

## Thirty Years of Trends in Transit-Oriented Development across America

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### Abstract

*A national study by the Transit Cooperative Research Program (TCRP) released in 2004 looked at transit-oriented development (TOD) across the United States. Transit-Oriented Development in the United States: Experiences, Challenges, and Prospects examined many aspects of TOD including the location of a number of TODs in regions across the country. This paper builds upon the TCRP study by examining trends of travel behavior and vehicle ownership from 1970 – 2000 (including data from 1980 and 1990) of TOD residents and households living in 103 TODs compared to averages for the 12 metropolitan regions in which the TODs are located. Results show that while regions have become increasing auto-dependent with respect to the commute trip, more than twice as many residents of TODs, on average, used transit for commuting compared to the regional average in 2000 (16.7% versus 7.1%). Over the past thirty years, transit commuting has increased amongst TOD residents by 11 percent while it has decreased across regions by 63 percent. Over three times the amount of TOD residents walked or cycled to work in 2000 compared to regional averages (11.2% versus 3.2%). Vehicle ownership is also consistently lower in TODs compared to the region. This article also reports findings by type of region (categorized by commuter, heavy or light rail technology). Implications of these findings lend credibility for government investment in TOD as a way to promote travel options and reduced auto-dependence.*

The United States is the most auto-dependent country in the world (Newman and Kenworthy 1999; Pucher and Lefèvre 1996). For each decade since WWII, trends indicate a declining mode share for transit, walking, and bicycling to work (Pucher and Renne 2003). Many have claimed that transit-oriented development (TOD) leads to more sustainable outcomes and reduced car dependence (Bernick and Cervero 1996; Calthrope 1993; Dittmar and Ohland 2004; Dunphy et al. 2004; Newman and Kenworthy 1999) but few studies, if any, have tracked long-term trends in TODs (Cervero et al. 2004). Part of the reason for this has been that many TODs have only been built in recent years, making trend analysis nearly impossible. On the other hand, many suburbs in regions across America have recently been dubbed a

“TOD” even though they have exhibited TOD-like characteristics for decades.<sup>1</sup>

While regions as a whole may have become more auto-dependent, is the same true for the neighborhoods that have not followed the typical suburban model of an auto-dominated landscape?

This article presents the results of a historical trend analysis comparing travel behavior and vehicle ownership change in 103 TODs located in twelve regions across the United States. The data compare the change in the TODs with the change in the region (metropolitan statistical area) as a whole. This method controls for regional variations and allows for data to show if TODs lead to more sustainable outcomes in travel behavior and vehicle ownership.

### Methodology

The research methodology to select the TODs in this analysis was compiled using a list in a recent study by the Transit Cooperative Research Program (TCRP), *Transit Oriented Development in the United States: Experiences, Challenges, and Prospects* (Cervero et al. 2004). In the TCRP study, a number of places were “self-identified<sup>2</sup>” as TODs. The TCRP study was the best starting point to generate a list of TODs across the United States. Aside from this list, no other source was found that provided a comprehensive list of TODs, but the TCRP list is not without problems:

Most of the TODs on the list were identified by survey respondents, though known TODs documented in the literature are also shown. Many more TODs are in various stages of planning and development; those listed ... were on the ground or substantially developed as of mid-2002. ...

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<sup>1</sup> TOD characteristics include compact, mixed-use, development with a high quality pedestrian urban environment.

<sup>2</sup> The TCRP study surveyed stakeholder groups, including transit agencies, local governments, redevelopment agencies, metropolitan planning organizations, and state departments of transportation to identify TODs in their region or jurisdiction. “Most of the TODs on the list were identified by survey respondents, though known TODs documented in the literature are also shown. Many more TODs are in various stages of planning and development; those listed ... were on the ground or substantially developed as of mid-2002” (Cervero et al. 2002, p. 9).

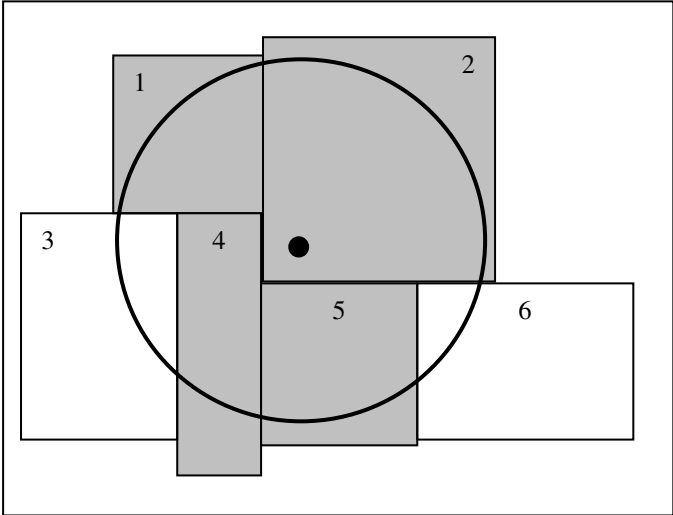
TOD designations, of course, are quite subjective; one person's TOD might be viewed by others as little more than an office building near a train stop. Moreover, [it] is not a complete inventory of TODs because not all transit agencies, local and state governments, and other surveyed entities responded to the question. Thus the list should be viewed as being illustrative rather than a complete inventory. Still, the list is thought to be representative of the types and geographic distributions of TODs found in the United States (Cervero et al. 2004, p. 9).

Because of the incomplete nature of the TCRP inventory, other TODs were added to the list when found in the literature or when government agencies formally designated them as a TOD. For example, in New Jersey, many of the state-designated Transit Villages did not appear. Furthermore, my research was limited to places with train stations and housing (although other uses also may have been present). Because some of the TODs on the TCRP list did not include rail and housing, they were eliminated from the analysis. The final list of 103 TODs are shown in Table 1.

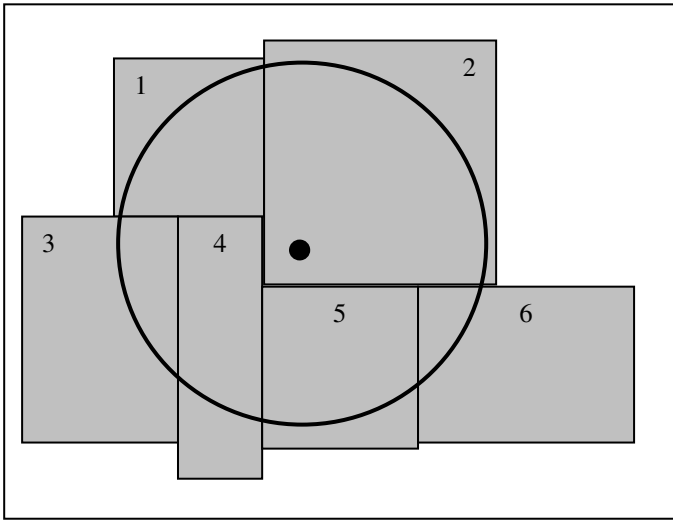
Using U.S. Census data, I then identified the Census tracts which best correspond to the half-mile TOD area around each train station. Census tracts were chosen for two reasons. First, tracts best correspond in size to neighborhoods, which was the scale that this study investigated. Second, tracts are the minimum unit of analysis maintained by the Geolytics Neighborhood Change Database, the software used to extract the data. Using tracts presented a problem because they do not exactly overlap with the TOD area (half-mile radius around the station). Therefore, for each tract a determination was made as to the percentage that overlaps with the half-mile TOD area. Two methods were applied to identify the TOD – the narrow and the broad approach. In the narrow approach, only those tracts with 50 percent or more area overlapping the half-mile area were selected. As shown in the example in Figure 1, tracts 1, 2, 4, and 5 were chosen to represent the TOD. In the broad approach, any tract with some area overlapping the half-mile area was selected. Figure 2 shows that

all six Census tracts were selected in this scenario. Upon running the data, results from both approaches were compared in order to pick the best approach with the most reliable data. Results in this paper are based on the narrow approach to represent households closest to the rail stations.

**Figure 1: Narrow Approach for Selecting Census Tracts to Represent a TOD**



**Figure 2: Broad Approach for Selecting Census Tracts to Represent a TOD**



**Table 1: Transit Oriented Developments by Region and Status**

| Older & Redeveloping Regions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Maturing – Heavy Rail Regions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Growing Regions with New Start - Light Rail                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Chicago MSA</b></p> <ul style="list-style-type: none"> <li>Evanston-Davis Street</li> <li>Evanston-Dempster</li> <li>Evanston-Main</li> <li>Marion Street Station</li> <li>Arlington Heights Station</li> <li>Riverdale Metra</li> <li>Woodstock Metra</li> <li>Franklin Park</li> </ul> <p><b>New York / New Jersey MSA</b></p> <p><u>New York</u></p> <ul style="list-style-type: none"> <li>Mount Vernon Station East</li> <li>Ossining</li> <li>New Rochelle</li> <li>Yonkers</li> <li>White Plains</li> </ul> <p><u>New Jersey</u></p> <ul style="list-style-type: none"> <li>Rutherford</li> <li>South Orange</li> <li>Morristown</li> <li>Metuchen</li> <li>Rahway</li> <li>South Amboy</li> <li>New Brunswick</li> <li>Cranford</li> <li>Ridgewood</li> <li>Linden</li> <li>Elizabeth</li> <li>Dunellen</li> <li>Plainfield</li> <li>Summit</li> <li>Westfield</li> <li>Bound Brook</li> <li>Somerville</li> <li>Belmar</li> <li>Collingswood</li> <li>Mattawan</li> <li>Bloomfield</li> </ul> | <p><b>Atlanta MSA</b></p> <ul style="list-style-type: none"> <li>Georgia State</li> <li>Midtown Station</li> <li>Arts Center</li> <li>Lindbergh City Center</li> </ul> <p><b>Miami MSA</b></p> <ul style="list-style-type: none"> <li>Dadeland South</li> <li>Dadeland North</li> </ul> <p><b>San Francisco MSA</b></p> <ul style="list-style-type: none"> <li>Concord</li> <li>Rockridge</li> <li>Daly City</li> <li>El Cerrito del Norte</li> <li>Downtown Berkeley</li> <li>Lake Merritt</li> <li>Fruitvale</li> <li>Hayward</li> <li>Fremont</li> <li>Embarcadero</li> <li>16th-Mission</li> <li>24th-Mission</li> <li>Colma</li> <li>Bay Meadown</li> <li>San Mateo Downtown</li> <li>Davis</li> <li>Martinez</li> <li>Emeryville</li> </ul> <p><b>Washington D.C. / Baltimore MSA</b></p> <ul style="list-style-type: none"> <li>Silver Spring Metro</li> <li>Bethesda Metro</li> <li>Grosvenor Metro</li> <li>Twinbrook Metro</li> <li>Gallery Place - Chinatown</li> <li>White Flint</li> <li>Rosslyn</li> <li>Courthouse</li> <li>Ballston</li> <li>Claredon</li> <li>Virginia Square</li> <li>Pentagon City</li> <li>Crystal City</li> <li>Owings Mills Metro</li> <li>Cultural Center Light Rail Station</li> <li>Lexington Market Metro</li> </ul> | <p><b>Portland Oregon MSA</b></p> <ul style="list-style-type: none"> <li>La Salle</li> <li>Gresham</li> <li>Russellville Commons</li> <li>Stadium Station</li> <li>Collins Circle</li> </ul> <p><b>San Diego MSA</b></p> <ul style="list-style-type: none"> <li>American Plaza</li> <li>Rio Vista West</li> <li>Hazard Center</li> <li>La Mesa Village Plaza</li> <li>Village of La Mesa</li> <li>Mercardo at Barrio Logan</li> </ul> <p><b>Los Angeles MSA</b></p> <ul style="list-style-type: none"> <li>Hollywood/Highland</li> <li>Central Park Market at Del Mar Station</li> <li>Pine Court</li> <li>Holly Street Village</li> <li>North Hollywood Arts District</li> <li>Montage at Village Green</li> </ul> <p><b>Dallas MSA</b></p> <ul style="list-style-type: none"> <li>Mockingbird Station</li> <li>Southside on Lamar</li> <li>Galatyn Park (Ricardson)</li> <li>Plano Transit Village</li> <li>Westside Village</li> <li>Cedars Station</li> </ul> <p><b>Denver MSA</b></p> <ul style="list-style-type: none"> <li>Englewood City Center</li> <li>I-25/Broadway</li> </ul> <p><b>Salt Lake City MSA</b></p> <ul style="list-style-type: none"> <li>Delta Center</li> <li>4400 South Station</li> <li>7800 South Station</li> <li>10000 South Station</li> </ul> |

Once the tracts were identified (for both approaches), the Geolytics Neighborhood Change Database software allowed for the collection of Census data for 1970, 1980, 1990, and 2000. Because tract boundaries change over time, Geolytics enables users to collect variables for the Census years listed above using the 2000 tract boundaries. It also allows for the same comparison of metropolitan statistical area (MSA) boundaries for the regional comparison. It should be noted here that this analysis was a historical study of Census data for places currently described as TODs. Most likely, because the term “TOD” was rarely used prior to 1995, these places were not referred to as a TOD in the 1970s, 1980s, and even most of the 1990s. However, today all of these places feature a train station and housing, and at some point in recent years became to be considered by locals as a TOD.

Because regions have diverse histories, including different urban structures based on different transportation systems, I created a typology to classify regions and its TODs. The *Older and redeveloping regions* of New York and Chicago were initially built pre-WWII, before the dominance of the automobile in American life. Rail suburbs, in places like White Plains, NY, South Orange, NJ, and Evanston, IL, were built under a completely different context than TODs today, but these places have been reinventing themselves in ways similar to all TODs across the country. In the next type, *Maturing – heavy rail regions*, TODs were build post-1970 in response to new metro rail systems built in Atlanta, Miami, San Francisco, and Washington D.C.. Finally, *growing regions with ‘new start’ light rail systems* have built light rail post-1990. In part, this was in response to the *Intermodal Surface Transportation Efficiency Act* of the early 1990s which allowed funding for many new light rail systems. Cities such as Portland, San Diego, Los Angeles, Dallas, Denver, and Salt Lake City took advantage of this and are now working to encourage TOD.

While TOD calls for compact, mixed-use development oriented to a transit facility, the quality of the urban design varies for each place on the list. The degree to which any of these 103 TODs actually satisfy some criteria is subjective and varies from being a transit-oriented development (TOD) to a transit-adjacent development (TAD)<sup>3</sup>. Unfortunately, this research does not include a qualitative rating of each TOD under study, but this should be considered for future studies.

### Commuting Trends

Aggregate statistics for the United States report that the transit share of work travel has been on the decline for the past 40 years. The percentage of transit commute trips has steadily declined from 12.6 percent in 1960 to 4.7 percent in 2000 (Pucher and Renne 2003). The problem with aggregate data is that it masks important variations at the neighborhood (Census tract) level. Table 2 reports transit commuting trends in TODs and MSAs from 1970 – 2000. Overall, results confirmed that the transit mode share for commuting has fallen, on average, by 63 percent across the twelve regions over 30 years (from 19.0 percent in 1970 to 7.1 percent in 2000). It also showed that across the 103 TODs, the share of commuters using transit has increased from 15.1 percent in 1970 to 16.7 percent in 2000, representing a growth rate of 11 percent.

The most important finding was the much higher shares of transit commuting in TODs compared to MSAs in the year 2000. As shown in Figure 3, TODs have been able to maintain high levels of transit usage over the past 30 years while each

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<sup>3</sup> A TAD is defined as “development that is physically near transit; [but] fails to capitalize upon this proximity, however, to promote transit riding. A TAD lacks any functional connectivity to transit – whether in terms of land-use composition, means of station access, or site design. A number of U.S. TODs discussed in the literature more closely resemble TADs” (Transit Cooperative Research Program 2002, p. 6). For the purposes of this study, each place being studied is referred to as a TOD even if the urban environment is more characteristic of a TAD.

Census reveals that the percentage of commuting on transit continued to diminish across the regions. While transit's share of work travel was higher in the MSAs in 1970 (19 percent compared to 15.1 percent in the TODs) that situation reversed by the year 2000, where TODs was twice the regional average. The percentage of transit commuting was over three times higher in TODs compared to averages for *Maturing – heavy rail regions* and over twice as much for TODs in *New start – light rail regions*. The data were skewed in *Older and redeveloping regions* because of New York City<sup>4</sup>, where the MSA average was higher compared to the suburban TODs, but there was about 1.5 times the percentage of transit commuting in the TODs of Chicago compared its regional average. On average, for *Older and redeveloping regions*, there was a greater rate of decline in the share transit commuting in the MSA compared to the TODs. While transit has declined by 30 percent across the New York region from 1970 – 2000, the percentage of transit commuting in the TODs has increased by four percent.

When looking at the TODs of other regions, such as Portland, Oregon, or Washington D.C., which have been credited with aggressive policies to promote transit and TOD, growth has been much greater (58 percent for both). Growth was also seen in the TODs of Miami, San Francisco, Los Angeles, and Salt Lake City. Like Chicago, Atlanta data revealed a decline in the share of transit use to work for the TODs, but the rate of decline was not as great as the region as a whole. Only in the light rail regions of San Diego, Dallas, and Denver did the percentage of transit commuting in the TODs decline faster than the region, but in each of these places the share of transit commuting in the TODs was about twice as high as in the MSA in the year 2000. Since many of the TODs in the *New start – light rail regions* were not

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<sup>4</sup> The TODs in the New York / New Jersey region are all located in the suburban areas outside of New York City.

built until the late 1990s or post-2000 Census, data are not available to analyze trends in those TODs. Another interesting trend to watch is related to the share transit commuting in the TODs of *Older redeveloping regions*, which increased slightly from 1990 to 2000.

Also shown in Table 2 is the substantial increase (32 percent) in the percentage of transit commuting in TODs of *Maturing – heavy rail regions* from 1970 – 2000. Each of these regions has invested substantially in metro systems, and to varying degrees, has promoted TOD through partnerships and policies.<sup>5</sup> For example, the Washington Metropolitan Area Transit Authority (WMATA) has been viewed by many as a national leader in pursuing joint development and TOD, as demonstrated by over 50 joint development projects by 2003 with a market value of approximately \$4 billion (Cervero et al. 2004, p. 236). In comparison to Atlanta, the growth in the transit share of commuting in the District of Columbia may result partially from a better mix of land uses. An analysis comparing two TODs in Washington, D.C. with two in Atlanta showed that those in Atlanta failed to include mixed-uses, as 100 percent of the building space was devoted to offices, whereas those in Washington, D.C., had a balanced mix of office, retail, residential, and entertainment uses (Renne and Newman 2002). In essence, those in Atlanta were more like TADs than TODs. Furthermore, those sampled in D.C. were more pedestrian-friendly than the ones in Atlanta, which included large surface parking lots nearby the stations. This may be a reason why TODs in Atlanta had half the percentage of walking, cycling, and other commute trips compared to those in Washington, D.C., (see Table 3).

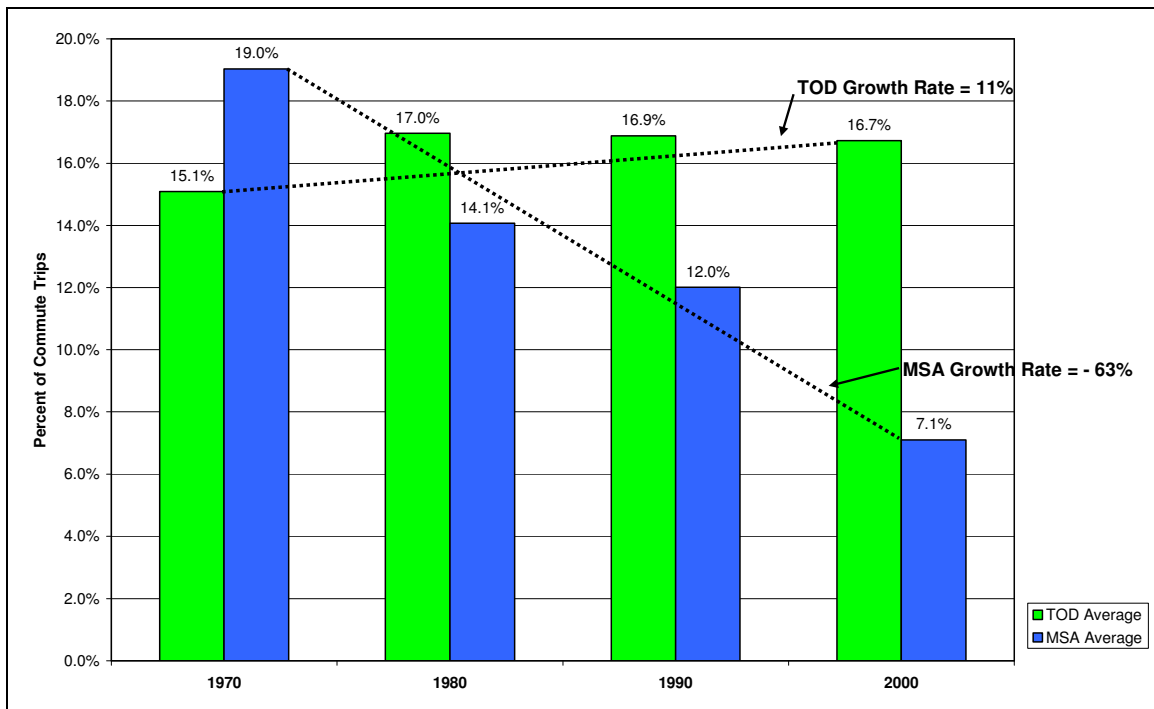
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<sup>5</sup> For a detailed summary of policies, see Cervero, Arrington, et al. 2004.

**Table 2: Transit Share of Work Trips for TODs and MSAs by Region Type<sup>1</sup>**

| Region <sup>2</sup>                                                                                               | Percent of Commuters Using Transit in 1970 | Percent of Commuters Using Transit in 1980 | Percent of Commuters Using Transit in 1990 | Percent of Commuters Using Transit in 2000 | Percent Change 1970 - 2000 |
|-------------------------------------------------------------------------------------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|----------------------------|
| <b>Older and Redeveloping Regions</b>                                                                             |                                            |                                            |                                            |                                            |                            |
| Chicago TOD Average (n=8)                                                                                         | 24.0%                                      | 21.7%                                      | 18.7%                                      | 16.7%                                      | -30%                       |
| Chicago MSA Average                                                                                               | 22.1%                                      | 16.6%                                      | 13.7%                                      | 11.5%                                      | -48%                       |
| NY/NJ TOD Average (n=26)                                                                                          | 15.7%                                      | 13.1%                                      | 13.6%                                      | 16.4%                                      | 4%                         |
| NY/NJ MSA Average                                                                                                 | 35.5%                                      | 26.7%                                      | 25.4%                                      | 24.9%                                      | -30%                       |
| <b>TOD Average</b>                                                                                                | <b>19.8%</b>                               | <b>17.4%</b>                               | <b>16.1%</b>                               | <b>16.5%</b>                               | <b>-17%</b>                |
| <b>MSA Average</b>                                                                                                | <b>28.8%</b>                               | <b>21.6%</b>                               | <b>19.5%</b>                               | <b>18.2%</b>                               | <b>-37%</b>                |
| <b>Maturing - Heavy Rail Regions</b>                                                                              |                                            |                                            |                                            |                                            |                            |
| Atlanta TOD Average (n=4)                                                                                         | 20.9%                                      | 22.5%                                      | 24.9%                                      | 19.3%                                      | -8%                        |
| Atlanta MSA Average                                                                                               | 9.2%                                       | 7.7%                                       | 4.6%                                       | 3.7%                                       | -60%                       |
| Miami TOD Average (n=2)                                                                                           | 0.5%                                       | 2.7%                                       | 5.4%                                       | 6.5%                                       | 1094%                      |
| Miami MSA Average                                                                                                 | 7.1%                                       | 5.0%                                       | 4.4%                                       | 3.9%                                       | -45%                       |
| San Francisco TOD Average (n=18)                                                                                  | 17.8%                                      | 22.3%                                      | 20.1%                                      | 21.0%                                      | 18%                        |
| San Francisco MSA Average                                                                                         | 11.6%                                      | 11.4%                                      | 9.6%                                       | 9.5%                                       | -18%                       |
| Washington D.C. TOD Average (n=16)                                                                                | 19.0%                                      | 27.4%                                      | 32.5%                                      | 30.0%                                      | 58%                        |
| Washington D.C. MSA Average                                                                                       | 15.4%                                      | 13.1%                                      | 11.3%                                      | 9.4%                                       | -39%                       |
| <b>TOD Average</b>                                                                                                | <b>14.6%</b>                               | <b>18.8%</b>                               | <b>20.7%</b>                               | <b>19.2%</b>                               | <b>32%</b>                 |
| <b>MSA Average</b>                                                                                                | <b>10.8%</b>                               | <b>9.3%</b>                                | <b>7.5%</b>                                | <b>6.6%</b>                                | <b>-39%</b>                |
| <b>New Start - Light Rail Regions</b>                                                                             |                                            |                                            |                                            |                                            |                            |
| Portland TOD Average (n=5)                                                                                        | 9.2%                                       | 13.4%                                      | 11.8%                                      | 14.6%                                      | 58%                        |
| Portland MSA Average                                                                                              | 5.5%                                       | 7.6%                                       | 5.0%                                       | 5.7%                                       | 3%                         |
| San Diego TOD Average (n=6)                                                                                       | 8.3%                                       | 11.2%                                      | 6.5%                                       | 6.7%                                       | -19%                       |
| San Diego MSA Average                                                                                             | 3.7%                                       | 3.4%                                       | 3.5%                                       | 3.4%                                       | -7%                        |
| Los Angeles TOD Average (n=6)                                                                                     | 6.2%                                       | 11.5%                                      | 10.2%                                      | 8.4%                                       | 37%                        |
| Los Angeles MSA Average                                                                                           | 4.2%                                       | 5.2%                                       | 4.7%                                       | 4.7%                                       | 11%                        |
| Dallas TOD Average (n=6)                                                                                          | 14.5%                                      | 9.1%                                       | 9.2%                                       | 3.2%                                       | -78%                       |
| Dallas MSA Average                                                                                                | 5.2%                                       | 3.5%                                       | 2.3%                                       | 1.8%                                       | -66%                       |
| Denver TOD Average (n=2)                                                                                          | 9.4%                                       | 8.6%                                       | 8.4%                                       | 7.5%                                       | -20%                       |
| Denver MSA Average                                                                                                | 4.3%                                       | 6.0%                                       | 4.2%                                       | 4.3%                                       | 0%                         |
| Salt Lake City TOD Average (n=4)                                                                                  | 2.4%                                       | 5.8%                                       | 3.2%                                       | 5.0%                                       | 108%                       |
| Salt Lake City MSA Average                                                                                        | 2.2%                                       | 5.0%                                       | 3.1%                                       | 3.0%                                       | 36%                        |
| <b>TOD Average</b>                                                                                                | <b>8.3%</b>                                | <b>9.9%</b>                                | <b>8.2%</b>                                | <b>7.6%</b>                                | <b>-9%</b>                 |
| <b>MSA Average</b>                                                                                                | <b>4.2%</b>                                | <b>5.1%</b>                                | <b>3.8%</b>                                | <b>3.8%</b>                                | <b>-9%</b>                 |
| <b>Total TOD Average (n=103)</b>                                                                                  | <b>15.1%</b>                               | <b>17.0%</b>                               | <b>16.9%</b>                               | <b>16.7%</b>                               | <b>11%<sup>3</sup></b>     |
| <b>Total MSA Average (n=12)</b>                                                                                   | <b>19.0%</b>                               | <b>14.1%</b>                               | <b>12.0%</b>                               | <b>7.1%</b>                                | <b>-63%<sup>3</sup></b>    |
| Source: Author's calculations from US Census (1970, 80, 90, 00) using the Geolytics Neighborhood Change Database. |                                            |                                            |                                            |                                            |                            |
| Notes: 1. Data reported for the narrow TOD analysis (Census tracts closest to rail station) and the full MSA.     |                                            |                                            |                                            |                                            |                            |
| 2. The number of TODs in each region is depicted by 'n'.                                                          |                                            |                                            |                                            |                                            |                            |
| 3. A t-test confirms that these numbers are statistically independent (error = .01).                              |                                            |                                            |                                            |                                            |                            |

**Figure 3: Trends in Transit Shares of Work Trips in TODs Compared to MSAs (1970 – 2000)**



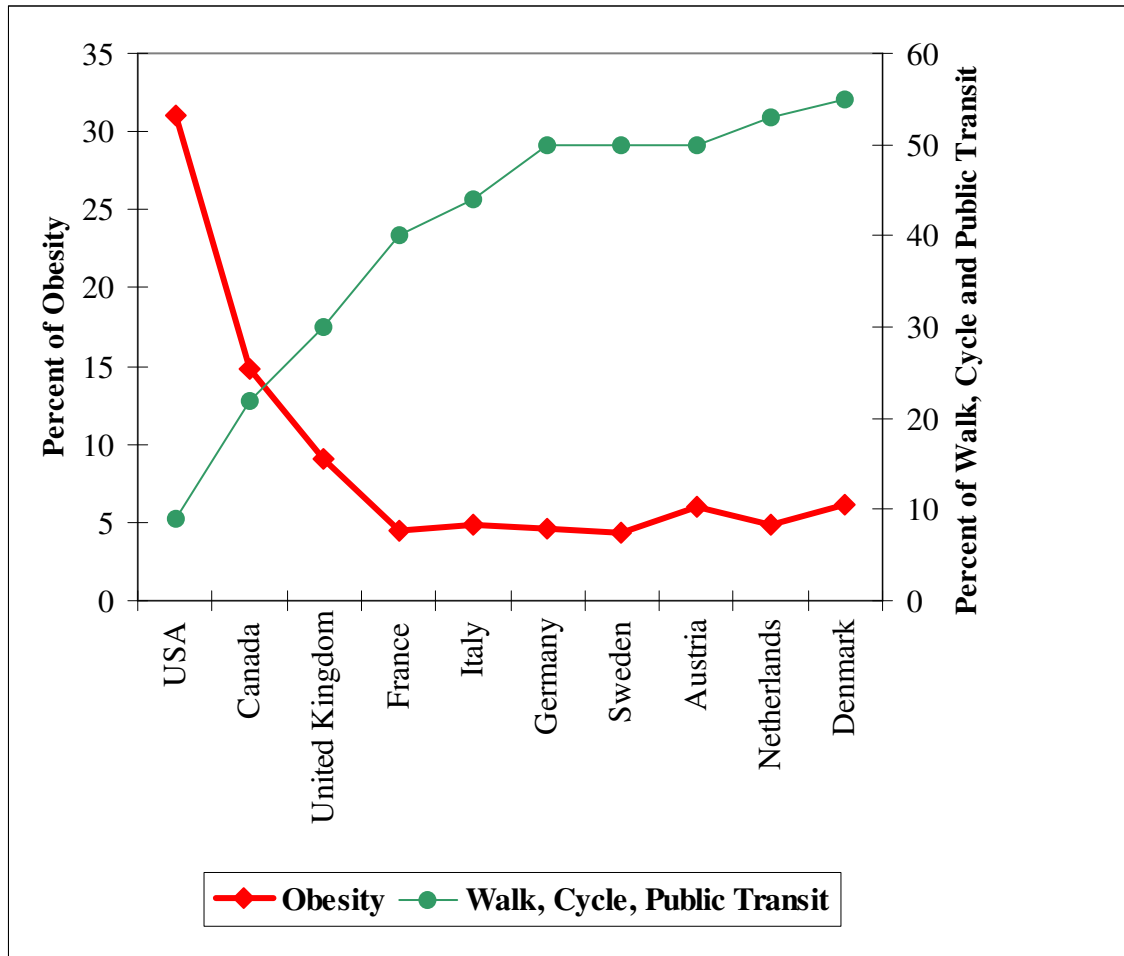
Source: See Table 2

Note: n = 103 TODs and 12 MSAs

Like transit, walking and cycling have been a declining mode of transport across the United States. Some researchers even have linked increasing levels of obesity with corresponding decreases in walking, cycling, and use of public transport. In a comparison of walking, cycling, and transit use with rates of obesity across different countries, Pucher (2004) has shown a striking relationship (shown in Figure 4). Others also have found similar relationships. Some have stated that those living in the most sprawling counties are likely to weigh more than those living in more compact counties (Ewing et al. 2003; McCann and Ewing 2003). Furthermore,

The odds of having hypertension, or high blood pressure, are six percent higher for every 50-point increase in the degree of sprawl. The 25 most sprawling counties had average hypertension rates of 25 per 100 while the 25 least sprawling had hypertension rates of 23 per 100 (McCann and Ewing 2003, pp. 2-3).

**Figure 4: Does Auto-Dependency Make Us Fat?**



Source: (Pucher 2004)

Frank, Engelke, and Schmid also discussed these issues in a recent book titled *Health and Community Design: The Impacts of the Built Environment on Physical Activity* (2003). They advocate that compact and mixed-use development can have significant health benefits.

Data in Table 3 show that a significantly higher percentage of work trips were made by walking, cycling, and other modes in TODs compared to regional averages (11.2 percent in TODs compared to 3.2 percent in regions)<sup>6</sup>. As a whole, TODs reported about 3.5 times more walking and cycling shares of commute trips than

<sup>6</sup> Data in Table 3.4 include walking, cycling, and other modes to work. Unfortunately, Geolytics does not allow for the disaggregating of "other." Hereinafter, this mode will be referred to only as walking and cycling. In double checking the accuracy of this data, it was found that the totals from this column equal the totals reported on the Census website for walking, cycling, and other, where other equaled an average of 0.6 percent of trips across the 12 regions and no more than 1.0 percent in any region.

MSAs. Although there was an overall decrease in the percentage walking and cycling to work, the decline was not as pronounced in the TODs compared to the regions.<sup>7</sup> The percentage of walking and cycling to work decreased by 36 percent in the TODs compared to 59 percent in the MSAs over the 30 year period.

TODs in *Maturing – heavy rail regions* demonstrated the least negative outcomes. Walking and cycling only declined by 24 percent in these TODs compared to 44 percent in the TODs of the other regions. The same cities that had the largest increases in transit ridership (Miami, San Francisco, Washington, D.C., and Portland) also had the lowest declines in walking and cycling. Overall, TODs displayed higher shares of transit use, walking, and cycling to work compared to MSAs. Figure 5 shows that while transit use, walking, and cycling have been constantly decreasing across regions, the TODs in these regions have been able to maintain high levels of sustainable transport. While regions have decreased by 62 percent, on average, TODs have only decreased by 14 percent.

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<sup>7</sup> The TODs in New York / New Jersey were the only exception, but the regional data most likely reflected trends in New York City, which is atypical compared with most of the United States.

**Table 3: Walking, Cycling or Other Modes Share of Work Trip for TODs and MSAs by Region Type<sup>1</sup>**

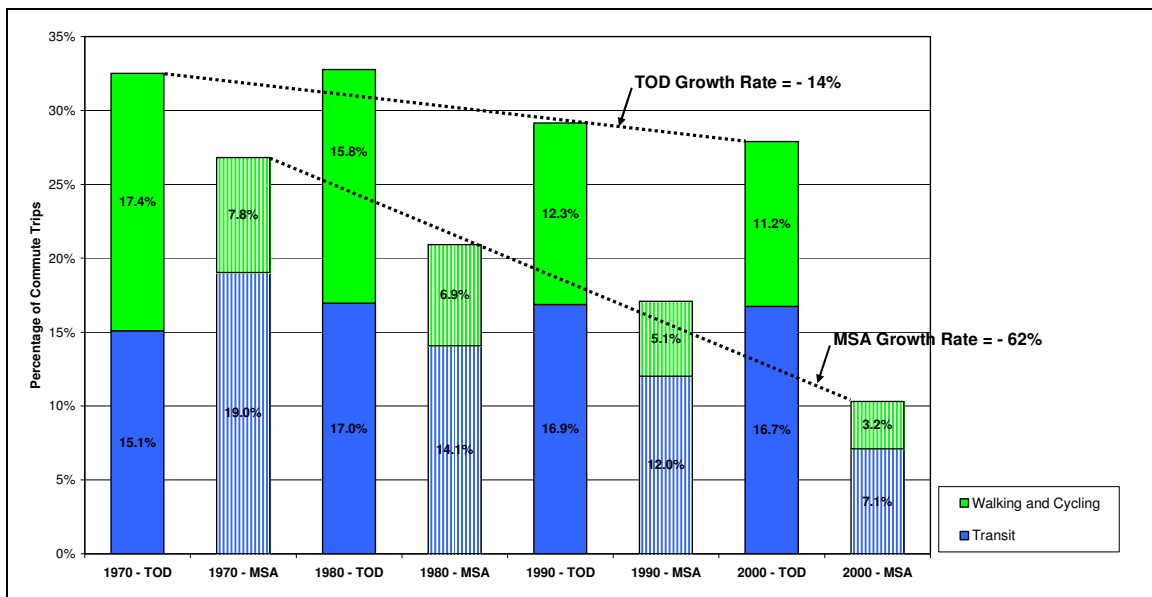
| Region <sup>2</sup>                   | Percent of Commuters Walking in 1970 <sup>3</sup> | Percent of Commuters Walking or Biking in 1980 | Percent of Commuters Walking or Biking in 1990 | Percent of Commuters Walking or Biking in 2000 | Percent Change 1970 - 2000 |
|---------------------------------------|---------------------------------------------------|------------------------------------------------|------------------------------------------------|------------------------------------------------|----------------------------|
| <b>Older and Redeveloping Regions</b> |                                                   |                                                |                                                |                                                |                            |
| Chicago TOD Average (n=8)             | 13.6%                                             | 14.1%                                          | 9.8%                                           | 8.9%                                           | -34%                       |
| Chicago MSA Average                   | 9.6%                                              | 7.9%                                           | 5.7%                                           | 3.4%                                           | -64%                       |
| NY/NJ TOD Average (n=26)              | 16.9%                                             | 14.3%                                          | 8.6%                                           | 8.2%                                           | -51%                       |
| NY/NJ MSA Average                     | 10.0%                                             | 10.2%                                          | 7.3%                                           | 5.8%                                           | -42%                       |
| <b>TOD Average</b>                    | <b>15.2%</b>                                      | <b>14.2%</b>                                   | <b>9.2%</b>                                    | <b>8.6%</b>                                    | <b>-44%</b>                |
| <b>MSA Average</b>                    | <b>9.8%</b>                                       | <b>9.0%</b>                                    | <b>6.5%</b>                                    | <b>4.6%</b>                                    | <b>-53%</b>                |
| <b>Maturing - Heavy Rail Regions</b>  |                                                   |                                                |                                                |                                                |                            |
| Atlanta TOD Average (n=4)             | 13.1%                                             | 16.1%                                          | 7.9%                                           | 7.4%                                           | -43%                       |
| Atlanta MSA Average                   | 4.4%                                              | 3.2%                                           | 3.1%                                           | 1.4%                                           | -68%                       |
| Miami TOD Average (n=2)               | 3.3%                                              | 3.6%                                           | 3.0%                                           | 2.8%                                           | -15%                       |
| Miami MSA Average                     | 7.3%                                              | 5.5%                                           | 4.1%                                           | 2.2%                                           | -70%                       |
| San Francisco TOD Average (n=18)      | 19.8%                                             | 19.1%                                          | 14.9%                                          | 16.1%                                          | -19%                       |
| San Francisco MSA Average             | 8.6%                                              | 9.1%                                           | 6.4%                                           | 4.4%                                           | -49%                       |
| Washington D.C. TOD Average (n=16)    | 17.3%                                             | 18.3%                                          | 14.9%                                          | 14.2%                                          | -18%                       |
| Washington D.C. MSA Average           | 8.4%                                              | 7.0%                                           | 5.4%                                           | 3.2%                                           | -62%                       |
| <b>TOD Average</b>                    | <b>13.4%</b>                                      | <b>14.3%</b>                                   | <b>10.2%</b>                                   | <b>10.1%</b>                                   | <b>-24%</b>                |
| <b>MSA Average</b>                    | <b>7.2%</b>                                       | <b>6.2%</b>                                    | <b>4.8%</b>                                    | <b>2.8%</b>                                    | <b>-61%</b>                |
| <b>New Start - Light Rail Regions</b> |                                                   |                                                |                                                |                                                |                            |
| Portland TOD Average (n=5)            | 23.2%                                             | 23.4%                                          | 19.5%                                          | 20.4%                                          | -12%                       |
| Portland MSA Average                  | 7.8%                                              | 7.4%                                           | 5.4%                                           | 3.7%                                           | -52%                       |
| San Diego TOD Average (n=6)           | 13.2%                                             | 22.6%                                          | 9.4%                                           | 7.7%                                           | -42%                       |
| San Diego MSA Average                 | 9.5%                                              | 9.1%                                           | 6.1%                                           | 4.0%                                           | -58%                       |
| Los Angeles TOD Average (n=6)         | 15.2%                                             | 13.5%                                          | 10.7%                                          | 9.5%                                           | -37%                       |
| Los Angeles MSA Average               | 7.7%                                              | 7.6%                                           | 5.1%                                           | 3.2%                                           | -58%                       |
| Dallas TOD Average (n=6)              | 31.9%                                             | 9.4%                                           | 26.1%                                          | 11.2%                                          | -65%                       |
| Dallas MSA Average                    | 5.8%                                              | 3.4%                                           | 3.2%                                           | 1.6%                                           | -72%                       |
| Denver TOD Average (n=2)              | 13.4%                                             | 6.3%                                           | 7.9%                                           | 5.5%                                           | -59%                       |
| Denver MSA Average                    | 7.8%                                              | 6.4%                                           | 4.9%                                           | 3.1%                                           | -60%                       |
| Salt Lake City TOD Average (n=4)      | 12.9%                                             | 8.0%                                           | 6.9%                                           | 7.1%                                           | -45%                       |
| Salt Lake City MSA Average            | 6.5%                                              | 5.7%                                           | 4.5%                                           | 2.3%                                           | -65%                       |
| <b>TOD Average</b>                    | <b>18.3%</b>                                      | <b>13.9%</b>                                   | <b>13.4%</b>                                   | <b>10.2%</b>                                   | <b>-44%</b>                |
| <b>MSA Average</b>                    | <b>7.5%</b>                                       | <b>6.6%</b>                                    | <b>4.8%</b>                                    | <b>3.0%</b>                                    | <b>-60%</b>                |
| <b>Total TOD Average (n=103)</b>      | <b>17.4%</b>                                      | <b>15.8%</b>                                   | <b>12.3%</b>                                   | <b>11.2%</b>                                   | <b>-36%</b>                |
| <b>Total MSA Average (n=12)</b>       | <b>7.8%</b>                                       | <b>6.9%</b>                                    | <b>5.1%</b>                                    | <b>3.2%</b>                                    | <b>-59%</b>                |

Source: Author's calculations from US Census (1970, 80, 90, 00) using the Geolytics Neighborhood Change Database.

Notes: 1. Data reported for the narrow TOD analysis (Census tracts closest to rail station) and the full MSA. Also, Geolytics does not allow for the disaggregating of the data to report only walking and cycling without "other".

2. The number of TODs in each region is depicted by 'n'.

**Figure 5: Trends in the Combined Share of Transit, Walking, and Bicycling to Work in TODs Compared to MSAs (1970 – 2000)**



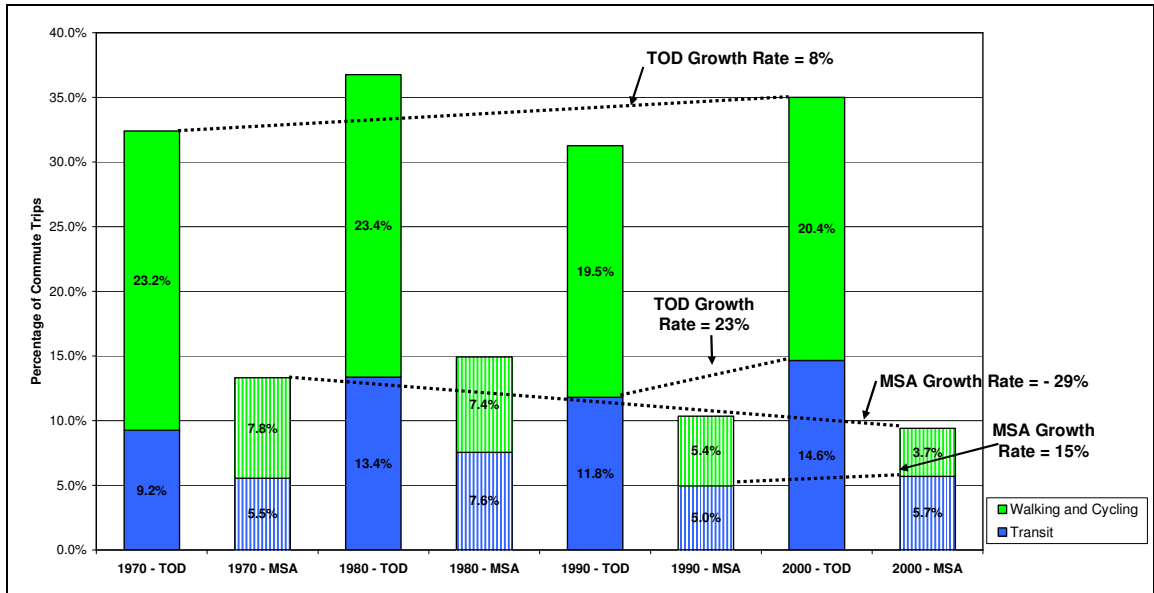
Source: See Tables 2 and 3

Note: n = 103 TODs and 12 MSAs

Evidence for the successful outcomes in TODs is best understood when looking at the TODs in the regions which have done the most to promote compact, mixed-use, and pedestrian-friendly land use planning and zoning. *Transit-Oriented Development in America* (Cervero et al. 2004) noted that Portland, San Francisco, and Washington, D.C., were three of the best examples of regions that have promoted TOD. Washington, D.C., is dubbed the “model for the nation;” San Francisco is noted for having “actively embraced TOD over the past two decades, albeit often in a piecemeal community-by-community fashion,” (Cervero et al. 2004, p. 415); and Portland is cited for having “the most aggressive TOD program in the United States,” (Cervero et al. 2004, p. 363). Furthermore, Miami has also seen positive outcomes in TODs as they have “aggressively sought to encourage TOD,” (Cervero et al. 2004, p. 269). Figures 6 – 9 presents trends in the combined shares of transit, walking, and cycling to work in each of these regions. All four demonstrated much higher and

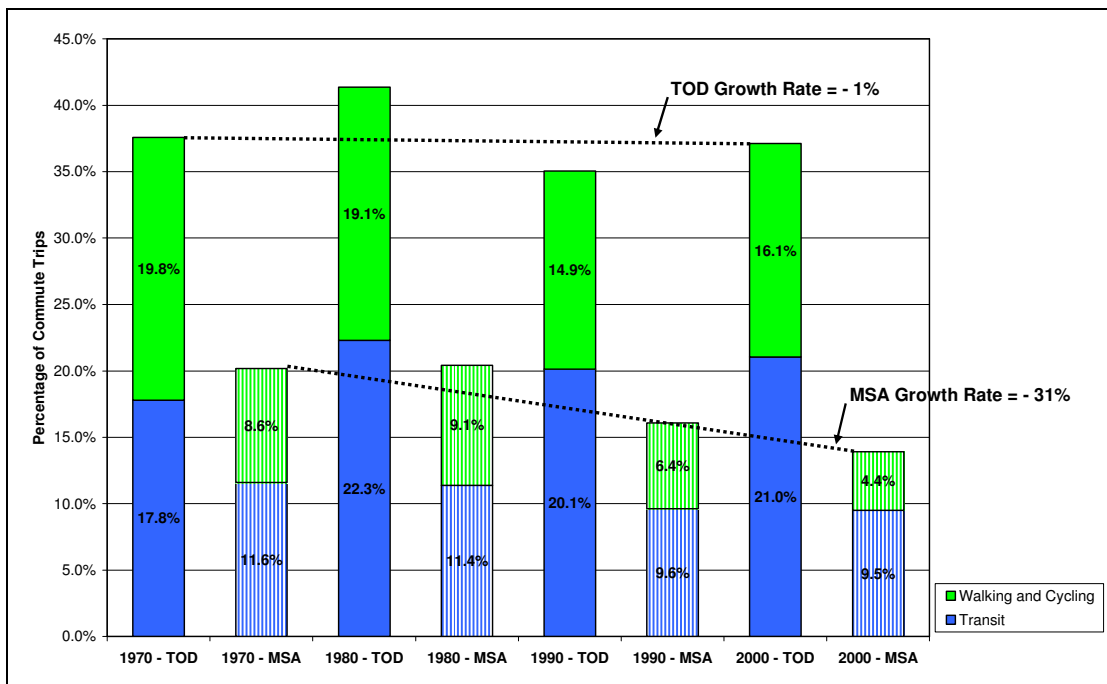
stable or growing levels of sustainable transport in the TODs compared to the MSAs, where levels appeared continually on the decline.

**Figure 6: Trends in the Combined Share of Transit, Walking, and Bicycling to Work in Portland’s TODs Compared to the MSA (1970 – 2000)**



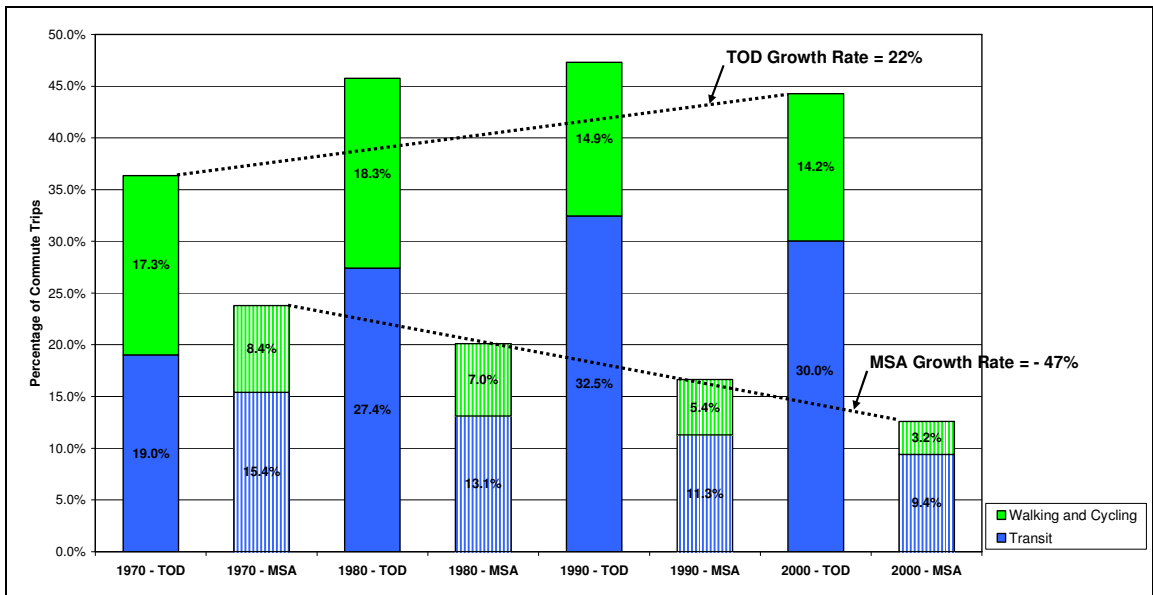
Source: See Tables 2 and 3  
Note: n = 5 TODs

**Figure 7: Trends in the Combined Share of Transit, Walking, and Bicycling to Work in San Francisco’s TODs Compared to the MSA (1970 – 2000)**



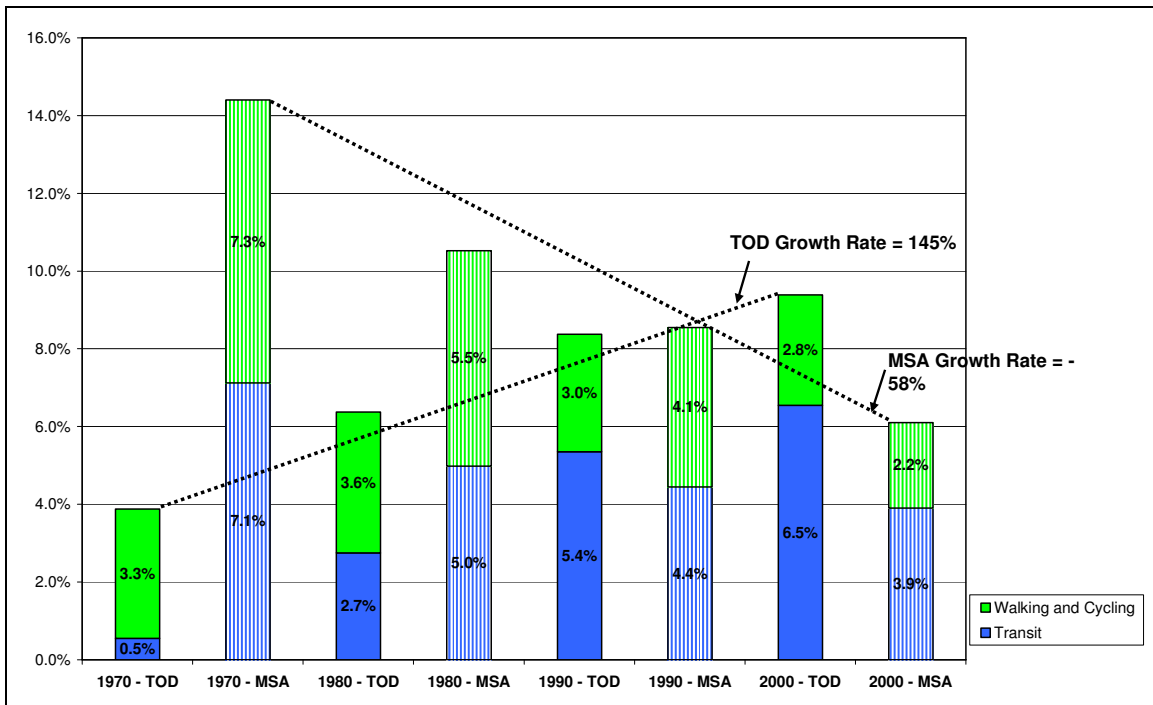
Source: See Tables 2 and 3  
Note: n = 18 TODs

**Figure 8: Trends in the Combined Share of Transit, Walking, and Bicycling to Work in Washington D.C.'s TODs Compared to the MSA (1970 – 2000)**



Source: See Tables 2 and 3  
Note: n = 16 TODs

**Figure 9: Trends in the Combined Share of Transit, Walking, and Bicycling to Work in Miami's TODs Compared to the MSA (1970 – 2000)**

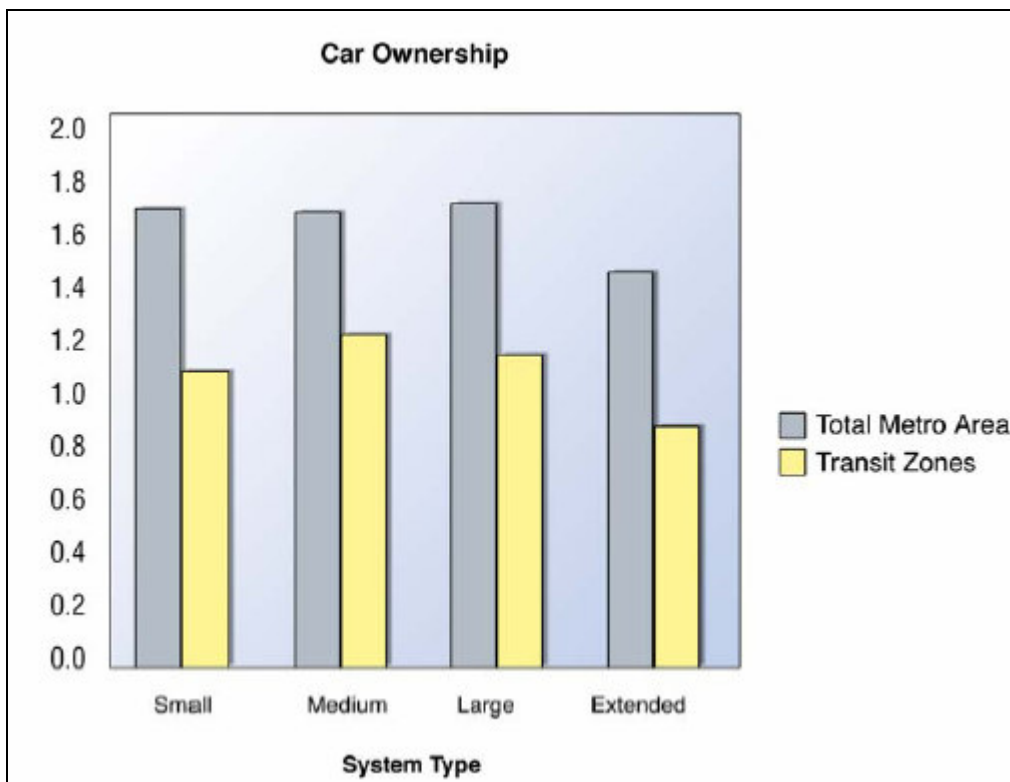


Source: See Tables 2 and 3  
Note: n = 2 TODs

### Vehicle Ownership Trends

A recent study by Reconnecting America's Center for Transit-Oriented Development found lower vehicle ownership rates, on average, within a half-mile of rail stations. They looked at all 3,341 fixed guideway transit stations across the United States for the year 2000 and reported that within the transit precinct, households owned 0.9 vehicles per household compared to 1.6 vehicles per household across the regions. Averages varied slightly by region type, as shown in Figure 10 (Center for Transit-Oriented Development 2004).

**Figure 10: Vehicle Ownership in Transit Precincts across America**



Note: The system type characterizes the extensiveness of the transit network. Denver, with 30 stations, is an example of a small system. Cleveland, with 50 stations, is an example of a medium system. Washington, D.C., with 163 stations, is an example of a large system and New York, with 962 stations, is an example of an extended system.

Data from my study support these findings. As shown in Table 4, nearly twice as many households living in TODs did not own a car compared to the regions in 2000 (18.5 percent versus 10.7 percent). Miami was the only region where the

TOD's percentage of car-less households increased over 20 years, from 3.3 to 6.1 percent<sup>8</sup>. Portland's TODs had the highest percentage of car-free households, with over one-quarter not owning a vehicle in 2000.

Patterns were similar in households that did not own a vehicle or only owned one car (see Table 5). 62.7 percent of households living in TODs across the United States had fewer than two vehicles compared to only a 44.7 percent average for all MSAs. In Portland and Salt Lake City, there was an increase in the percentage of TOD households in this category from 1980 – 2000. In Chicago, San Francisco, San Diego, and Los Angeles, over 60 percent of households in TODs owned less than two vehicles and in Atlanta, Portland, and Washington, D.C., this percentage was over 70 percent, which is 1.5 to 2 times greater than the regional averages (see Figure 11). This has implications for parking standards, which are often the same for TOD and non-TOD areas. The oversupply of parking in TODs for households that have lower vehicle ownership has been a major obstacle to creating vibrant, pedestrian-friendly districts around train stations.

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<sup>8</sup> Data for vehicle ownership is only available for 1980, 1990, 2000.

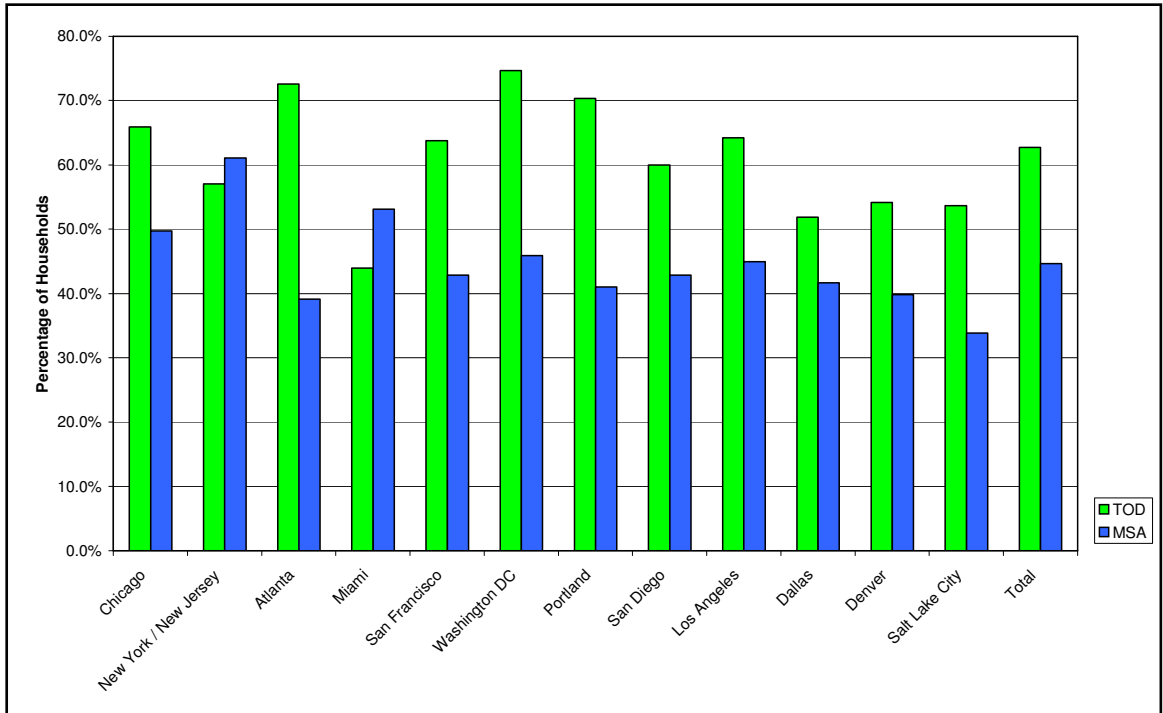
**Table 4: Households without Vehicles for TODs and MSAs by Region Type<sup>1</sup>**  
(percentage of households without vehicles)

| Region <sup>2</sup>                                                                                               | Percentage of Households without Vehicles in 1980 | Percentage of Households without Vehicles in 1990 | Percentage of Households without Vehicles in 2000 | Percent Change 1980 - 2000 |
|-------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|---------------------------------------------------|---------------------------------------------------|----------------------------|
| <b>Older and Redeveloping Regions</b>                                                                             |                                                   |                                                   |                                                   |                            |
| Chicago TOD Average (n=8)                                                                                         | 21.8%                                             | 17.6%                                             | 17.0%                                             | -22%                       |
| Chicago MSA Average                                                                                               | 18.9%                                             | 16.4%                                             | 13.6%                                             | -28%                       |
| NY/NJ TOD Average (n=26)                                                                                          | 20.6%                                             | 18.3%                                             | 18.7%                                             | -9%                        |
| NY/NJ MSA Average                                                                                                 | 31.8%                                             | 29.0%                                             | 28.7%                                             | -10%                       |
| <b>TOD Average</b>                                                                                                | <b>21.2%</b>                                      | <b>17.9%</b>                                      | <b>17.8%</b>                                      | <b>-16%</b>                |
| <b>MSA Average</b>                                                                                                | <b>25.4%</b>                                      | <b>22.7%</b>                                      | <b>21.1%</b>                                      | <b>-17%</b>                |
| <b>Maturing - Heavy Rail Regions</b>                                                                              |                                                   |                                                   |                                                   |                            |
| Atlanta TOD Average (n=4)                                                                                         | 28.7%                                             | 29.4%                                             | 17.7%                                             | -38%                       |
| Atlanta MSA Average                                                                                               | 11.0%                                             | 8.9%                                              | 7.3%                                              | -33%                       |
| Miami TOD Average (n=2)                                                                                           | 3.3%                                              | 5.4%                                              | 6.1%                                              | 87%                        |
| Miami MSA Average                                                                                                 | 14.8%                                             | 13.5%                                             | 12.1%                                             | -18%                       |
| San Francisco TOD Average (n=18)                                                                                  | 25.6%                                             | 22.3%                                             | 22.9%                                             | -11%                       |
| San Francisco MSA Average                                                                                         | 12.1%                                             | 10.4%                                             | 9.9%                                              | -18%                       |
| Washington D.C. TOD Average (n=16)                                                                                | 26.5%                                             | 23.9%                                             | 22.5%                                             | -15%                       |
| Washington D.C. MSA Average                                                                                       | 15.3%                                             | 13.2%                                             | 12.0%                                             | -22%                       |
| <b>TOD Average</b>                                                                                                | <b>21.0%</b>                                      | <b>20.3%</b>                                      | <b>17.3%</b>                                      | <b>-18%</b>                |
| <b>MSA Average</b>                                                                                                | <b>13.3%</b>                                      | <b>11.5%</b>                                      | <b>10.3%</b>                                      | <b>-22%</b>                |
| <b>New Start - Light Rail Regions</b>                                                                             |                                                   |                                                   |                                                   |                            |
| Portland TOD Average (n=5)                                                                                        | 29.7%                                             | 26.6%                                             | 25.6%                                             | -14%                       |
| Portland MSA Average                                                                                              | 10.2%                                             | 8.5%                                              | 7.9%                                              | -22%                       |
| San Diego TOD Average (n=6)                                                                                       | 23.7%                                             | 16.8%                                             | 14.8%                                             | -38%                       |
| San Diego MSA Average                                                                                             | 9.3%                                              | 7.9%                                              | 8.0%                                              | -13%                       |
| Los Angeles TOD Average (n=6)                                                                                     | 22.0%                                             | 19.5%                                             | 18.4%                                             | -16%                       |
| Los Angeles MSA Average                                                                                           | 10.3%                                             | 8.9%                                              | 10.1%                                             | -2%                        |
| Dallas TOD Average (n=6)                                                                                          | 19.5%                                             | 17.9%                                             | 7.0%                                              | -64%                       |
| Dallas MSA Average                                                                                                | 6.5%                                              | 6.4%                                              | 6.1%                                              | -7%                        |
| Denver TOD Average (n=2)                                                                                          | 17.4%                                             | 16.4%                                             | 9.2%                                              | -47%                       |
| Denver MSA Average                                                                                                | 7.8%                                              | 7.6%                                              | 7.0%                                              | -11%                       |
| Salt Lake City TOD Average (n=4)                                                                                  | 10.9%                                             | 9.0%                                              | 9.5%                                              | -13%                       |
| Salt Lake City MSA Average                                                                                        | 6.7%                                              | 6.1%                                              | 5.8%                                              | -14%                       |
| <b>TOD Average</b>                                                                                                | <b>20.5%</b>                                      | <b>17.7%</b>                                      | <b>14.1%</b>                                      | <b>-31%</b>                |
| <b>MSA Average</b>                                                                                                | <b>8.5%</b>                                       | <b>7.6%</b>                                       | <b>7.5%</b>                                       | <b>-12%</b>                |
| <b>Total TOD Average (n=103)</b>                                                                                  | <b>22.7%</b>                                      | <b>20.0%</b>                                      | <b>18.5%</b>                                      | <b>-19%</b>                |
| <b>Total MSA Average (n=12)</b>                                                                                   | <b>12.9%</b>                                      | <b>11.4%</b>                                      | <b>10.7%</b>                                      | <b>-17%</b>                |
| Source: Author's calculations from US Census (1970, 80, 90, 00) using the Geolytics Neighborhood Change Database. |                                                   |                                                   |                                                   |                            |
| Notes: 1. Data reported for the narrow TOD analysis (Census tracts closest to rail station) and the full MSA.     |                                                   |                                                   |                                                   |                            |
| 2. The number of TODs in each region is depicted by 'n'.                                                          |                                                   |                                                   |                                                   |                            |

**Table 5: Households with One or No Vehicles for TODs and MSAs by Region Type<sup>1</sup>**  
(percentage of households with one or no vehicles)

| Region <sup>2</sup>                                                                                               | Percentage of Households with One or No Vehicles in 1980 | Percentage of Households with One or No Vehicles in 1990 | Percentage of Households with One or No Vehicles in 2000 | Percent Change 1980 - 2000 |
|-------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|----------------------------|
| <b>Older and Redeveloping Regions</b>                                                                             |                                                          |                                                          |                                                          |                            |
| Chicago TOD Average (n=8)                                                                                         | 69.2%                                                    | 67.0%                                                    | 65.9%                                                    | -5%                        |
| Chicago MSA Average                                                                                               | 57.9%                                                    | 51.8%                                                    | 49.7%                                                    | -14%                       |
| NY/NJ TOD Average (n=26)                                                                                          | 61.8%                                                    | 57.3%                                                    | 57.1%                                                    | -8%                        |
| NY/NJ MSA Average                                                                                                 | 66.2%                                                    | 60.8%                                                    | 61.1%                                                    | -8%                        |
| <b>TOD Average</b>                                                                                                | <b>65.5%</b>                                             | <b>62.2%</b>                                             | <b>61.5%</b>                                             | <b>-6%</b>                 |
| <b>MSA Average</b>                                                                                                | <b>62.0%</b>                                             | <b>56.3%</b>                                             | <b>55.4%</b>                                             | <b>-11%</b>                |
| <b>Maturing - Heavy Rail Regions</b>                                                                              |                                                          |                                                          |                                                          |                            |
| Atlanta TOD Average (n=4)                                                                                         | 77.5%                                                    | 76.9%                                                    | 72.6%                                                    | -6%                        |
| Atlanta MSA Average                                                                                               | 43.1%                                                    | 38.7%                                                    | 39.1%                                                    | -9%                        |
| Miami TOD Average (n=2)                                                                                           | 44.5%                                                    | 44.0%                                                    | 43.9%                                                    | -1%                        |
| Miami MSA Average                                                                                                 | 58.6%                                                    | 53.7%                                                    | 53.1%                                                    | -9%                        |
| San Francisco TOD Average (n=18)                                                                                  | 69.0%                                                    | 63.7%                                                    | 63.7%                                                    | -8%                        |
| San Francisco MSA Average                                                                                         | 47.8%                                                    | 42.8%                                                    | 42.8%                                                    | -10%                       |
| Washington D.C. TOD Average (n=16)                                                                                | 75.7%                                                    | 73.2%                                                    | 74.7%                                                    | -1%                        |
| Washington D.C. MSA Average                                                                                       | 51.9%                                                    | 45.5%                                                    | 45.9%                                                    | -12%                       |
| <b>TOD Average</b>                                                                                                | <b>66.7%</b>                                             | <b>64.5%</b>                                             | <b>63.7%</b>                                             | <b>-4%</b>                 |
| <b>MSA Average</b>                                                                                                | <b>50.4%</b>                                             | <b>45.2%</b>                                             | <b>45.2%</b>                                             | <b>-10%</b>                |
| <b>New Start - Light Rail Regions</b>                                                                             |                                                          |                                                          |                                                          |                            |
| Portland TOD Average (n=5)                                                                                        | 67.0%                                                    | 66.7%                                                    | 70.3%                                                    | 5%                         |
| Portland MSA Average                                                                                              | 44.7%                                                    | 40.8%                                                    | 41.0%                                                    | -8%                        |
| San Diego TOD Average (n=6)                                                                                       | 62.3%                                                    | 59.2%                                                    | 60.0%                                                    | -4%                        |
| San Diego MSA Average                                                                                             | 45.8%                                                    | 42.0%                                                    | 42.9%                                                    | -6%                        |
| Los Angeles TOD Average (n=6)                                                                                     | 67.0%                                                    | 61.0%                                                    | 64.2%                                                    | -4%                        |
| Los Angeles MSA Average                                                                                           | 47.0%                                                    | 42.6%                                                    | 44.9%                                                    | -4%                        |
| Dallas TOD Average (n=6)                                                                                          | 57.2%                                                    | 54.9%                                                    | 51.9%                                                    | -9%                        |
| Dallas MSA Average                                                                                                | 39.9%                                                    | 41.2%                                                    | 41.6%                                                    | 4%                         |
| Denver TOD Average (n=2)                                                                                          | 60.8%                                                    | 61.8%                                                    | 54.2%                                                    | -11%                       |
| Denver MSA Average                                                                                                | 40.7%                                                    | 40.7%                                                    | 39.8%                                                    | -2%                        |
| Salt Lake City TOD Average (n=4)                                                                                  | 48.1%                                                    | 48.3%                                                    | 53.6%                                                    | 12%                        |
| Salt Lake City MSA Average                                                                                        | 37.1%                                                    | 35.5%                                                    | 33.8%                                                    | -9%                        |
| <b>TOD Average</b>                                                                                                | <b>60.4%</b>                                             | <b>58.7%</b>                                             | <b>59.0%</b>                                             | <b>-2%</b>                 |
| <b>MSA Average</b>                                                                                                | <b>42.5%</b>                                             | <b>40.5%</b>                                             | <b>40.7%</b>                                             | <b>-4%</b>                 |
| <b>Total TOD Average (n=103)</b>                                                                                  | <b>65.9%</b>                                             | <b>62.6%</b>                                             | <b>62.7%</b>                                             | <b>-5%</b>                 |
| <b>Total MSA Average (n=12)</b>                                                                                   | <b>48.4%</b>                                             | <b>44.7%</b>                                             | <b>44.7%</b>                                             | <b>-8%</b>                 |
| Source: Author's calculations from US Census (1970, 80, 90, 00) using the Geolytics Neighborhood Change Database. |                                                          |                                                          |                                                          |                            |
| Notes: 1. Data reported for the narrow TOD analysis (Census tracts closest to rail station) and the full MSA.     |                                                          |                                                          |                                                          |                            |
| 2. The number of TODs in each region is depicted by 'n'.                                                          |                                                          |                                                          |                                                          |                            |

**Figure 11: Percentage of Households in TODs and MSAs that Own Zero or One Vehicle in 2000**



## Conclusions

This study is the first of its kind to monitor long-term travel behavior and vehicle ownership trends in TODs. Commuting patterns shown above lend credibility to the hypothesis that TODs lead to higher shares of work travel on transit, walking, and cycling modes. The journey-to-work data reported high and sustained shares of transit commuting in TODs compared to its regional average. There have also been sustained shares of walking and cycling commutation in many TODs while regions report large declines.

Cities, such as Miami, San Francisco, and Washington, D.C., which invested in metro systems in the 1970s, report substantial growth in transit commuting in its TODs, while the rest of the region has shown the effects of automobile dependence. In New York, transit commuting has been able to maintain its share in TODs while transit's importance has decreased quite considerably in the region. In Chicago and Atlanta, although TODs have lost some of its share of transit commuters, this has occurred at a slower rate compared to the region as a whole. Finally, mixed results were found in *Growing – new start regions* because not enough time has passed to measure results since data from many new TODs were not captured in the 2000 Census. If these regions embrace smart growth and TOD, results are likely to mimic the positive outcomes found in Portland where TOD's experienced a 23 percent increase in the percentage of transit commuting from 1990 – 2000. This was eight percentage points higher than the regional average, which grew by 15 percent during the same time period.

Data from this study also report sustainable outcomes with respect to vehicle ownership in TODs compared to regional averages. While approximately two-thirds of households across regions own two or more vehicles, only about two in five

households fit this description in TODs. As discussed, the average TOD household owns 0.9 cars compared to 1.6 for regions.

The policy implications of these findings are clear: **TODs encourage sustainable transport use for commuting and maintain lower rates of vehicle ownership.** While some critics may suggest that this is simply a result of individuals who choose to self-select their housing in such locations, other research is proving that the demand for living in such places is far exceeding the supply (Center for Transit-Oriented Development 2004; Levine and Inam 2004). This is due largely as a result of restrictive zoning policies that inhibit higher density development. Because market forces value access to transit facilities, one of the best ways to encourage TOD would be for the removal of low density zoning laws. Governments constantly battle the regional benefits of TOD in the midst of local opposition to high density development. Because most land use decisions are made based on local politics, low density usually prevails. A number of policies, including the use of redevelopment authorities, have been effective at implementing TOD in the United States and Australia because planners are able to make decisions outside of a microscopic public scrutiny process.

With respect to travel behavior, this analysis looked solely at the work trip. Some scholars argue that because the work trip accounts for only a quarter of all trips, TODs are best judged based on the non-work travel, but a recent study, based mainly in California, proved inconclusive with respect to TODs and non-work travel behavior (Boarnet and Crane 2001). I would argue that most transportation investment decisions continue to be made based on peak hour traffic congestion, which is a result of work travel. Therefore, encouraging TOD along congested travel corridors is an effective way to reduce auto-dependence and reduce vehicle

ownership. While the success of each TOD depends upon its design, density, and land use mix (Cervero and Kockelman 1997) as transit networks increase in regional connectivity and transit precincts mature over time, more services and amenities will be available if higher residential and employment densities are permitted. As more options become available for TOD residents and employees, there is a greater likelihood that non-work travel too will become more sustainable.

Finally, these findings suggest that governments take a closer look at encouraging maximum utilization of their transit station precincts. Moreover, it also suggests that the construction of new rail and new TODs in cities is worthwhile to reverse auto-dependence and provide opportunities for residents where car ownership and use is an option, not a necessity.

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