HIDDEN IN PLAIN SIGHT

Capturing The Demand For Housing Near Transit

Reconnecting America's
Center For Transit-Oriented Development

September 2004

ON THE COVER (left to right): Dallas Area Rapid Transit in Plano, TX; station in Solana Beach, CA; the Portland streetcar.

Photo Credits (left to right): Dallas Area Rapid Transit; Rob Quigley Architects; City of Portland.

The Center for Transit-Oriented Development

The Center for Transit-Oriented Development (CTOD) was launched in 2003 to help bring transit-oriented development (TOD) to scale as a nationally recognized real estate product. The CTOD is working with transit agencies, developers, investors and communities to use transit investments to spur a new wave of development that improves housing affordability and choice, revitalizes downtowns and urban and suburban neighborhoods, and provides value capture and recapture for individuals, communities and government. The Center for TOD is based in Oakland, California and is headed by Shelley Poticha and by Hank Dittmar, president and CEO of Reconnecting America. The Center for TOD is a major program of Reconnecting America, a non-profit organization that is working to integrate transportation networks and the communities they serve in order to generate lasting public and private returns, improve economic and environmental efficiency and give consumers greater choice.

The CTOD is a joint venture with the Center for Neighborhood Technology in Chicago, led by Scott Bernstein, which has the largest in-house public interest Geographic Information System (GIS) group in the Midwest, and with Strategic Economics in Berkeley, led by Dena Belzer, who has helped to establish best practices for TOD and adds expertise in real estate and urban economics and regional TOD capacities and challenges. The CTOD's governance team works closely with an advisory group, whose skills include mixed-use development, transit agency management, community development, local government, and investment banking.

Reconnecting America Board of Directors

C-07-04

U.S. Department
of Transportation
**Federal Transit
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Administrator

400 Seventh St., S.W.
Washington, D.C. 20590

SEP 8 2004

Dear Colleague:

It is with great excitement and anticipation that we issue this report on the potential for transit oriented residential development.

With the recent surge in interest in and construction of rail transit systems, families and communities are seeking ways to take full advantage of their promise – seeking improved mobility, environmental benefits, and economically thriving neighborhoods.

In this report, the Center for Transit-Oriented Development has estimated the demand for housing within a half-mile of 27 existing rail systems and 15 planned extensions or new systems over the next 20 years. The findings are nothing short of astonishing.

Over 14.8 million households are expected to want housing within a half-mile of these rail systems by 2025 – more than double the number of households living there today. Meeting this demand would require building an average of 2,100 residential units near each of the 3,391 transit stations that was studied. For communities, transit systems, real estate developers, and financial institutions, this potential demand for housing presents not only a tremendous opportunity, but a challenge as well. To fully capture the benefits of our transit investments:

- Our communities must adopt policies to support the attractive, higher-density housing that families and individuals are seeking -- revisiting zoning rules, parking policies, and infrastructure investments;
- Our transit systems must make continued improvements, not only to the operations of the systems themselves, but to the surrounding plazas, streetscapes and other amenities that make transit attractive; and
- Real estate developers and financial institutions must fully embrace the economic potential of urban development.

We hope you will read this report with an eye toward your role in creating attractive, vibrant, and economically thriving communities for ourselves and our children.

Sincerely,

Jennifer L. Dorn

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EXECUTIVE SUMMARY

Photo by Dallas Area Rapid Transit

Demand for housing near transit spurred development that's revitalized the historic downtown of Plano, Texas.

Primary funding for this study was provided by the Federal Transit Administration (FTA). The Surdna Foundation and the Fannie Mae Foundation also contributed to this national market assessment of transit-oriented development (TOD).

The study looks at:

- national real estate and consumer trends that affect the potential market for housing within a half mile of fixed guideway transit stops (TOD);
- the demographics and travel behavior of residents who live near transit;
- the potential demand for housing within walking distance of transit stations in the year 2025; and
- the ability of transit-served regions to accommodate this emerging consumer market.

The study resulted in four major accomplishments:

- analysis of the Center for Transit-Oriented Development's (CTOD) national TOD database, a Geographic Information System (GIS) platform for analyzing conditions around the nation's 3,341 existing fixed transit stops and the 630 additional stations that are scheduled to be built by 2025;
- regional housing demand projections for the types of households that show a preference for living in transit-oriented communities;
- a methodology for assessing the unused capacity of areas within walking distance of transit, which can be used to help measure a region's potential for TOD; and
- a demonstration of the study's methodology in seven case study regions.

There are tremendous shifts occurring nationally in demographics, consumer preferences, employer location strategies and transportation infrastructure investments. Consumers are choosing smaller, more compact housing in neighborhoods where shops and services are within walking distance, and where high-quality transit service is an option. While these trends have been documented and in some cases even quantified, there have been few attempts to calculate their impact on the demand for higher-density housing near transit. The Center for Transit-Oriented Development has built a national demand estimate for housing within a half mile of fixed guideway transit stops through 2025 for the 27 regions that currently have transit systems, as well as for 15 regions that are seeking to build new fixed-guideway systems by 2025 using the FTA New Starts program. This estimate is based on household demand projections for each region that capture the effect of different demographic trends in different metropolitan areas. Because the study considers only the half-mile radius around transit stations, a readily definable area but not the total area that can accommodate transit-oriented development, this is a relatively conservative estimate of potential demand for TOD in 2025. Studies have shown that people will ride transit from beyond the half mile if they have good feeder bus service or bike access. Development around these access modes could also be considered transit-oriented development. Inclusion of these areas would offer a more complete assessment of the demand for housing near transit, but is beyond the scope of this study.

This study finds there is likely to be significant demand for housing within a half-mile radius of fixed guideway transit stations – areas called "transit zones" for the purposes of this study — over the next 25 years. Our market assessment shows that at least a quarter of all new households — 14.6 million households — could be looking for housing in these transit zones. This is a staggering figure, since only a small portion of all new housing is being built in these locations today. Because there are currently about 6 million households living within a half mile of transit stations, this means there is the potential to more than double the amount of housing in transit zones by 2025. If this market is captured, transit-oriented development could become the armature for a significant portion of regional growth and help increase transit ridership.

Most of the demand will occur in the five metro regions that have mature and extensive transit systems – New York, Chicago, the San Francisco Bay Area, Boston and Philadelphia – and in Los Angeles, which has a large transit system and high population growth rate. But all of the regions that are expanding their systems have the potential for high rates of growth in demand, especially regions like Denver, Salt Lake City and Seattle, which have small systems but high rates of growth. Indeed, the study shows that many of these regions with newer systems could accommodate from a quarter to up to a third of all regional growth in housing in transit zones.

Photo by RTKL Associates

Housing in Addison Circle, a TOD project in Addison, Texas, is architecturally distinct, and there is every kind of residential real estate product.

A methodology was developed to assess the capacity for accommodating development around stations. The analysis indicates that urban downtowns in major cities are doing a very good job of accommodating residential densities sufficient to support high-quality transit, and urban neighborhoods in these cities are also making progress toward optimal densities. But these same neighborhood types in small and mid-sized cities and suburban town centers and suburban neighborhoods have not matured to the point where densities support high-quality transit, and these places offer significant opportunities for accommodating future demand.

Whether this potential demand is actually realized, however, has much to do with whether the market is able to deliver an attractive higher-density housing product near stations. This transit-oriented housing product will need to have the characteristics that consumers consider important, and it will have to

be priced so that it is both affordable and competitive with other housing options in the region. Whether the market is able to deliver more of this kind of housing product has much to do with whether appropriate public policies, such as higher-density zoning and reduced parking requirements, are put in place and the right infrastructure investments are made, including continued improvements to transit systems and "placemaking" elements such as plazas and streetscape improvements.

Photo by City of Portland

Portland's streetcar catalyzed development of 5,000 residential units around Portland State University and in the Pearl District.

As part of this study the Center for TOD analyzed its TOD database. This database contains information about every existing fixed-guideway transit system in the U.S., the 3,341 stations along these systems, and the 630 new stations scheduled to open by 2025. This information has been integrated into a Geographic Information System (GIS) with data from the 2000 U.S. Census and other sources, creating a powerful database that for the first time makes it possible to find out who lives near transit, including information about household size and type and the ages of residents, their travel behavior, income, home ownership, and car ownership. The database also includes information about the transit zones, such as average density, land area in residential use, block structure, age of housing stock, block size and distance to a region's Central Business District.

The assessment of the national TOD database, combined with an analysis of national and regional housing projections, focused on determining who lives near transit now, who is likely to want to rent or buy housing near transit in the future, where the most demand is likely to occur, and whether there is unused capacity around transit. Case studies were conducted in seven regions – Los Angeles, Chicago, Washington D.C., Denver, Cleveland, Memphis and Charlotte – to demonstrate the study's methodology and investigate regional similarities and differences. The case studies suggest many avenues for further inquiry, and support four major conclusions:

- First, any assessment of the importance of transit-oriented development nationally should also consider regional context. Transit-oriented development is not a national panacea; it is a specific tool that requires different policies in different contexts. In some regions more density may be needed around transit, whereas in other regions more transit may be required to better serve existing high densities. In still other regions both density and transit may be sufficient but there may not be the pedestrian connectivity that makes riding transit an easy and appealing alternative, or the transit system may not provide the regional connectivity that makes it a viable transportation option for residents.
- Second, not every region will experience the same magnitude of demand for higher-density housing near transit, but where the conditions are right transit-oriented development could accommodate a significant share of regional growth, even in those regions that only have small transit systems.
- Third, building higher-density transit-oriented development projects that are walkable and that contain a good mix of mutually supportive uses will have benefits beyond increasing transit ridership. This is demonstrated in regions such as Washington D.C. and Denver, where a high percentage of transit zone residents also walk to work and real estate values have risen substantially.
- Finally and most importantly, specific policies will have to be put in place to ensure that the market can deliver a product that will help realize the potential demand.

Changing demographics and consumer preferences are opening a window of opportunity that could allow for a transformation of the American dream of a single-family detached home in the suburbs into something more sustainable and affordable – like a row house or courtyard housing or a condo in a high-rise building in a walkable neighborhood next to transit. As both home prices and rents spiral ever higher and driving anywhere becomes more difficult and time-consuming, housing near transit at the very least offers the possibility of reduced transportation expenses and time to read the paper on the train while commuting in the morning. Realizing the growing demand in the marketplace for lively, walkable, transit-oriented developments will enable the national investment in transit to capture a greater return on that investment.

1 KEY TRENDS DRIVING DEMAND FOR TOD

Photo by Mary Volm/City of Portland

Changing demographics portend greater demand for housing in walkable neighborhoods like this one in Portland

Nationally there are tremendous shifts occurring in demographics, consumer preferences, employer location strategies, and transportation infrastructure investments. Consumers are choosing smaller, more compact housing in neighborhoods where shops and services are within walking distance, and where high quality transit service is an option. Regions are building more transit. Transit-oriented development, when done right, creates a mix of uses within walking distance of stations in a design that encourages walking, promotes transit ridership, and provides housing choices. A rich mix of land uses is central to transit-oriented development, and this means that rider-serving amenities such as retail and day care, as well as commercial spaces, are available in residential areas, and that office development is integrated into station areas. If transit-oriented development can capture this potential market then the investment in public transit will become the armature for a significant portion of regional growth, helping to increase transit ridership as well as decrease traffic and air pollution, increase housing affordability and choice, revitalize urban and suburban neighborhoods, and generate lasting public and private returns.

Unfortunately, many of the successful examples of transit-oriented development are the result of "clever exceptionalism," and have required persistent advocacy and extraordinary public attention. As a result, there aren't enough good examples of TOD to showcase, there are too few developers and planners with expertise in TOD, and too few elected officials and advocates to champion exemplary projects, and it's unlikely that without further action market demand will be met. The barriers to delivering high quality projects that meet the objectives of the marketplace, that succeed as places in their own right as well as nodes in regional transit systems, and that improve regional transportation system performance are great.

There are six major challenges to creating high-performing TOD:

- finding a common definition or agreement on the goals and outcomes;
- balancing the tension between the requirements of making a project a successful place and making it a successful transportation node;
- reducing complexity, time, uncertainty, and costs;
- creating a supportive regulatory and policy environment;
- acknowledging that more than transit is needed to drive real estate investments; and
- convincing investors that TOD is an asset class.

There is little if any meaningful information or systematic analyses available today to help transit agencies, local governments or developers consistently create optimal transit-oriented projects. It is only when successful projects are easily recognized and routinely produced that TOD will begin to provide a real and effective alternative to auto-oriented mobility and to create a lasting positive impact on regional economies in ways that address social inequities and improve environmental quality. The primary challenge is to move beyond the rhetoric, prototypes and serendipity to a more in-depth understanding of what constitutes optimal TOD and how to get such projects built as a matter of course rather than as the exception. This should start with a fact-based understanding of TOD and a performance-based definition of objectives including:

- increased location efficiency;
- expanded mobility, shopping and housing choices;
- financial return and value capture; and
- a balance between the requirements of a successful place and a successful node.

Study after study shows that transit is a viable alternative to the car only if what takes place at either end of the ride meets the needs and desires of a significant number of individuals. Ridership is much higher in regions with frequent service, high quality interconnections, and wonderful, affordable places to live, work and play near transit stations than it is in regions where transit pays little attention to its surroundings. In Arlington County, Virginia, just outside Washington D.C., for example, it is possible to live in the suburbs, close to transit, and not own a car: 47 percent of the residents who live within a half mile of Metrorail stations in Arlington County use transit to get to work and 73 percent of transit riders walk to stations. Car ownership rates near Arlington County stations are much lower than in the region as a whole, and it seems to be by choice, as average household income is higher than the regional average. In the Southwest, Denver is considering a ballot measure that would fund a build-out of the transit system in a dozen years in order to meet the lifestyle objectives of residents. Clearly, the market is changing and there is demonstrable demand for convenient neighborhoods that provide housing and transportation choices.

But while an increasing number of regions are seeing the benefits of directing regional growth to transit-oriented locations, few have put in place the infrastructure — financial and otherwise — to allow the market to deliver these neighborhoods. This assessment of the market demand for TOD is intended to help both the public and the private sectors decide on the level of resources to devote to TOD and to inform decisions about where these resources should be channeled.

Transit Is In A Building Boom

The vast majority of major metropolitan regions are planning or building some form of urban rail or busway system, and the competition for limited federal funds is intense. As of 2003, 25 "New Starts" projects were being constructed under full-funding grant agreements with the Federal Transit Administration (Figure 1), an additional 52 projects were in some stage of the federal approval process, and there were 151 more New Starts named in the last federal transportation authorization. These fixed-guideway projects collectively are seeking approximately $60 billion in public (federal, state and local) and private investment over the next 15 years.

Many of these systems will not be built if the demand or local financing capacity is not there. At the direction of Congress, the FTA has adopted a rigorous project evaluation process and a key criterion is supportive local land-use policies. This is evidence of the degree to which ideas about TOD are taking hold and of the need for improved practices and standards, without which many of the new systems may fail to meet ridership projections.

Urban And Suburban Investment Is On The Rise

Another important trend is the reversal of the population decline in many U.S. cities in the 1990s. Rebecca Sohmer and Robert Lang analyzed downtown population trends in the 1990s for the Fannie Mae Foundation and the Brookings Institution and found that downtowns grew in 75 percent of cities surveyed. Sohmer and Lang argued the desirability of downtowns is due to their proximity to work, mass transit, and amenities, and that this proximity augurs well for continued growth in downtown popula-

New Starts Projects in Preliminary Engineering and Final Design as of 2003

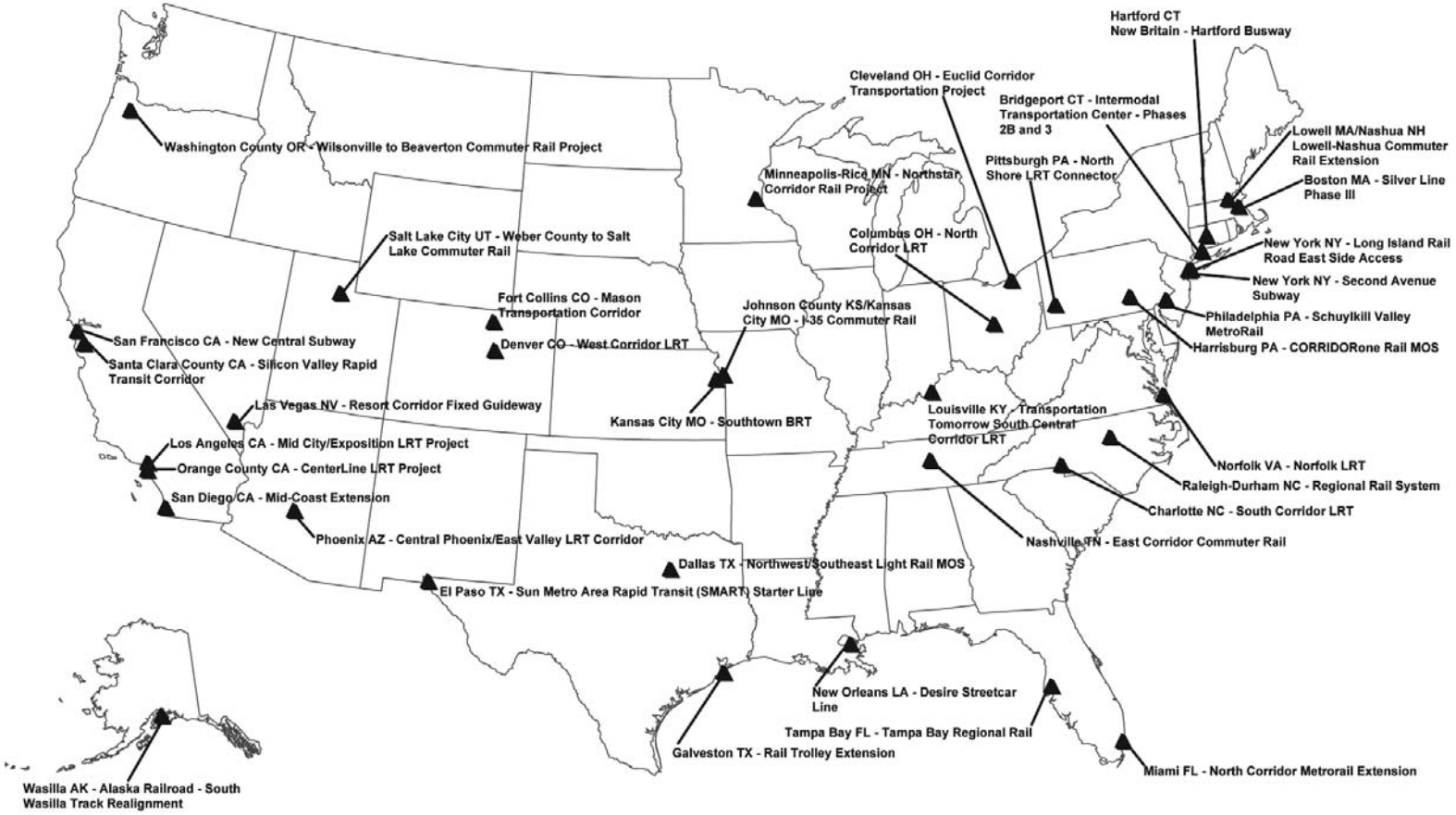


Figure 1: *New Starts Projects in Preliminary Engineering and Final Design*

tions and adjacent neighborhoods. In booming cities such as Chicago, Seattle and Portland, downtown growth far outpaced overall growth – Chicago's downtown population grew by almost 50 percent from 1990 to 2000. Downtown populations grew even in cities not known for their urbanism, such as Houston, which experienced the biggest increase at 69 percent, and Memphis, up 18 percent, and even in industrial cities such as Detroit and Philadelphia.

Even those who live outside central cities are expressing a preference for the convenience and vitality of urban life. Many suburbs are revitalizing their downtowns to make them more pedestrian friendly, encourage street life, and create a mix of land uses, and they are using their commuter rail stations as an anchor and major asset. They're changing zoning and acquiring land in order to build higher density housing and mixed use, and to improve access to transit. In the suburbs surrounding Washington D.C., New York, Boston, Chicago, the Bay Area and Dallas there's a premium attached to access to transit, and even suburban single-family homes are advertised as being within walking distance of a train.

Consumer Demand Is Changing

Much has been written about the preference of the Echo Boomers, aged 24-34, for exciting, densely populated urban locations. A study in 2001 by the Federal Highway Administration found that 57 percent of this generation preferred small lot housing and that 53 percent felt that an easy walk to stores was an extremely important determinant in housing and neighborhood choice. Economic development expert Richard Florida made a compelling case in *The Rise of the Creative Class* that the economically successful regions of the future will be those that attract technology and talent, and that creative workers are attracted to cities because they are centers of innovation. Florida also found a clear correlation between child-friendly cities and creative hubs. Other surveys have also documented shifting preferences:

- AARP reports that 71 percent of older households want to live within walking distance of transit.
- According to the National Association of Realtors, condo sales are booming, and for the first time the price midpoint of condos is higher and the sales volume is growing faster than for detached single family homes.
- *Professional Builder* reports that 37 percent of all households want small lots and clustered development.

Investors Are Seeing The Value Of Locating Near Transit

As a consequence of these trends, real estate forecasters and investment experts are advising their clients to invest in mixed-use communities, and companies are showing a preference for these kinds of neighborhoods. Price Waterhouse Coopers' annual *Emerging Trends in Real Estate*, which rates all types of real estate investment, has continued to advise investors to seek out opportunities in "24-hour cities" with mixed-use development and mass transit access. According to the 2001 report, "Major 24-hour metromarkets maintain their preeminence while some suburban areas struggle with sprawl and congestion issues. 'Subcities' – our new term for suburban locations that are urbanizing and taking on 24-hour market characteristics – show particular promise for investors."

According to leading commercial real estate broker and property manager Jones Lang LaSalle, "Urban locations, though not always central business districts, will continue to be desirable. This is reinforced by the importance of public transportation to companies and workers." In Atlanta, to cite one example, Bell-South decided to relocate its entire metropolitan workforce of 20,000 from 72 locations around the metropolitan area to three locations within walking distance of MARTA rail stations.

Demographic Trends Are Creating Demand For TOD

There's a larger shift underlying these trends in real estate investment and downtown population growth. The demographics of this country are gradually changing, which portends a fundamental shift in the demand for housing and in locational preference. There are several interrelated demographic trends underway, which were dramatically illuminated in the 2000 Census, and each has the potential to significantly increase demand for urban-style housing near transit.

Household size is shrinking, producing more households of empty nesters, singles and non-family residents. Baby boomers are aging, swelling the ranks of older households as they pass from the child-rearing stage of life to the empty-nest phase. Evidence suggests that they are fueling much of the growth in

urban populations as they seek smaller homes in locations with a greater mix of amenities. The traditional nuclear family that made up 40 percent of households in 1970 now comprises less than 24 percent of households. As seen in Figure 2, the new age distribution is more a pillar than a pyramid, with a population by 2020 of nearly an equal number of school-aged children, young professionals, parents, young retirees and the elderly.

According to Catherine Ross' and Anne Dunning's analysis of the 1995 National Personal Transportation Survey (NPTS), single adults with no children, and households of two or more adults with no children were the most likely to live in urban locations. These households are less interested in a single-family home on a quarter acre in a distant suburb than in the 24/7 lifestyle, cultural richness and diversity of walkable urban neighborhoods.

Another notable finding in the 2000 Census was the continuing increase in diversity of the nation's population due to immigration from Asian and Latin American countries. Historically, most immigrants and minorities have settled in cities. While this trend is changing, with more immigrants settling in suburban or even rural locations, demographer William Frey projects that most immigrants will continue to live in relatively dense urban locations (including inner suburbs). Because immigrant households also tend to have lower incomes, these households tend to own fewer automobiles and drive less.

According to Ross' and Dunning's 1995 NPTS analysis, African-Americans, Asians and Hispanics are all more likely to use public transit or to walk than are Non-Hispanic White Americans. For immigrants this is also due to cultural preferences. Many came here from countries where the use of public transit is much more common. As these immigrants are assimilated into the general population we can expect their incomes to rise and driving to increase, but they are likely to continue to be willing to use transit as well, particularly if the availability, quality and convenience of transit continues to improve.

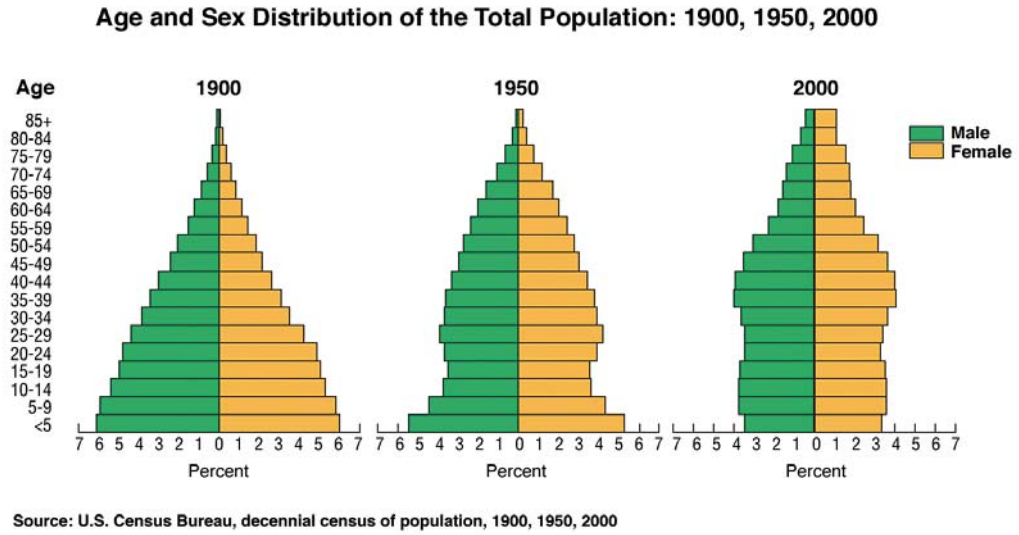


Figure 2: *Age and Sex Distribution of the Total Population: 1900, 1950, and 2000*

2 THE NATIONAL TOD DATABASE

Photo by Rob Quigley Architects

Business owners say this commuter rail station put Solana Beach, California on the map, making it a destination stop.

The Center for TOD has created the first national TOD database containing information about every fixed-guideway transit system in the U.S., the 3,341 existing stations along these systems, the half-mile radius around these stations, and the people who live in these transit zones. There are 27 metropolitan regions that are currently operating some form of fixed-route transit, including heavy and light rail, commuter rail, streetcars and trolley buses, bus rapid transit, and cable cars. Included in the database are selected Amtrak stations that serve commuters as well as long-distance travelers. Bus networks were not included in this study, but represent an important component of regional transit networks. The database also includes information about an additional 630 stations in 15 regions that are seeking funding to build new systems through the Federal Transit Administration's New Starts program and another 21 regions that are extending their fixed-route systems. Some of these systems have just opened; the rest are likely to open by 2025. This set of 630 stations was selected out of the universe of projects that are seeking federal funding as being most likely to be open by 2025. It is a conservative list of projects as it does not include many that are beginning the federal process and may be completed by 2025, nor does it include the projects being constructed without federal assistance. For example, the Metropolitan Transportation Commission is advancing 18 rail and rapid bus projects for planning and construction, and is only seeking federal New Starts funding for two of them. Table 1 lists the metro regions and the number of current and planned stations included in the database.

This information about transit has been integrated into a GIS format with data from the 2000 U.S. Census and other sources, creating a powerful database that makes it possible to find out who lives near transit, including information about household size and type and the ages of residents, their travel behavior, income, home ownership, and car ownership. The national TOD database was built with general support grants from the Surdna Foundation and the Fannie Mae Foundation, and a GIS layer identifying new rail starts was added as part of this study and funded by the FTA.

For the purposes of this study the half-mile radius around transit stations is called the transit zone, because it is the geographic area within which transit is most likely to have an impact on travel behavior of its residents. Information about the transit zones in the database includes the average density, land area in residential use, block structure, age of housing stock, block size and distance to a region's Central Business District. The fact that data is linked in a GIS system makes it possible to produce analytical

Metro Area	Metro Area Type*	Current Stations	Planned New Stations
Atlanta	Medium	46	-
Baltimore	Medium	77	-
Boston	Extensive	280	7
Buffalo	Small Static	15	-
Charlotte	New Start	-	18
Chicago	Extensive	418	9
Cleveland	Medium	50	33
Columbus	New Start	-	14
Dallas	Medium	54	23
Denver	Small Expanding	31	26
Fort Collins	New Start	-	15
Galveston	Small Static	10	6
Harrisburg	New Start	-	8
Hartford	New Start	-	12
Houston	Small Expanding	18	-
Kansas City	New Start	-	24
Lancaster	New Start	-	3
Las Vegas	New Start	-	5
Los Angeles	Large	124	40
Louisville	New Start	-	22
Memphis	Small Expanding	13	9
Miami	Medium	40	20
Minneapolis-St. Paul	New Start	-	27
Nashville	New Start	-	6
New Orleans	Small Static	17	47
New York	Extensive	962	30
Norfolk	New Start	-	11
Philadelphia	Extensive	337	28
Phoenix	New Start	-	30
Pittsburgh	Medium	72	9
Portland, OR	Large	110	22
Raleigh-Durham	New Start	-	16
Reading, PA	New Start	-	5
Sacramento	Medium	39	-
Salt Lake City	Small Expanding	24	12
San Diego	Medium	69	21
San Francisco Bay Area	Extensive	305	19
Seattle	Small Expanding	23	38
St. Louis	Small Static	20	2
Syracuse	Small Static	8	-
Tampa Bay Area	Small Expanding	10	4
Washington, D.C.	Large	169	9

Table 1: *National TOD Database Metro Regions*

* "New Start" refers to those regions that are building fixed-guideway systems for the first time.

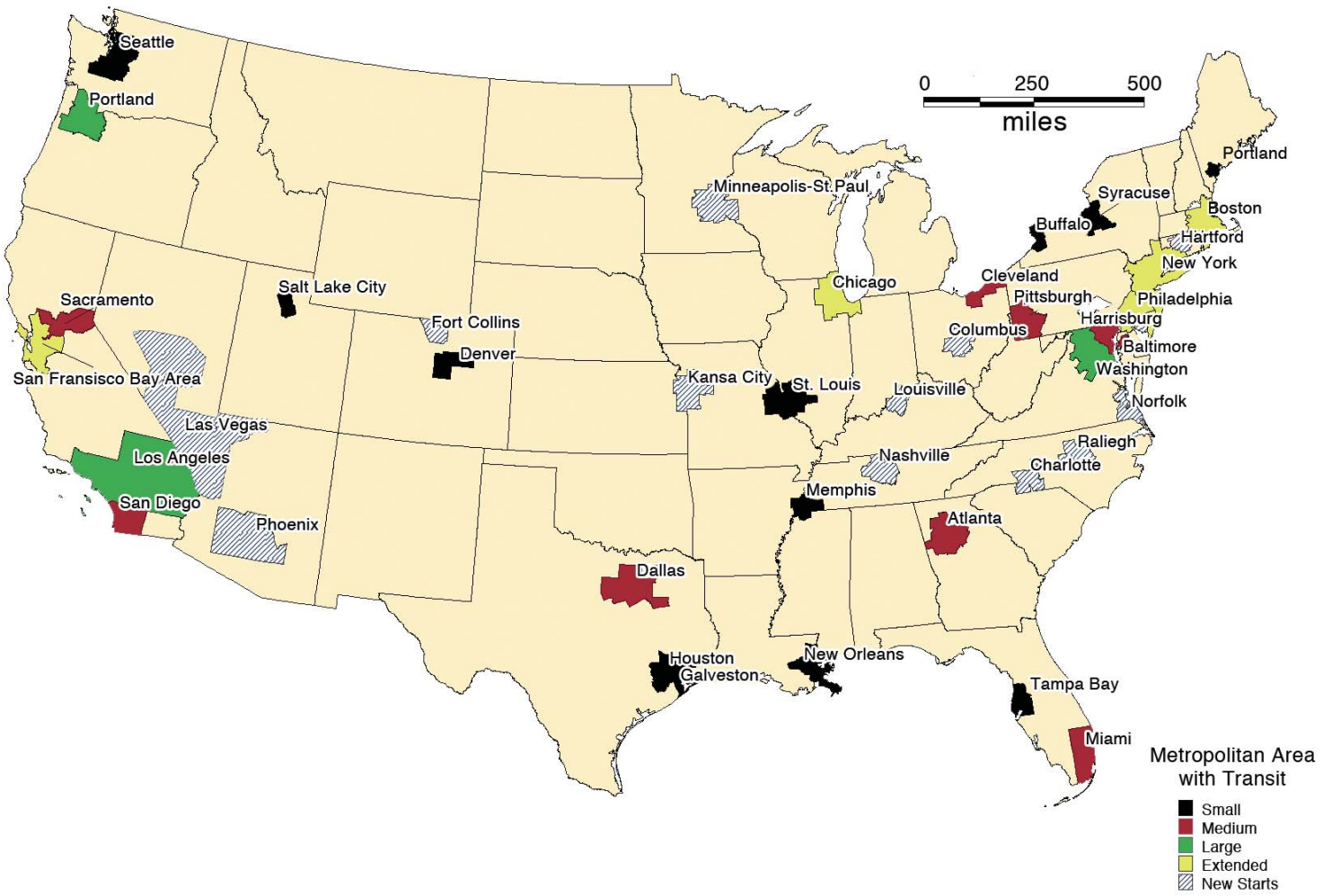


Figure 3: *Metro Regions by System Size with New Starts Regions*

and expository maps of individual station areas, metropolitan regions and the nation as a whole. It is possible to generate information that permits comparisons between residents of transit zones and residents of the regions at large, as well as between and among these residents in other regions and the nation.

The 27 regions with existing transit systems all have fixed-guideway systems, but otherwise they are very different. The most salient difference, for the purpose of this analysis, is the size of their transit systems. Obviously, the more extensive the system, the more origins and destinations are accessible by transit, making transit a more viable alternative to driving. The 27 regions have been grouped according to the number of stations they serve, and they have been classified as small-static-system, small-expanding-system, medium-system, large-system and extensive-system regions. The distinction between static and expanding is made only for the regions with small systems because the regions with medium, large and extensive systems are all expanding their systems to some degree. Figure 3 shows the 27 regions by system size, along with the 15 New Start regions.

To illustrate the impact that the size of a transit system has on a region's ability to support transit-oriented development, four transit systems representing the four categories — small, medium, large and extensive — are depicted in Figure 4 at the same geographic scale. Clearly, there is an order-of-magnitude difference between each of these systems, and between their differing potentials to influence residents' decisions about where to live and developers' decisions about where to invest.

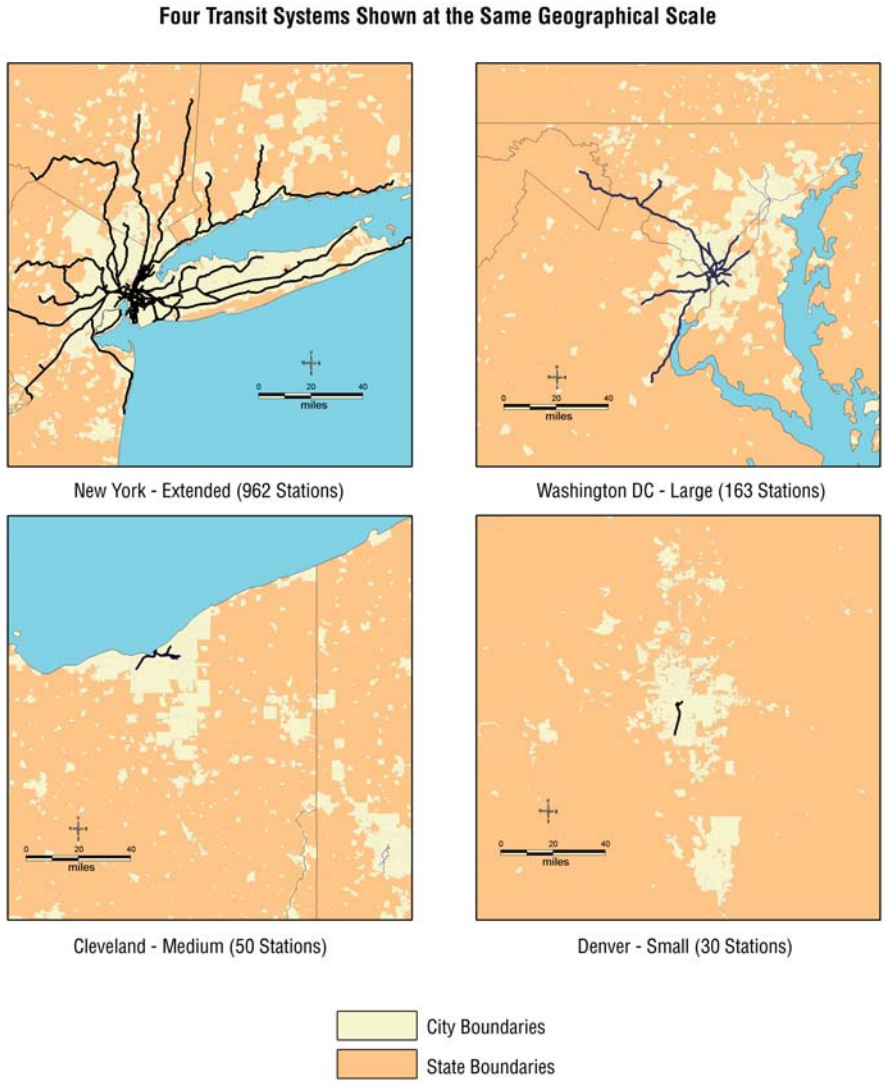


Figure 4:
Four Transit Systems Shown at the Same Geographical Scale

3 WHO LIVES NEAR TRANSIT NOW?

Photo by Art Cueto

The transit mall in Santa Monica, CA, anchors high-density residential and commercial around a pedestrian promenade.

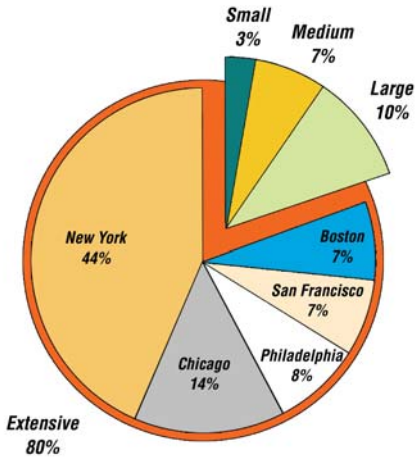


Figure 5: *Percentage of population living in transit zones sorted by region.*

A total of 14 million people or 6.2 million households live within a half-mile radius of existing fixed-guideway transit stations, according to the 2000 U.S. Census and the national TOD database. This equates to 12 percent of the total population of the 27 metro regions covered in this study. These transit zones represent only 1 percent of the total land area in these regions, clearly demonstrating that transit zones tend to be more densely populated than these regions as a whole. Eighty percent of the total transit zone population in the U.S. lives in the five regions that have extensive transit systems – New York, Chicago, Philadelphia, San Francisco and Boston. Despite the fact that only 20 percent of the total number of transit zones residents live in the regions with small, medium and large systems, these residents still total 2 million people.

Those metro regions with large and medium-sized systems that have either located fixed-guideway systems in densely populated areas or aggressively promoted TOD appear to have had some success in accommodating a higher than average proportion of residents in transit zones. In the Washington D.C.

metro region, for example, 10 percent of all residents live in transit zones, and in San Diego, California, 7 percent of residents live in transit zones – a percentage that is nearly twice the average capture rate for other metro regions with similarly sized fixed guideway transit systems. Figure 5 depicts the percentage of the population living in the transit zones by region.

Household Sizes Are Smaller In Transit Zones

In general, the average household size in transit zones is smaller than in the metro regions as a whole. However, the size difference is most pronounced in regions with small transit systems. Houston and Memphis, both small-expanding-system regions, have an average household size of less than two people in transit zones compared to two to seven for the regions as a whole. Interestingly, Los Angeles, a large-system region, has the highest average household size in transit zones with three people, which is also the average household size for the region as a whole.

Regions with small transit systems also have a higher percentage of single-person households in transit zones compared to the regions as a whole. On average, 51 percent of transit zone households in the small-system regions are single-person households, as compared to 27 percent for those metro regions as a whole. In the regions with extensive transit systems, in contrast, 34 percent of households in transit zones are single-person households compared with 27 percent for the region as a whole.

While the census data is not explicit about which types of households classified as "families" have children under the age of 20 living in them, it is interesting to note that more than 30 percent of the households in transit zones in medium-, large- and extensive-system regions are families of three or more people, as compared to between 42 and 45 percent in those metro regions as a whole. This seems to indicate that families with children are much more prevalent in transit zones in regions where the transit system offers a more viable alternative to the car.

	One Person Households		Families of Three or More People*	
Metropolitan Area	Metro	Transit	Metro	Transit
Small	27%	51%	40%	19%
Medium	26%	38%	41%	31%
Large	24%	38%	45%	34%
Extensive	27%	34%	42%	36%

* Families are households of related individuals.

Table 2: *Selected Household Types by System Type*

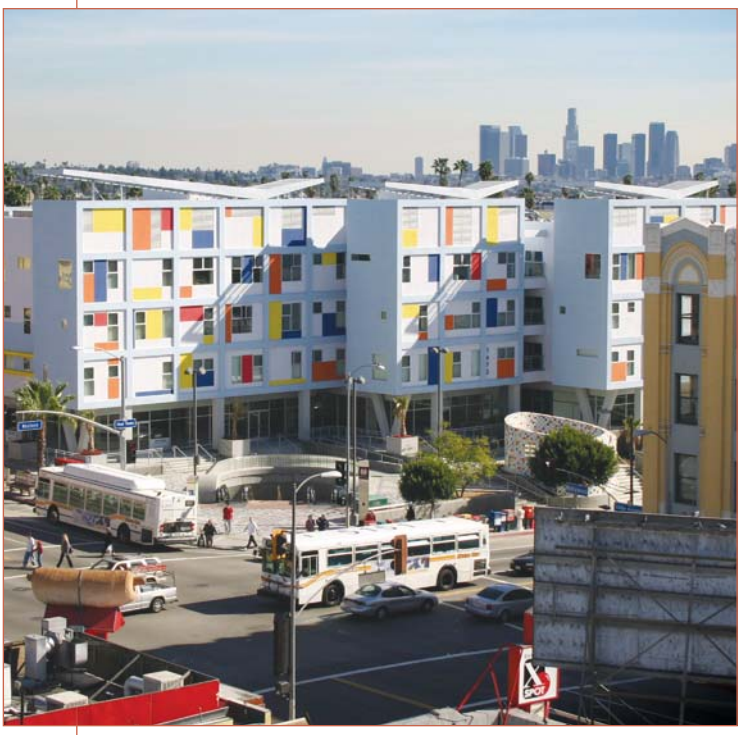
Householder Age In Transit Zones Similar To Region

The age of residents of transit zones is relatively similar to the age in the metro regions as a whole. As with some of the other demographic variables, the difference is greatest in the regions with small systems, and most similar in regions with large or extensive systems. Not surprisingly, the biggest difference is for those under the age of 17; clearly there are fewer children living in transit zones. In contrast, there tend to be more people aged 18-24 in transit zones than in the regions as a whole. The difference,

	Age 0-17		Age 18-24		Age 25-64		Age 65+	
Metro Area Type	Metro Region	Transit Zone	Metro Region	Transit Zone	Metro Region	Transit Zone	Metro Region	Transit Zone
Small	28%	17%	9%	16%	51%	55%	11%	12%
Medium	28%	22%	9%	13%	52%	53%	11%	12%
Large	29%	24%	9%	12%	51%	54%	10%	9%
Extensive	27%	23%	9%	11%	52%	54%	12%	11%

Table 3: *Age Breakdown of Current Households By System Type*

Photo by Art Cueto



Afforddable housing at a Metro stop in Hollywood, CA; transit helps make housing affordable in tight housing markets.

again, is not that much, and it is greatest in regions with small systems. As the median age increases the percentage living in transit zones becomes more similar to the percentage living in the region as a whole.

Incomes Of Transit Zone Residents Are Similar In All Regions

Median incomes of households in transit zones tend to be lower than those of households in the larger metro region. There are three regions where transit zone median incomes are slightly higher than the regional median income – Houston, Tampa, and Pittsburgh – and another ten regions where the median incomes are only 10 to 15 percent lower than the regional median – including New York, Boston and Chicago. However, there are some regions where incomes are dramatically lower in the transit zones, including Los Angeles, Seattle and Baltimore.

Virtually every metro region has a significantly higher proportion of households with incomes of less than $10,000 living in transit zones. But for households with incomes between $10,000 and $60,000, the proportion of households living in transit zones is very similar to the proportion of households with these incomes living in the region as a whole. Going up the income scale, there are fewer households with incomes ranging from $60,000 to $100,000 in transit zones. But there is less of a disparity between the number of residents with incomes in the $100,000 to $200,000 range, and most regions have almost the same proportion of households with incomes of more than $200,000 in transit zones as in the region as a whole. Thus, while incomes in transit zones are clearly skewed toward the lower end of the distribution, transit zones are by no means enclaves of only low-income households. Indeed, as transit systems get larger, there are significantly fewer very-low-income households and more upper-income households.

Home Ownership Rates Are Lower In Transit Zones

As one would expect given the higher proportion of low-income households in transit zones and the higher density housing stock in urban areas, there are also lower rates of home ownership in transit zones than in the region as a whole. The average home ownership rate across all transit zones in all metro regions was only 31 percent, compared to 66 percent for the metro regions overall. However, there is considerable variation in home ownership rates depending on the size of the transit system. Those regions with small systems had lower than average home ownership rates in transit zones, and higher than average home ownership rates overall. Metro regions with medium-sized transit systems had higher than average home ownership rates in transit zones, and slightly higher home ownership rates in the regions as a whole. In the regions with large transit systems and in those with extensive systems home ownership rates tended to be below average for the metro regions as a whole, while some of these regions had relatively high rates of home ownership in the transit zones.

It is interesting to note that in regions with very high median home prices, including the San Francisco Bay Area and New York, overall home ownership rates tend to be low. This may indicate that in regions with tight housing markets, transit helps make housing more affordable for residents by reducing household transportation expenditures.

Car Ownership Rates Are Significantly Lower In Transit Zones

Households in transit zones own an average of 0.9 cars, compared to an average of 1.6 cars in the metro regions as a whole. But there is little variation between car ownership rates in the transit zones versus the regions as a whole in those regions with small, medium or large systems. All of these regions average about 1.1 or 1.2 cars per household in transit zones, and 1.7 cars per household in the regions as a whole. Even some of the regions with extensive transit systems fall into this range. However, New York, which has the most extensive transit system in the country by far, has lower car ownership rates both for the region as a whole (1.5 cars per household) and for the transit zones (0.7 cars per household). Renters in the transit zones have even fewer cars per household than homeowners do. Renters in the New York region have an average of just 0.4 cars per household in transit zones. Evidently, the more a region is widely accessible by fixed-guideway transit, the easier it is for residents not to own cars. Evidence from Arlington County, Virginia suggests that lower rates of car ownership near transit may be by choice. According to research by Reconnecting America, car ownership rates near Metro stations in Arlington County are much lower than in the region as a whole, while average household income is higher than the regional average.

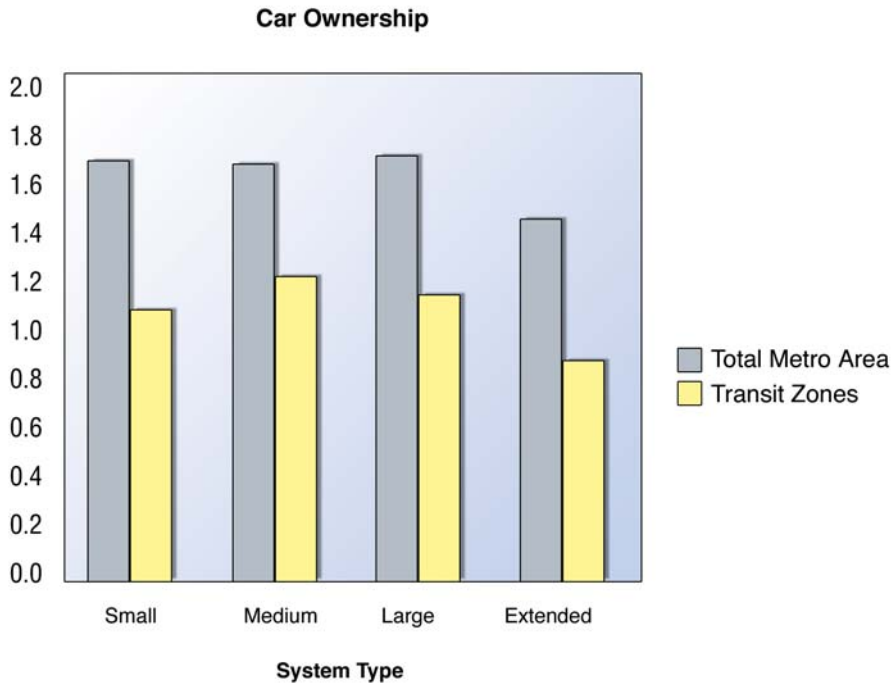


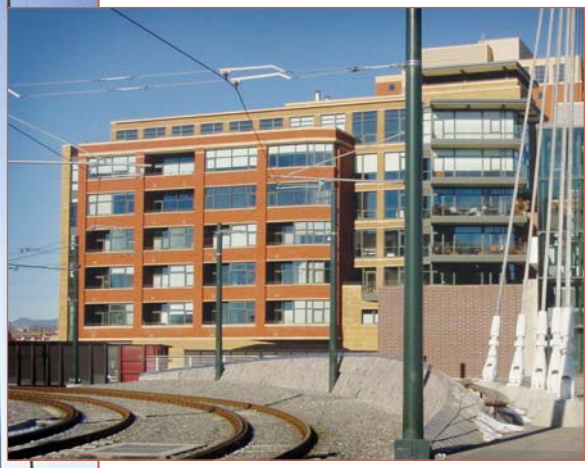
Figure 6: *Car Ownership Rates by Transit System Type*

Significantly Fewer Residents Commute By Car In Transit Zones

Only 54 percent of residents living in transit zones commute by car, compared to 83 percent in the regions as a whole. More residents commute by car in the regions with small and medium-sized systems (72 percent and 77 percent, respectively) than in the large and extensive systems (65 percent and 49 percent, respectively). The regions with the lowest percentage of residents commuting by car are New York (36 percent), Washington D.C. (54 percent), and Seattle (54 percent). The regions with the highest percentage of residents commuting by car are Memphis (86 percent), Dallas (86 percent), Tampa (79 percent) and Sacramento (89 percent) — all systems with newer, smaller fixed-guideway transit networks. As with car ownership, the size of the transit system seems to be a significant determinant of whether or not residents commute by car.

4 THE MARKET DEMAND FOR HOUSING IN TRANSIT ZONES

Photos by East West Partners



Attractive high-density housing is being built in the rail yards behind Union Station and in Denver's popular downtown neighborhoods.

While the demographic and consumer preference trends discussed at the beginning of this report have been documented and in some cases even quantified, there have been few attempts to calculate their impact on the demand for smaller, more compact housing near transit. Because of the capabilities of the national TOD database, the Center for Transit-Oriented Development has been able to build an estimate of the potential national demand for housing in transit zones through 2025 in the 42 regions included in the database.

This study finds that potential demand is likely to be very significant. Our market assessment shows that at least a quarter of all households that will be looking for housing in the next 20 years – 14.6 million households — will be looking to rent or to buy housing within a half mile of fixed-guideway transit stops. This is a staggering figure, since according to New Urban News, only a small portion of all new housing is being built in these locations today. Since there are currently about 6 million households living within a half mile of transit stations, this study suggests there will be potential to more than double the amount of housing in transit zones by 2025. If this market is captured, transit-oriented development could accommodate a significant portion of regional growth.

The national estimate is based on household demand projections for each region that have been segmented by household type and by age of the head of household – two of the key variables affecting demand for housing near transit. Because it is an aggregate of regional calculations it preserves the

effect of different demographic trends in different metropolitan areas. The potential demand estimate takes into account, explicitly or implicitly, a number of factors that could drive demand for transit-based housing: overall population growth, growth in the number of household types that will show a greater propensity for living near transit (such as "empty nesters"), the current size of a transit system and the current number of stations, as well as any expansions that might be funded by the FTA.

The result is an estimate of potential demand for housing near transit in 2025. Because the study considers only the half-mile radius around transit stations, a readily definable area but not the total area that can accommodate transit-oriented development, this is a relatively conservative estimate of potential demand for housing in TOD in 2025. Zupan and Pushkarev have shown that people will ride transit from beyond the half mile if they have good feeder bus service or bike access. Development around these access modes could also be considered transit-oriented development. Inclusion of areas beyond the half mile would offer a more complete assessment of the demand for housing near transit, but is not within the scope of this study.

Note that the results should be interpreted as the "potential demand" by households that are likely to prefer relatively compact housing in a transit zone if such housing exists with the characteristics they consider important, and if the price makes it both affordable and competitive with other housing options. Whether this potential is realized will depend on appropriate public policies, such as higher-density zoning and reduced parking requirements, continued investments in transit, and the dynamics of the regional housing market.

This demand is likely to be more modest in the near term, and accelerate as transit comes on line in growing regions around the country, allowing some time for regions to prepare for the demand by altering zoning and eliminating barriers that prevent developers from meeting the market demand and that provide investors with the degree of certainty they need. Figure 7 depicts this gradual growth in demand.

For a complete discussion of how potential demand was calculated refer to the methodology section included in the appendices. The remainder of this section provides more detail about where demand will occur, and who will generate it.

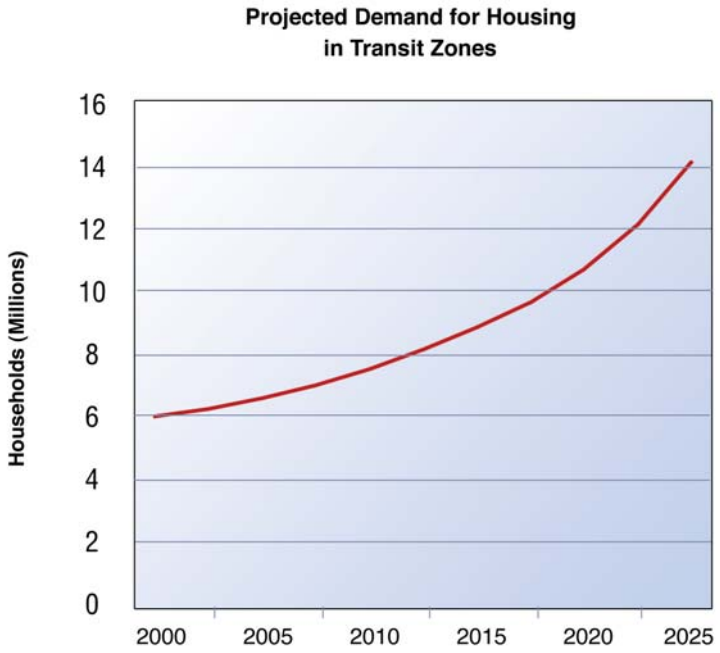


Figure 7: *Projected Demand for Housing in Transit Zones*

Ten Metropolitan Areas Generate The Most Demand

The ten metropolitan regions that show the potential to generate the most significant demand for housing in transit zones include the five regions that currently have extensive systems (New York, Boston, Philadelphia, Chicago, San Francisco), the three regions with large and growing systems (Los Angeles, Washington D.C. and Portland), and two of the metro regions that have medium-sized but growing systems (Dallas and Miami). Table 4 shows the potential demand in each of these regions.

Eighty percent of the households currently living in transit zones live in the five metropolitan regions with extensive systems. These five regions are expected to account for nearly 62 percent of the total potential demand for housing in transit zones in 2025. Los Angeles emerges as second only to New York in terms of potential demand. This is a function of the sheer size of the L.A. metro region, as well as its demographic and household characteristics.

Table 4:
Top Ten Metro Areas By Potential Demand for TOD Housing

	Total Regional Households			Transit Zone Households		
Metropolitan Area	2000	2025	% Change (2000-2025)	2000	2025 (Potential Demand)	% Change (2000-2025)
New York	7,579,408	8,735,318	15%	2,951,779	4,934,450	67%
Los Angeles	5,347,107	7,185,742	34%	332,919	1,751,841	426%
Chicago	3,361,804	3,968,737	18%	816,351	1,447,012	77%
San Francisco Bay Area	2,470,199	3,601,521	46%	429,145	985,441	130%
Boston	2,378,587	3,135,789	32%	417,393	839,500	101%
Philadelphia	2,424,635	2,789,000	15%	496,141	820,908	65%
Washington, D.C.	2,073,074	2,642,535	28%	252,227	650,417	158%
Portland, OR	996,928	1,101,720	11%	87,465	269,074	208%
Dallas	1,906,764	2,965,771	56%	57,017	264,532	364%
Miami	1,905,394	2,786,714	46%	63,917	262,552	311%

Note: Current Households in Transit Zones includes households in half-mile radius around both existing and planned future stations.

Regions With Expanding Systems Show Highest Rates Of Growth In Potential Demand for TOD

All of the regions that are expanding their transit systems have the potential for high rates of growth in demand. Even some metro areas with small but expanding systems – such as Denver, Salt Lake City and Seattle – will see particularly high growth in potential demand due to high rates of population growth. Table 5 shows the potential demand for housing in transit zones for each type of metro area compared to the number of households currently living there. The table also shows the increase in potential demand, the contribution of each metro area type to the growth in potential demand, and the share of total

Table 5:
Growth in Potential Demand For Each Type of Metro Area

Metro Area Classification	Households in Transit Zones 2000	Potential TOD Households 2025	Potential New TOD Households 2025	Potential Increase in Transit Zone Housing	% of Total Potential Demand for TOD
Small Static	103,586	148,772	45,186	43.6%	1.0%
Small Expanding	178,469	642,768	464,299	260.2%	4.4%
Medium	478,113	1,352,683	874,570	182.9%	9.3%
Large	672,611	2,671,332	1,998,721	297.2%	18.3%
Extensive	5,110,809	9,027,311	3,916,502	76.6%	61.8%
New Starts	202,867	769,467	566,600	279.3%	5.3%
Total	6,746,454	14,612,333	7,865,879	116.6%	100.0%

* Current Households in Transit Zones includes households in half-mile radius around both existing and planned future stations.

potential demand by each metro area type.

The potential for growth in transit zone population is 250 to 300 percent in small-expanding, large, and New Start areas — far higher than the 117% figure for all metro areas combined. This is due to the same basic factors cited above: household growth and the emergence of transit as a viable mode of transportation and armature for regional growth. Las Vegas, Phoenix, Raleigh-Durham, and Dallas, for example, are all projected to see household growth of more than 50 percent by 2025, and all are building and expanding their transit systems. Many other metro areas with small-expanding, large, and New Start systems will also see household growth of 30 percent or more.

The potential for roughly 464,000 new units in metro areas with small-expanding transit systems may seem modest compared with the nearly 4 million potential new units in regions with extensive transit systems. However, the potential growth is significant in both percentage and absolute terms. Metro areas that currently have medium and large transit systems also have the potential to see very large growth in their housing stock in transit zones, in both percentage and absolute terms. Together, these two types of regions represent more than one-third of the total growth in potential demand and will represent up to 30 percent of the total potential demand in 2025. Their share of actual demand and construction may be even higher given their high growth rates and lower densities compared to regions with extensive transit systems.

Photo by Dallas Area Rapid Transit

Potential demand for TOD is high in regions with small but expanding transit systems; in Dallas' West End neighborhood, for example.

Metro Areas With Emerging TOD Markets

Table 6 indicates the metro areas that are likely to emerge as significant new markets for housing in transit zones. Table 6 also shows that in these fast-growing metro areas, most of which lie in the Sun Belt, existing and future transit zones have the potential to accommodate anywhere from 15 percent to nearly 25 percent of the household growth projected between now and 2025. Though the change in these regions is small in absolute terms, given their size, the amount of new TOD housing has the potential to significantly shape development patterns and increase transit usage.

Metro Area	Projected Household Growth, 2000-2025	Potential Demand in 2025	Potential Increment in Transit Zone Housing	Potential Transit Zone Growth as % of Total Household Growth
Atlanta	50.4%	204,161	153,317	20.2%
Houston	46.3%	151,644	139,413	20.6%
Phoenix	72.0%	149,363	120,247	14.0%
Baltimore	59.6%	178,369	109,345	23.0%
Tampa Bay Area	41.3%	109,786	100,026	24.0%
Minneapolis-St. Paul	38.5%	113,928	88,327	20.2%
San Diego	46.3%	174,007	77,848	16.9%
Las Vegas	88.2%	81,783	75,870	14.6%
Charlotte	54.3%	64,743	54,933	17.6%
Sacramento	44.7%	88,074	51,985	17.5%

Note: Current Households in Transit Zones includes households in half-mile radius around both existing and planned future stations.

Table 6: *Emerging TOD Regions*

Singles And Couples Without Children Will Generate Majority Of Potential Demand for TOD

Nearly two-thirds of the total demand for housing near transit will be generated by single householders and couples without children, a disproportionate share given the size of these groups relative to the size of the U.S. population as a whole. This potential demand is due both to the increase in the number of these households and to their greater preference for this kind of housing. Households with children will account for only about 20 percent of the demand for housing in transit zones. Table 7 shows the projected total number of each type of household in 2025 in all 42 metro areas in the study, and the number of those households that are likely to want to live near transit. It also shows the percentage that each household type will comprise of total households in 2025, and the percentage of households likely to show a preference for TOD housing.

Table 7:
Household Type Breakdown of All Projected Households and Potential TOD Residents

	Total Households In 2025		Potential TOD Demand in 2025	
Household Type	# of Households	Household Type as % of Total	# of Households	Household Type as % of Total
Singles and Couples, No Children	37,997,673	55.5%	9,366,172	64.1%
Other Households without Children	8,631,005	12.6%	2,202,480	15.1%
Married Couple with Children	14,944,052	21.8%	1,709,108	11.7%
Single Parents, Other Households with Children	6,911,596	10.1%	1,334,573	9.1%
TOTAL	68,484,325	100.0%	14,612,333	100.0%

Households Headed By Indviduals Aged 65 And Over Will Be Disproportionately Represented Among Potential TOD Residents

Table 8 shows the age breakdown of projected households and of households likely to prefer TOD. Table 9 shows the actual numbers in each region. The largest number of potential TOD households is in the 35-64 age group, but because these households are less likely to have a preference for TOD, they represent a smaller proportion of potential TOD households than they represent of total households: 42 percent compared to 50 percent. Households headed by individuals aged 15-34, in contrast, are represented at roughly the same level as their share of the overall population of households, while households headed by individuals aged 65 and over are represented at a higher level, accounting for roughly 35 percent of the likely candidates for housing in transit zones compared to 28 percent of the total number of households.

Table 8:
Age Breakdown of All Projected Households and Potential TOD Residents

	Total Households In 2025		Potential Demand in 2025		
Age Group	# of Households	Age Group as % of Total	# of Households	% of Total Households With TOD Preference	Age Group as % of Total
15-34	15,098,616	22.0%	3,392,642	22.5%	23.2%
35-64	34,549,718	50.4%	6,145,013	17.8%	42.1%
65+	18,835,991	27.5%	5,074,678	26.9%	34.7%
TOTAL	68,484,325	100.0%	14,612,333	21.3%	100.0%

Metro Area	Total Households in Metro Area, 2000	Households in Transit Zone, 2000	Total Projected Households, 2025	Potential Households in Transit Zones, 2025
Atlanta	1,504,871	50,844	2,263,875	204,161
Baltimore	798,844	69,024	1,275,278	178,369
Boston	2,378,587	417,393	3,135,789	839,500
Buffalo	468,719	19,628	474,698	32,467
Charlotte	575,293	9,810	887,721	64,743
Chicago	3,361,804	816,351	3,968,737	1,447,012
Cleveland	891,305	60,706	930,813	89,274
Columbus	610,757	25,522	839,126	61,301
Dallas	1,906,764	57,017	2,965,771	264,532
Denver	825,022	45,338	1,201,670	88,187
Fort Collins	97,164	7,21	50,476	11,208
Galveston	94,441	7,025	138,170	11,514
Harrisburg	248,931	13,136	315,205	23,882
Hartford	457,407	17,623	495,908	36,946
Houston	1,460,850	12,231	2,136,833	151,644
Kansas City	694,468	20,588	910,441	66,015
Lancaster	172,560	4,141	220,605	16,659
Las Vegas	588,371	5,913	,107,127	81,783
Los Angeles	5,347,107	332,919	7,185,742	1,751,841
Louisville	412,050	11,751	503,345	36,182
Memphis	424,202	7,961	551,162	50,177
Miami	1,905,394	63,917	2,786,714	262,552
Minneapolis-St. Paul	1,136,615	25,601	1,573,841	113,928
Nashville	479,569	2,782	718,243	52,502
New Orleans	505,579	53,535	573,067	59,640
New York	7,579,408	2,951,779	8,735,318	4,934,450
Norfolk	577,659	7,723	744,287	54,174
Philadelphia	2,424,635	496,141	2,789,000	820,908
Phoenix	1,194,250	29,116	2,054,679	149,363
Pittsburgh	966,500	44,357	975,669	91,714
Portland, OR	996,928	87,465	1,101,720	269,074
Raleigh-Durham	461,097	10,104	736,646	53,253
Reading, PA	141,570	11,845	163,81	2,273
Sacramento	665,601	36,089	962,918	88,074
Salt Lake City	432,040	24,732	646,030	53,654
San Diego	994,677	96,159	1,454,824	174,007
San Francisco Bay Area	2,470,199	429,145	3,601,521	985,441
Seattle	1,368,730	86,408	1,681,732	124,576
St. Louis	1,012,419	17,236	1,163,760	34,132
Syracuse	282,601	6,161	293,312	1,019
Tampa Bay Area	1,009,316	9,760	1,426,207	109,786
Washington, D.C.	2,073,074	252,227	2,642,535	650,417

Table 9:
Demand For TOD Housing in All Metro Regions with Fixed-Guideway Transit

5 CASE STUDIES

Photo by Dennis Leach

Market Common's 400 residential units plus office over retail in Arlington, VA, fetched top dollar when it sold in 2003.

Seven case study regions were selected to demonstrate the TOD residential demand methodology and to investigate regional similarities and differences. The metropolitan areas chosen for the case studies vary by size and metropolitan structure, have different growth rates, and are served by very different transit systems. Not surprisingly, the analysis suggests significant differences in the way those systems serve their respective populations, which in turn, could impact demand for residential TOD.

The Case Study Regions Show Very Different Patterns Of Transit Use

Table 10 shows the number of stations and basic population statistics for the seven case study regions. Table 11 shows the average household size and population density of transit zones in the case study regions, and the number of stations per 100,000 residents. The density of service ranges widely. At one end of the spectrum is Chicago, which is well-served by fixed-guideway transit. With five stations per 100,000 residents, Chicago has the third highest "station density" in the country, after Philadelphia and New York. At the other end of the spectrum is the Los Angeles region, with only 0.8 stations per 100,000 people, one of the lowest ratios. The other metro areas fall at various points in between.

Not surprisingly, the percentage of the total population that lives within a half mile of transit stations also varies significantly, ranging from a high of 22 percent in Chicago — the second highest in the nation, after New York — to a low of 1 percent in Memphis. Washington D.C., with 3.1 stations per 100,000 people and 10 percent of the metro population living in transit zones, ranks quite high in terms of population living in transit zones, even when it is compared to the five regions that have extensive transit systems (Washington D.C.'s system is classified as large).

When one looks at the average number of residents per transit zone, Los Angeles ranks highest in the country, despite the fact that the transit system provides relatively poor coverage (as measured by stations per 100,000 residents). After Los Angeles, Chicago's transit zones are the most densely populated, followed by Washington D.C. and Cleveland. It would appear that even though the system in Los Angeles is small relative to the size of the overall region, its transit zones are densely inhabited, and therefore transit has the potential to serve a significant number of people.

Table 10:
Number of Stations, Population and Households in Case Studies, 2000

		Population, 2000			Households, 2000		
Metro Area	Metro Area Type	Metro Area	Transit Zones	% in TZs	Metro Area	Transit Zones	% in TZs
Charlotte	New Start	1,499,293	21,813	0%	575,293	9,810	0%
Chicago	Extensive	9,311,088	2,088,487	22%	3,361,804	812,477	24%
Cleveland	Medium	2,247,700	129,388	6%	891,305	53,383	6%
Denver	Small Expanding	2,108,595	37,990	2%	825,022	17,450	2%
Los Angeles	Large	16,373,645	813,098	5%	5,347,107	263,470	5%
Memphis	Small Expanding	1,135,614	16,810	1%	424,202	7,961	2%
Washington, D.C.	Large	5,491,942	545,772	10%	2,073,074	246,730	12%

Note: Current Households in Transit Zones includes ONLY households in half-mile radius around existing stations.

Metro Area	Transit Coverage: Stations/100,000 Population	Transit Coverage: Stations/100,000 Households	Transit Zone Density: Average Population	Transit Zone Density: Average HH/Station
Charlotte	0.0	0.0	n/a	n/a
Chicago	4.5	12.4	4,996	1,944
Cleveland	2.2	5.6	2,588	1,068
Denver	1.5	3.8	1,225	563
Los Angeles	0.8	2.3	6,557	2,125
Memphis	1.1	3.1	1,293	612
Washington, D.C.	3.1	8.2	3,229	1,460

Note: Current Households in Transit Zones includes ONLY households in half-mile radius around existing stations.

Table 11: *Transit Coverage, Household Size and Density in Case Studies*

However, while these figures are good indicators of service density, they do not tell the whole story about the performance of the transit system and its ability to leverage demand for residential TOD. The more extensive the system, the more origin-and-destination combinations it services. In Chicago it is possible to travel by fixed rail transit from nearly any part of the region to any other part, while in Los Angeles the fixed rail system is more limited. Therefore, it should not be surprising that a smaller percentage of people use fixed rail transit in Los Angeles, even if they live close to a station, and in spite of the fact that population and household density in the transit zones is higher than in Chicago.

In fact, the 2000 Census journey-to-work data in Table 12 show precisely this: 16 percent of residents of transit zones in Los Angeles ride all modes of transit to work, compared to 25 percent in Chicago. But, in Los Angeles, 14 percent of total commuters are using buses, thus the rail system accounts for only a negligible share of the transit trips. In Chicago, on the other hand, bus only accounts for 11 percent of total commute trips. Corridors along bus routes also could — and in some instances, do — accommodate higher-density transit-oriented housing in the same way that transit zones do, but there are fewer examples to point to. As discussed earlier, this is something that can and should be encouraged. This is even more pronounced in the Washington D.C. region where 30 percent of commuters use transit overall, but bus only accounts for 8 percent of commute trips, indicating that the rail system is capturing a significant share of the transit trips. In the other four case study regions, bus captures virtually all of the transit commute trips.

Commute Mode (Percent of Employed Population)

Metropolitan Area	Public Transit: Transit Zones	Public Transit: Metro Area	Bus: Transit Zones	Walk: Transit Zones	Walk: Metro Area
Chicago	25%	11%	11%	6%	3%
Washington, D.C.	30%	9%	8%	10%	3%
Memphis	6%	2%	6%	5%	1%
Cleveland	13%	4%	10%	6%	2%
Denver	12%	5%	11%	3%	2%
Charlotte	4%	1%	4%	1%	1%
Los Angeles	16%	5%	14%	5%	3%

Note: Data for Charlotte are for areas within a half-mile of planned transit stations.

Table 12: *Journey-to-Work Mode in Case Studies*

Washington D.C. also stands out because a relatively high percentage of transit zone residents walk to work, even though the percentage of residents who walk to work in the region as a whole is not notable. This suggests that good transit-oriented development not only offers residents the option of using transit, but also non-motorized modes of transportation. This benefit may become even more apparent when one looks at non-commute trips. The high percentage of transit zone residents who walk to work indicates that transit zones in Washington D.C. support walking, and that residents are therefore likely to choose to walk for other trips, but the census provides no data to verify this hypothesis.

Although the percentage of transit zone residents who walk to work in Denver surpasses the percentage in Washington D.C., this may be largely a function of the fact that the rail system there mainly serves the downtown area, which skews the numbers since downtown is the most dense and walkable part of the region. Because downtown Denver is also the place where most of the jobs are located, transit zone residents by definition live close to their employment and can probably choose to walk to work.

This highlights another issue: the relationship of the transit system to the structure of the metro area. Denver's system appears to perform quite well in terms of service to residents of transit zones, largely because it is composed mainly of stations that are located in dense, central residential neighborhoods and the primary employment center. Many larger transit systems also serve outlying areas with lower densities, where a smaller percentage of residents commute to downtown employment centers that are well-served by transit.

Table 13 shows some current and projected statistics for the seven case study regions. The data show tremendous potential demand in Los Angeles for housing near fixed-guideway transit. However, given the existing high densities in transit zones, the ability to actualize this potential demand by building more housing may require first expanding the transit system and building more stations. Chicago and Washington D.C. also show great potential.

Table 13:
Potential to Increase TOD in Case Study Regions

	2000			2025		
Metropolitan Region	Current Total Households	Current Households in Transit Zones	Existing Stations	Total Projected House-holds, 2025	Potential House-holds in Transit Zones	Future Stations
Denver	825,682	17,450	31	1,201,670	88,187	26
Chicago	3,362,436	812,477	418	3,968,737	1,447,012	9
Washington, D.C.	2,074,456	246,370	169	2,642,535	650,417	9
Los Angeles	5,351,556	263,470	124	7,185,742	1,751,841	40
Cleveland	891,566	53,383	50	930,813	89,274	33
Charlotte	575,510	9,810	0	887,721	64,743	18
Memphis	424,498	7,961	13	551,162	50,177	9

The potential in the remainder of the case study regions is more modest, but in some cases it is still significant. Denver could potentially quintuple the number of households living in transit zones. This goal, or something slightly less ambitious, seems attainable given Denver's rapid projected household growth (roughly 375,000 households, or a 46 percent increase by 2025), the expansion of its transit system, the underutilized capacity around transit stations (as indicated by the relatively low population densities), and the current interest in building TOD. In fact, a goal of accommodating roughly 70,737 additional households, or 19 percent of the region's projected growth, in transit zones seems modest in light of these findings.

Charlotte, Memphis and Cleveland will also see potential gains in the number of TOD households. Charlotte, with projected household growth of nearly 40 percent and the lowest transit zone density of any of the case study cities, seems much better positioned for TOD than Cleveland, with projected household growth of 3 percent, and higher transit zone density.

What these case studies clearly illustrate is that without an interconnected transit system relative to the size of the population, regions are much less likely to capture a significant proportion of their potential residential TOD demand.

6 ASSESSING CAPACITY TO ACCOMMODATE DEMAND

Photo by Evelyn Johnson for McLarand Vasquez Emsiek & Partners

Fruitvale in Oakland: A dozen transit villages are coming out of the ground at BART stations.

This TOD market assessment indicates that 14.6 million households could want to live within a half mile of transit by 2025, an increase of 8.5 million households over the existing 6.1 million households who lived in transit zones in 2000. Although it is difficult to obtain data on the amount of land available for residential development in station areas, particularly at the national scale of this study, the Center for Transit-Oriented Development's survey indicates that transit zones still have considerable capacity.

To understand the order-of-magnitude potential for TOD on the ground and to better pinpoint where these opportunities exist, two assessments of capacity were undertaken. First, existing TOD projects deemed to be exemplary were analyzed in order to create a TOD typology that would categorize stations according to the context of the neighborhoods in which they are located, and to suggest minimum densities, a mix of land uses and amenities, and a level of transit service including a degree of regional connectivity and service frequency. This typology, which was introduced in *The New Transit Town: Best Practices for Transit-Oriented Development* and is shown in Table 14, is put forward as a starting point for defining the common types of TOD and distinguishing them from each other in terms of their role and function.

Secondly, the transit zones in the database were grouped according to the transit system type and service frequency, the distance of the station from the Central Business District, the average residential density, the average block size, and the average year the housing was built. The inherent distinctions between these different types of transit zones made it possible to create a transit zone typology with six categories — urban downtown, urban neighborhood, suburban town center, suburban neighborhood, neighborhood transit zone, and commuter town center – that was roughly analogous to the typology of exemplary projects. The comparison of existing transit zone densities to project-based densities provides a basis for comparing current conditions with optimum conditions, as depicted in Table 15.

This comparison shows that Urban Downtowns in major cities are doing a fairly good job of accommodating residential densities that are sufficient to support high quality transit. This has been documented in numerous other studies of the recent revival of downtowns across the country. But virtually all other areas have room for additional housing complemented by shops and services within walking distance. Downtowns in small and mid-sized cities are close to achieving minimum density targets, but there is probably room to add housing on underutilized parcels or convert commercial buildings to lofts or other residential units. Urban Neighborhoods surrounding downtowns are also showing signs of infill as residents realize the convenience of living close to work.

But neither Suburban Town Centers, which are major employment and housing nodes and which offer significant potential for development, nor Suburban Neighborhoods, have matured to the point that the majority provide sufficient residential densities to support high-quality transit service. Overall, both offer significant opportunities for accommodating future demand for transit-oriented housing and high-quality transit service.

Table 14: *Typology of Transit-Oriented Development*

TOD Type	Land Use Mix	Minimum Housing Density	Regional Connectivity	Frequencies
Urban Downtown	Office Center Urban Entertainment Multifamily Housing Retail	>60 units/acre	High Hub of Radial System	<10 minutes
Urban Neighborhood	Residential Retail Class B Commercial	>20 units/acre	Medium Access to Downtown Subregional Circulation	10 minutes peak 20 minutes off-peak
Suburban Center	Primary Office Center Urban Entertainment Multifamily Housing Retail	>50 units/acre	High Access to Downtown Subregional Hub	10 minutes peak 10-15 minutes off-peak
Suburban Neighborhood	Residential Neighborhood Retail Local Office	>12 units/acre	Medium Access to Suburban Center and Access to Downtown	20 minutes peak 30 minutes off-peak
Commuter Town Center	Retail Center Residential	>12 units/acre	Low Access to Downtown	Peak Service Demand Responsive

The study results make it clear that, overall, potential demand for higher-density residential development in transit zones will outstrip the supply of this housing, which suggests that this product type should be viable in all of the metropolitan areas with transit systems. By 2025 there will be 3,971 transit zones around rail lines and stations – including the 3,341 in existence now and the 630 potential stations that were in the funding pipeline in 2003 and likely to be built by 2025. If all the projected demand is to be accommodated within these 3,971 transit zones, it would necessitate the construction of approximately 2,100 new units around every station. Clearly, since many station areas are already fully developed and others have substantial constraints to further intensification, achieving this goal will be challenging, but not impossible. The Suburban Town Center in Addison, Texas will include more than 4,000 units when it is fully built out, while more than 500 units have been constructed in a suburban neighborhood at the Ohlone Chynoweth station in Santa Clara County, California.

Table 15: *Desirable Densities Versus Current Densities*

TOD Typology	Project-Based Density* (du/ac)	Current Density* (du/ac)	Difference* (du/ac)
Urban Downtown (major cities)	60	69.8	
Urban Downtown (mid-size cities)	60	31.5	28.5
Urban Neighborhood	20	8.5	11.5
Suburban Town Center	50	3.8	46.2
Suburban Neighborhood	12	0.7	11.3
Commuter Town Center	12	3.0	9.0

*Average gross density of residential acreage

7 CONCLUSION

Photo by Sky High Studios/Laurel, MD

The result of 30 years of channeling growth around transit in Arlington, VA; half of residents walk and take transit.

The study suggests that demand for higher-density housing in transit zones could far outstrip the supply of this kind of housing. Most of this demand will occur in the five metro regions that have mature and extensive transit systems, and in Los Angeles, which has a large system as defined by the number of fixed-guideway stations. However, it is not large when considered relative to the vast size of the region as a whole. Nevertheless, all of the regions that are expanding their transit systems have the potential for high rates of growth in housing demand, especially regions like Denver, Salt Lake City and Seattle, which have expanding systems and high rates of population growth. Indeed, many of these regions with newer systems could accommodate from a quarter to a third of all household growth in transit zones.

Whether this potential demand is actually realized, however, has much to do with whether the market is able to deliver an attractive higher-density housing product near stations. This housing will have to have the characteristics that consumers consider important, and it will have to be priced so that it is both affordable and competitive with other housing options in the region. Whether the market is able to deliver more of this kind of product also depends on whether appropriate public policies, such as higher-density zoning and reduced parking regulations, are put in place and whether the right infrastructure investments are made, including continued improvements to transit systems and "placemaking" elements, such as plazas and streetscape improvements.

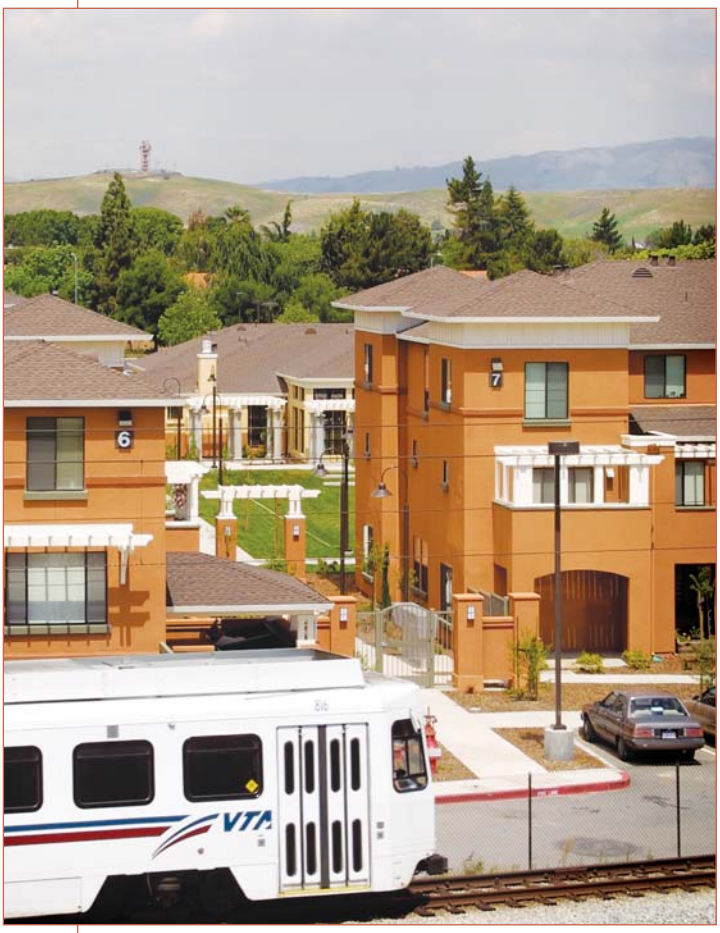


Photo by McLarand Vasquez Emsiek & Partners

Ohlone-Chynoweth station pioneered both multifamily and affordable housing in a single-family neighborhood in San Jose, CA.

This study focused on determining who lives near transit now, who is likely to want to live near transit in the future, where the most demand is likely to occur, and whether there is unused capacity in these transit zones. Further analysis and research is needed to better understand the interaction between metropolitan structure and the layout of the transit system, the importance of density relative to other features of the transit zones and the transit systems, the significance of household size, and the range of factors that affect the performance of transit systems in order to fine tune our understanding of how to accommodate residential demand.

While the capabilities of the national TOD database and the results of this study suggest many avenues for further inquiry, the study and especially the case studies support four major conclusions:

➤ First, any assessment of the potential of transit-oriented housing nationally should also consider regional context. Transit-oriented development is not a national panacea; it is a specific tool that requires different policies in different contexts. In some regions more density may be needed around transit, whereas in other regions more transit may be required to better serve existing high densities. In still other regions both density and transit may be sufficient, but there may not be the pedestrian connectivity that makes riding transit an easy and appealing alternative, or the transit system may not provide the regional connectivity that makes it a viable transportation option for residents.

➤ Second, not every region will experience the same magnitude of demand for higher-density housing near transit, but where the conditions are right, transit-oriented development could accommodate a significant share of regional growth, even in those regions that only have small transit systems.

➤ Third, building higher-density transit-oriented development projects that are walkable and that contain a good mix of synergistic uses will have benefits beyond increasing transit ridership. This is demonstrated by regions such as Washington D.C. and Denver, where a high percentage of transit zone residents also walk to work.

➤ Finally and most importantly, specific policies such as revising zoning and parking regulations will have to be put in place to ensure that the market can deliver a product that will help realize the potential demand.

Changing demographics and consumer preferences are opening a window of opportunity that could allow for a transformation of the American dream of a single-family detached home in the suburbs into something more sustainable and affordable – like a row house or courtyard housing or a condo in a high-rise building in a walkable neighborhood next to transit. As both home prices and rents increase and driving becomes more difficult and time-consuming, housing near transit at the very least offers the possibility of reduced transportation expenses, as shown by Dunphy, and time to read the paper on the train while commuting in the morning. Realizing the growing demand in the marketplace for lively, walkable, transit-oriented housing development will enable the national investment in transit to capture a greater return on investment.

APPENDICES

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METHODOLOGY

GIS Database

Using data from the Federal Transit Administration (FTA) and other sources, we have developed a database of the nation's heavy rail, light rail, bus rapid transit, and commuter rail systems and the 3,341 stations served by those systems, as well as selected Amtrak stations, in 27 metropolitan regions that have and are expanding fixed-route transit systems, as well as 15 metro regions that are developing fixed-route systems. This information is integrated in Geographic Information System (GIS) format with data from the U.S. Census, allowing users to view transit stations and their surroundings in spatial format. The result is a powerful database that allows us to see who lives near transit (for example, what age groups and household types), the travel behavior of station area residents, the number of autos per household, average income, household size, land area in residential use, block structure, and so on.

To develop the current transit station database we utilized the Fixed Guideway Transit Network GIS database maintained by the Bureau of Transportation Statistics (BTS). Where gaps in the BTS data existed we contacted the respective transit agency to acquire the GIS transit file. Creating a GIS database of the 15 new systems involved manually digitizing all of the New Starts stations.

We gathered demographic data within a half mile buffer zone around every transit station in the country. We refer to these as "transit zones." We built into our GIS database U.S. Census Bureau data at both a census-block and block-group level, using the best geographic scale available depending on the census data we were examining. We used GIS to create a half-mile buffer, or transit zone, around every fixed-guideway transit station in the United States. A single half-mile buffer was delineated around each station within a particular metropolitan area to prevent double counting in cases in which two transit stations were within a half mile of each other and their transit zones overlapped. Then each transit zone was associated with a larger metropolitan region. Unique to this analysis and worth noting is the method we employed to estimate the residential density at each station. We utilized population data at a census block level to calculate the acres for those census blocks that had at least one person, the assumption being that these blocks, or at least a portion of them, were in residential use.

The GIS then allowed us to proportionally estimate the demographic characteristics of each of these transit zones according to U.S. Census Bureau data. Using the best available geographic scale of the various datasets, we gathered

information on journey-to-work trends, car ownership, home ownership, income, type of housing, age distribution, and household and family type. In addition we also calculated the distance to the Central Business District (CBD) and the block size (to use as a proxy for walkability) for each transit zone. We believed this data would provide a good indication of the urban form and allowed us to develop a transit zone typology based on the following four specific TOD characteristics: Average Residential Density, Average Block Size in Acres, Average Miles to CBD, and Average Year Housing Units Built.

Metropolitan Region Typology

Metropolitan regions were constructed using all metropolitan statistical areas (MSAs) for regions that are all part of the same commute shed. For example, the New York Metropolitan region is made up of multiple MSAs including New Jersey and Connecticut. Once the individual metropolitan regions were identified, they were then grouped according to the size of their transit systems and whether the systems were being expanded. As a result, six different categories were employed: "small-static-system regions" (e.g. Buffalo) where transit systems are not likely to expand by 2025, "small-expanding-system regions" (e.g. Denver) where transit systems are expanding, "medium-system regions" (e.g. Cleveland, Miami and Dallas), "large-system regions" (e.g. Portland and Washington D.C.), "extensive-system regions" (Boston, Chicago, New York, Philadelphia and the San Francisco Bay Area), and "New Starts regions," where there are no existing transit systems but Federal Transit Administration funding is being sought and systems are scheduled to be built by 2025 (e.g. Raleigh-Durham, Phoenix, Columbus). Systems that will be funded with local dollars only have not been included in this analysis (e.g. Austin, Texas). But to the extent that such systems get built over the next 25 years, these places represent an additional increment of potential demand for residential TOD.

Transit Zone Typology

Our database made it possible to group transit zones on the basis of a number of characteristics, including system type, service frequency, the distance of a station from the central business district, and residential density. After associating the demographic and other data to these different transit zones we moved the database from Geographic Information System (GIS) format to Statistical Package for the Social Sciences (SPSS) format to run the typology analysis using the K-Means Cluster Analysis[1] in order to establish six transit zone categories. The inherent distinctions between the different types of transit zones enabled us to clearly categorize them, thereby providing baselines that can be used to analyze other station areas.

After excluding those stations where there was no one living in the transit zone, we ran the K-Means Cluster analysis on the following characteristics in order to determine the natural groupings for the transit zones:

- miles from the CBD
- residential density
- average block size
- average year the housing stock was built.

In order to perform the K-Means Cluster Analysis we needed to normalize these variables; to do this we calculated the difference from the mean for each characteristic and divided the results by the standard deviation (excluding zones with no residential population). We also ran the cluster assignment on the New Starts stations, normalizing the statistics using the means and standard deviation from the existing station data. The analysis yielded the six distinct station types. The 24 transit zones with no residential density (these were typically airports, tourist destinations or in industrial areas) were eliminated from the cluster analysis so as not to bias the grouping. Table A-1 summarizes the average characteristics for each of the other transit zones.

Transit zone 6 can be thought of as an urban neighborhood bordering the CBD with a mix of condominium and apartment high rises. Transit zone 6 has the highest residential density, the smallest block size and the oldest housing stock of all of the transit zones. The majority of these transit zones are located in Manhattan with only a small number found in other large urban areas (Chicago, San Francisco and Philadelphia). Transit zone 5 is a similar distance from the CBD, with a similar average block size and age of housing stock, but the residential density is less than half that in transit zone 6. Transit stations in this category can be found in larger cities throughout the U.S. Transit zone 4 can be thought of as an urban neighborhood with a high residential density and an average block size that is still walkable though it is larger than in transit zones 5 and 6. The housing stock is only slightly newer, indicating that these neighborhoods are mature. All of these zones are urban.

Transit zone 3 has a much lower density, the housing stock is newer and the block sizes are enormous. The average distance from the CBD of 20 miles indicates these transit zones are probably located in low density suburbs with

Table A-1: Transit Zone Characteristics

Zone	1	2	3	4	5	6
Average Miles to CBD	51	22	20	6	5	4
Average Residential Density	3.0	3.8	0.7	8.5	31.4	69.8
Average Block Size (acres)	17.4	11.5	68.6	7.2	3.9	4.1
Average Year Housing Built	1963	1959	1972	1954	1950	1947

Table A-2: Number of Transit Zones by Type

Zone Type	Number	Percent
Other	24	1%
1	274	8%
2	646	19%
3	84	3%
4	1601	48%
5	583	18%
6	126	4%
Total	3338	100%

large lot sizes that are probably surrounded by commuter park and ride lots and/or shopping centers surrounded by parking. Transit zone 2 is a similar distance from the CBD (22 miles) but has a higher residential density, older housing stock, and smaller block size. These zones are probably located in suburbs with functional downtowns where the transit station has played a central role. Transit zone 1 is, at an average 51 miles, the furthest from the CBD but the residential density is still quite high and the housing stock is well established. These transit zones probably surround commuter rail stations in small rural towns. Table A-2 indicates how many transit zones there are of each type and Table A-3 shows the types of transit serving the transit zones.

Table A-4 shows which types of transit zones are located in which types of regions.

Table A-3: Transit Zone Types

	Transit Zone Type							
Service Type	Other	1	2	3	4	5	6	Total
AMTRAK	0	17	16	0	9	3	0	45
Commuter	9	203	532	61	386	32	0	1,223
Light Rail	2	16	4	5	295	87	11	420
Rail Rapid Transit	13	38	94	18	911	461	115	1,650
Total	24	274	646	84	1,601	583	126	3,338

Table A-4: Which Transit Zones Are Located In Which Regions

	Small		Medium		Large		Extensive		Total
Transit Zone	No.	%	No.	%	No.	%	No.	%	No.
Other	2	1	4	1	11	3	7	0	24
1	5	3	7	2	44	11	218	9	274
2	11	6	39	9	87	22	509	22	646
3	4	2	20	4	25	6	35	2	84
4	161	85	365	82	187	47	888	39	1,601
5	7	4	10	2	48	12	518	23	583
6		0		0		0	126	5	126
Total	190	100	445	100	402	100	2,301	100	3,338

Estimating Potential Residential TOD Demand In Transit Zones

This study estimates the potential future demand for housing in transit zones. It is important to emphasize that this is "potential" demand, since our methodology examines housing preferences — i.e. we attempt to estimate the number of households that would choose this type of housing. Actual housing demand, in contrast, is a function of many factors that have not been taken into account, such as the dynamics of the individual housing market, price, and the aggregate effect of individual decisions.

Household Projections

The first step of the methodology involved creating projections of how many households of each type and each age group (determined by the age of the head of household) will be present in 2025. These projections were then combined with preference assumptions to estimate how many households in each age/type group will likely have a preference for housing in transit zones. The U.S. Census Bureau and the Harvard Joint Center for Housing Studies (under contract with the Census Bureau) provide population and household projections for the nation as a whole. Because these national projections mask significant differences among different metropolitan regions, the research team used other sources to calculate projections for each metropolitan area. The national results reported are, therefore, an aggregate of the metropolitan-level calculations.

Two sources of data were used: Woods and Poole projections of metropolitan population by age group and state-level PUMS (public use microdata set) data on households and population from the 2003 American Community Survey (ACS). The ACS data were used to determine household formation rates for each age group (i.e. how many single-person households, how many married couple with children households, etc.) and these rates were then applied to the population projections to estimate the number of future households by age and type. While the state level data may not be completely accurate in reflecting metro-level demographics, this methodology does capture some of the important differences in regions and states.

Table A-5: Age Breakdown for Household Projections

Age Group
0-19
20-24
25-34
35-44
45-54
55-64
65-74
75+

Table A-6: Household Type Breakdown for Projections

Household Type
Single householder, no others present
Single parent with children under 20, no others present
Householder and spouse/partner, no children
Householder and spouse/partner with children under 20, no others present
Other households without children
Other households with children

The PUMS data include two files: one of housing units and the other of population. Individuals in the population file can be linked to housing units (and to one another) using a serial number shared among all residents of a housing unit. Using the two data files, a complete list was compiled of individuals living in the states containing one or more of the metropolitan areas with existing or future transit systems.

In the PUMS file, one member of each household is labeled the "reference person." This individual was considered to be the head of the household. These data were used to compile a list of households with the types of individuals present in addition to the householder: a spouse or unmarried partner, a child or grandchild under 20, and other individuals (whether related or not). These data were then used to classify households by age of householder and type of household. Householders were grouped together by age on the basis of the Woods and Poole age categories as shown in Table A-5.

These age categories were then collapsed into a smaller number of categories in order to make them compatible with the census categories. However, they were maintained for the household projections in order to preserve as much detail as possible.

The proportions calculated as described above were then applied to the metro area population projections by age group to derive a household breakdown for each metropolitan area in 2025 (and intermediate years). In most cases the proportions applied were those calculated for the state in which the metropolitan area is located; in two cases the figures from several states were combined. For the New York metropolitan area, figures for New York, Connecticut and New Jersey were used, and for Washington D.C., figures for Maryland and Virginia were combined with those from the District of Columbia.

The projections that result from our methodology are consistent with information in the literature about changing household composition, particularly such trends as the growth in older households: across all metro areas, our projections show a 50 percent increase in the number of households in the over 75 age group and a doubling of households in the 65-75 age group. Furthermore, this methodology results in projections that are probably conservative from the standpoint of potential demand for TOD since it does not account for trends in household structure that are leading to a greater preference for housing in more urban settings near transit.

The total number of projected households in each metro area yielded by this methodology differed slightly from the projection of total households provided by Woods and Poole.[2] In order to ensure consistency with the figures from Woods and Poole, which is considered a reliable source of projections, the number of households in each category was deflated or inflated by the ratio of the Woods and Poole figure for total households in 2025 to the figure obtained using our methodology. In most cases the two figures differed by only 2 or 3 percent, and in no case was there a difference of more than 10 percent.

These regional projections were then combined with the preference assumptions to estimate the number of households in each category that would be potential TOD candidates. Two main sources of information were used for determining the "capture rate," or percentage of households in each category that would have such a preference. The first was the growing body of literature on housing preferences, which includes a number of surveys. The second was the demographic database created for this project, which contains detailed information on the current residents of transit zones, including age and household type. The capture rates were based mainly on the characteristics of the population currently living in transit zones. The census data provides the most comprehensive information about who lives near transit, and was considered the best starting point for determining who might choose to do so in the future.

In each metropolitan area, the percentage of the existing total population of each household type/age group living in transit zones was determined from census data, and these figures were averaged across all metro areas for each category (small-static, small-expanding, medium, etc.). A simple average, rather than a weighted average, was used.

These figures were then used to develop capture rates as described in Table A-7. In general capture rates were based

Table A-7: Capture Rate Calculations

Metro Area Type	Capture Rate Calculation
Small-Static-System Region	• For each household type/age category, the current percentage of households was increased by 10 percent. • Rates for all households in the 65+ age category were increased by an additional 10 percent above this level.
Small-Expanding-System Region	• The average existing percentage of each household type/age category was used. • Rates for all households in the 65+ age category were increased by an additional 10 percent.
Medium-System Region	• The average existing percentage of each household type/age category was multiplied by 0.8. • Rates for all households in the 65+ age category were increased by an additional 10 percent.
Large-System Region	• The average existing percentage of each household type/age category was multiplied by 0.8. • Rates for all households in the 65+ age category were increased by an additional 10 percent.
Extensive-System Region	• The average existing percentage of each household type/age category was increased by 15 percent. • Rates for all households in the 65+ age category were increased by an additional 10 percent.
New Starts	• Same as for small expanding systems.

on the average existing percentages for the next metro area category in the typology; because all the systems except the small-static systems are being expanded, it was assumed that each region except the small-static-system metro areas would evolve to become more like the next larger region.

In most cases, the same capture rate for a given household type/age category was applied to all the metropolitan areas in a given category of metro areas (e.g. Salt Lake City and Denver, which are both metropolitan areas with small but expanding transit systems). However, if the current percentage of households in a given household type/age category living in transit zones was higher than the number derived using the methodology, as was true in a small number of cases, the existing percentage was simply increased by 10 percent.

The capture rates were then applied to the total number of projected households in each category. Therefore, the categories used in the projections were matched with the census categories as shown in Table A-8.

The slightly different household categories were reconciled as in Table A-9.

Table A-8: Projections and Census Age Groupings

Projections	Census
0-19 20-24 25-34	15-34
35-44 45-54 55-64	35-64
65-74 75+	65+

Table A-9: Projections and Census Household Categories

Projections	Census
Single householders and couples without children	
Other households without children	"Householder Non-Family Not Alone"
Married couples with children	"Married Couple Family Households"
Single parents and all other households with children	"Other Family Households"

[1] A clustering technique that begins with the assignment of the number of clusters to be found. Points that will represent the centroids of these clusters are then evenly dispersed through the data and moved as if by gravity until they settle into positions in the data clouds and cease to move. This technique is much faster than the hierarchical technique but not as accurate, and is often used when large data sets must be analyzed.

[2] Woods and Poole provide projections of total households, but no breakdown of households by type or age group.