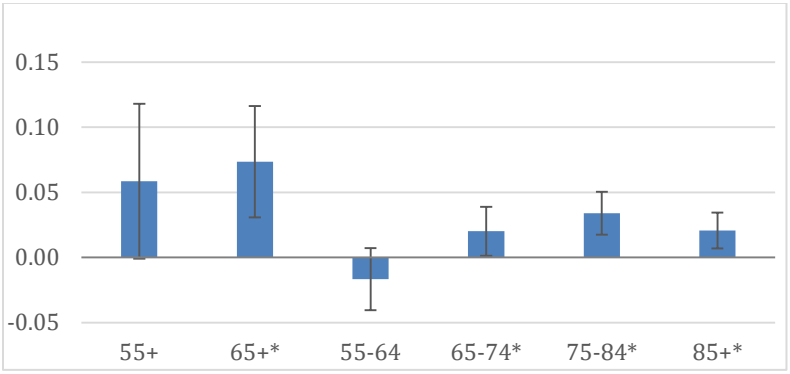

Figure 7.5 Coefficients for number of banks

Table 7.2 and Figure 7.5 show that there is significant and positive relationship between the number of banks available and the percentage of older adults (ages 65-74, 75-84 and 85+) in station areas. The presence of a bank branch in the station area might increase the percentage of a given category by 0.024 to .073 percentage points. This is true except for older adults between 55 to 64 years, to which an increase in a bank branch predicts a decrease. This could be related to the fact that the oldest subgroups are more used to face-to face services, and because they might

face lack of computer skills which could explain the reason why they prefer to be live near bank branches.

Number of grocery stores in the station area

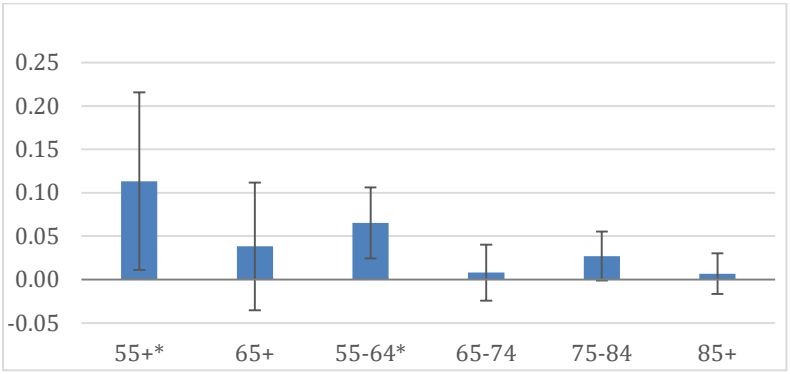

Figure 7.6 Coefficients for grocery stores

Older adults might face mobility difficulties that can prevent them to get to grocery stores or to carry their shopping back home. Under those circumstances, we expected to find a positive relation between the percentage of older adults and the number of grocery stores in the station area. Contrary to what we expected, grocery stores seems to be less important for the older subgroups. Table 7.2 and Figure 7.6 show that while an increase in one grocery store in the station area might increase the 55-64 subgroup (β= 0.0653), the increase is much smaller for other groups.

Number of hospitals in the station area

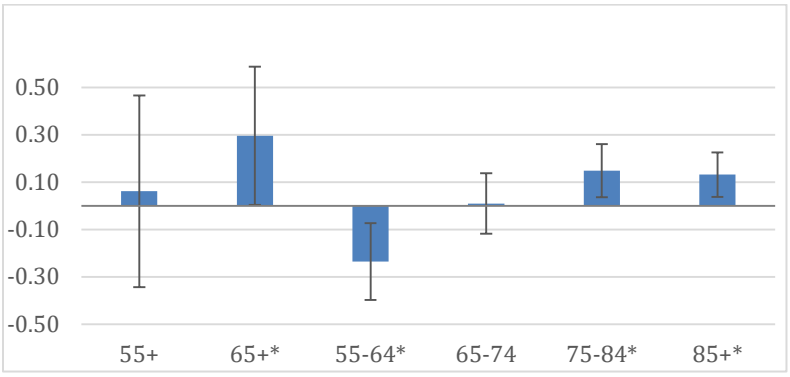

Figure 7.7 Coefficients for hospitals

Table 7.2 and Figure 7.7 shows that the older subgroups (75-84 and 85 and over) are more likely to live near hospitals. For instance, the presence of a new hospital might increase their population by about 0.15 and 0.13 percentage points, respectively. In the same way, hospital appear to decrease the percentage of the older adults between 55 to 64 years. These results are consistent with the number of visit to hospital or medical institutions and the age of patients.

Number of libraries in the station area

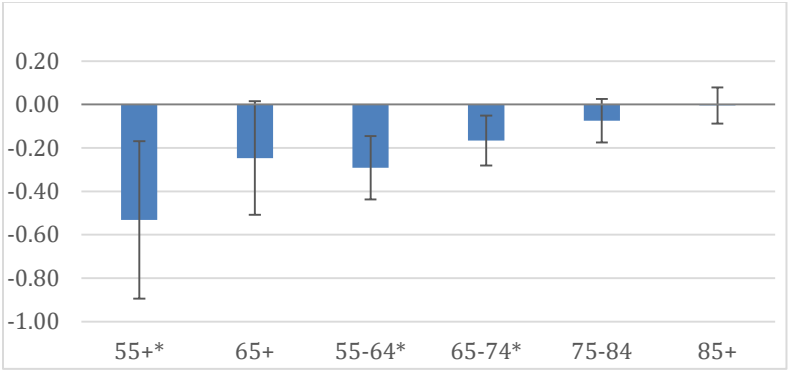

Figure 7.8 Coefficients for libraries

Libraries usually offer programs and services to engage and empower older adults. Therefore, we expected to find that older adults in higher percentages libraries. However, Table 7.2 and Figure 7.8 suggest the contrary. The younger subgroups in particular seem likely to live in station areas with libraries.

Number of parks in the station area

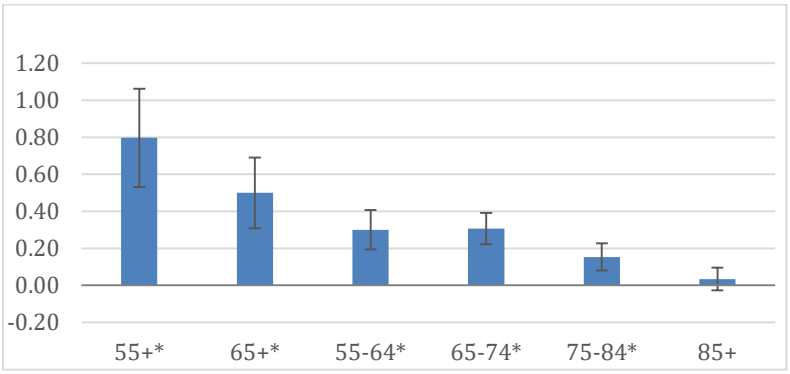

Figure 7.9 Coefficients for number of parks

The physical environment of where a person lives has been shown to influence how much physical activity they get. When selecting this variable, we had the theoretical expectation that older adults might be attracted to live near parks especially since physical activity is an important piece of healthy aging. However, Table 7.2 and Figure 7.9 show that an increase of one park in the station area might produce an increase of 0.80 percentage point in older adults 55 and over (β= 0.796) compared to an increase of 0.50 percentage points in older adults 65 and over (β= 0.499). While all older age cohorts have higher percentages near parks, the oldest groups are appear least likely to live near them.

Number of pharmacies in the station area

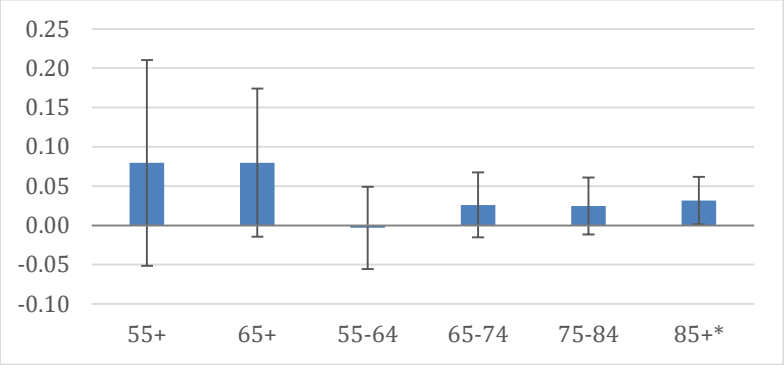

Figure 7.10 Coefficients for pharmacies

Older adults use more medicines than other age groups. As a result, it was expected that older adults are attracted to stations areas with access to pharmacies. However, as demonstrated in Table 7.2 and Figure 7.10, only the percentage of the oldest cohort was significantly higher when near a pharmacy. This could be related by the physical and metal conditions of older adults as they age.

Number of shopping opportunities and restaurants in the station area

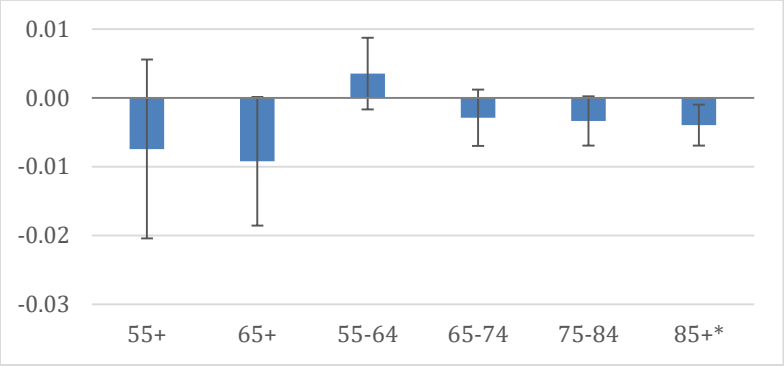

Figure 7.11 Coefficients for number of restaurants

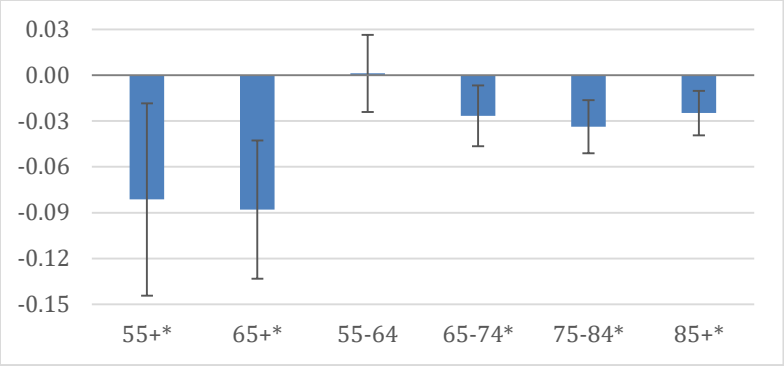

Figure 7.12 Coefficients for shopping opportunities

The number of restaurants and shopping opportunities in the station seems not to be an attractor for older adults. As Table 7.2, Figure 7.11, and Figure 7.12 show, the percentage of older adults decreases as the number of restaurants and shops increases. There are different reasons that could explain this finding: lack of mobility could be one of them. As people age, their lack of mobility may make it more difficult for them go to out.

Metropolitan Statistical Area Size (MSA)

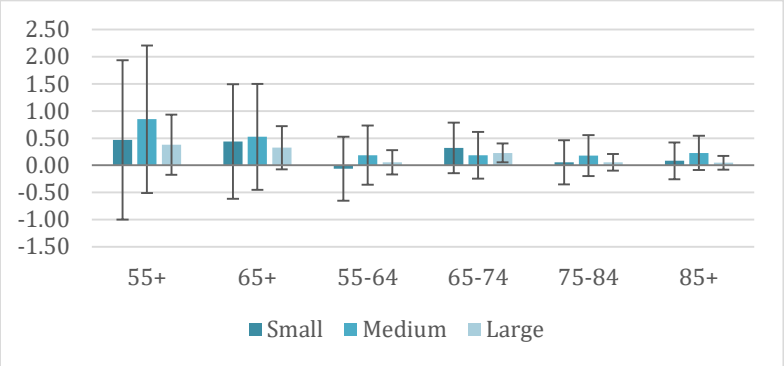

Figure 7.13 Coefficients for MSA size

As we mentioned before, the theoretical expectation was to find differences in the spatial dynamics of MSAs size. For these dummy variables, the reference variable is *very large MSAs.*

Table 7.2 and Figure 7.13 show that controlling for the rest of the variables, the differences between very large and other sizes of MSAs are not significant.

Transit Modes

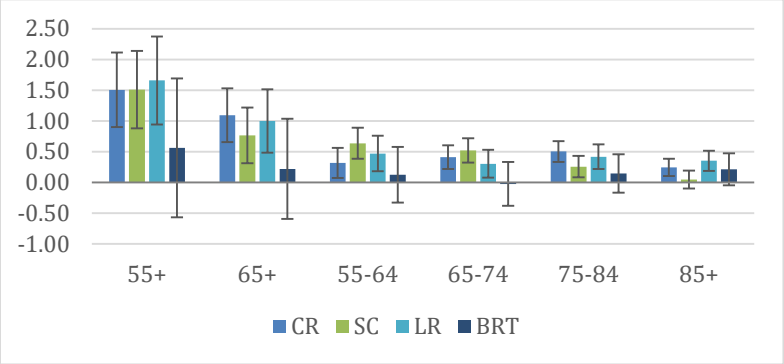

Figure 7.14 Coefficients for transit modes

Table 7.2 and Figure 7.14 shows that, compared to r*apid transit*, which is the reference variable, older adults are present in higher percentages near street cars, light rail and commuter rail, with the latter being counter to expectation. The greater presence of older adults near street cars matches with the findings from Chapter 4 that older adults tend to locate in high amenity, downtown areas where streetcars are usually located.

Station Year

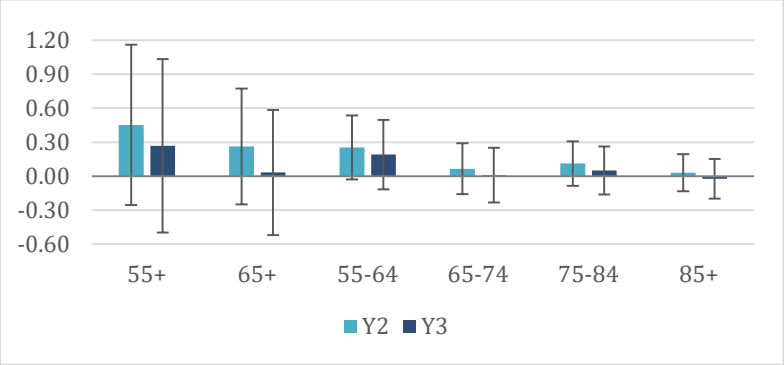

Figure 7.15 Coefficients for station year

Finally, the models show that age of the station is not a significant predictor of the percentage of older adults in the station area. As Table 7.2 shows there is no significance difference among station opened before 2000, between 2001 and 2005, and between 2006 and 2010. Therefore, can't make inference about preferences of older adults for old or new systems.

7.4 Conclusions

This study explores attractiveness and effectiveness of station areas from the perspective of an aging population. The main objective of this study was to identify station characteristics that might attract or repel older adults to station areas across different age cohorts. It should be note that our model can only establish correlation and any causal inference should be made with caution. Understanding these characteristics can help city and transit agencies understand how they can better plan TODs to make then attractive to older adults.

The regression model demonstrated that the presence of more housing units, banks, grocery stores, hospitals and parks increase the presence of older adults in a station area. On the other hand, higher median incomes, dense street intersections, libraries and restaurants seem to be negative correlated with percentage of older adults in the station area.

The model did not any statistical association between the percentage of older adults and MSA size or the age of the transit system. In terms of transit types, older adults appear more likely to live near *commuter rail, street car and light rail* systems. In contrast, adults are less likely to live near *rapid trans and bus rapid transit.*

Equally important, the analysis showed that certain factors have varying influence on different age categories, which could relate to different levels of cognitive and physical functional as people age. In this regard, the model for the younger sub group (55-64) exhibited a different pattern in several instances (i.e., counter to their older cohorts, their presence is negatively correlated with hospitals and negatively correlated with banks). This information is

important because it allows planners and decision makers to plan for different groups of older adults.

Chapter 8 Conclusion

8.1 Summation

Transit Oriented Development may be a good solution to the growing mobility crisis around our aging population. Providing transit options in areas that are heavily populated with older adults gives them mobility without using cars they often can no longer operate.

In the various analyses conducted for this project we find that:

- TODs and their adjacent areas in 2010 had a higher density of road network characteristics compared with TODs in 2000. It was also observed that aging populations (65 years and older) were a lower proportion of the population residing in TODs for 2000 and 2010.
- While TODs do not seem to be attracting aging adults they do seem to be attracting adults nearing retirement age (55-64). In addition, transit systems with multiple stops and a variety of transit modes had an increase over time in adults aged 55-64 and a decrease in adults aged 85+ compared to the adjacent TOD areas.
- Station that have seen the most growth in older adult population tend to be either high amenity location in vibrant downtown areas (such as Portland's Pearl District) or areas with retirement home and assisted-living facilities.
- A notable percentage of transit agencies and municipalities have practices to improve transportation options for older adults and to promote TODs. However, a

smaller percentage of them see TOD as an opportunity to meet older adults' needs. The main barriers to promote TOD for older adults are the cost of development, market forces, and the lack of specific amenities focused on older adults.

- Even when a transit agencies or municipalities reports that they are engaged in promoting TOD for older adults, this does not necessarily translate to providing high accessibility levels for older adults in these jurisdictions
- There are some station area factors that are statistically associated with a larger presence of older adults, but this depends on the specific age cohorts. The oldest cohorts are more prevalent in station areas with hospitals, banks, and a higher density of housing, whereas the younger (pre-retirement) cohorts are more likely to be found in higher income areas with parks and grocery stores.

8.2 Discussion

Our findings indicate that, for the most part, TOD is not being utilized as a strategy to better meet the transportation needs of older adults. Older adults are less likely to live in TODs and government agencies are not likely to consider TOD as part of their effort to better serve older adults. The lack of real-world examples makes it difficult to assess whether TOD can be an effective way to help older adult maintain a high quality of life. Another key takeaway from this research is that the near-retirement group has a much stronger presence in TODs.

The lack of concreate examples of communities explicitly using TOD to address the mobility problem of aging does not rule out the possibility that it can be an effective strategy. To the

contrary, it indicates the need to experiment with policies and practices that will attract older adults to TOD. Our case studies (Chapter 4) demonstrated that some of the stations with strong growth in older adults were in areas that had been explicitly planning for their needs (even if it this planning is coincidental to the presence of TOD). Further, our research indicates that the near-retirement cohort (55-64) already has a stronger presence in station areas than their older counterparts. This provides a strong impetus in the coming years for TOD planning that allows this population to remain in these places. The findings from this research (as summarized in the previous section and in the individual chapters) can provide a starting point for this experimentation.

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