

**CHPC Working Paper**  
**Building and Preserving Affordable Homes Near Transit:**  
**Affordable TOD as a Greenhouse Gas**  
**Reduction and Equity Strategy**

New Carver Apartments, Los Angeles, CA / Skid Row Housing Trust  
Less than 0.4 miles to Metro rail and 1 block to bus lines



Oxford Plaza, Berkeley, CA / Resources for Community Development  
Less than 3 blocks to BART rail and multiple bus lines



Alabama Manor, San Diego, CA / Community Housing Works  
Within 2 blocks of 4 major transit lines

**January 2013**

For more information, please contact Megan Kirkeby at [mkirkeby@chpc.net](mailto:mkirkeby@chpc.net) or (415) 433-6804 x 319 or  
James Pappas at [jpappas@chpc.net](mailto:jpappas@chpc.net) or (415) 433-6804 x 320

## Executive Summary

CHPC initiated this report in order to assess existing research on the role of preservation and development of affordable housing in transit-oriented corridors as a greenhouse gas (GHG) reduction strategy for California. As a result of our extensive review of existing literature, we have found three important trends: 1) Lower income households are less likely to own a car, more likely than other income groups to walk or take transit, especially in transit rich areas, and have lower vehicle miles traveled (VMT); 2) living in transit-oriented development (TOD) reduces auto use and resulting GHG emissions while also lowering transportation costs; and 3) housing near transit stations is subject to more rapidly increasing rents and property values, making these areas less affordable to low income households over time.

While more study is needed to quantify the specific reductions generated by Affordable TOD, **evidence suggests that preserving and building affordable homes near transit will allow California to achieve the maximum VMT and GHG reduction benefits** of investment in transit infrastructure and transit-oriented development. **Actions must be taken to ensure that people with low incomes, who are most likely to use transit and to benefit from its presence, are able to live nearby.**

### Summary of Key Findings

#### **Low Income People Own Fewer Cars and Use Transit More**

- People with lower incomes are more likely to be transit riders, with households that earn less than \$20,000 per year using transit more than 4 times as much as higher income groups.
- 48.5 percent of transit riders do not own a car, compared to the national average of only 6.1 percent of all American households that are carless. Low income households are far less likely to own a car.

#### **In California, Income and Proximity to Transit are Linked to Higher Transit Ridership and Lowered VMT**

- Living within a half mile of transit increases commuting by walking, biking, and transit for all income groups but those earning less than \$25,000 per year consistently have the highest rate of non-car commuting.
- Areas with high transit access have both the lowest transportation costs and lowest GHG emissions in each of California's four largest metro areas.

#### **Assessing the GHG Reduction Benefits of Affordable TOD**

- TOD residents in California who had previously not lived close to transit reduced their daily VMT by 9.8 resulting in almost 9 pounds less CO<sub>2</sub> emitted per day.
- A commonly cited estimate of the VMT and GHG emissions reduction provided by affordable housing is 4 percent reduction per affordable unit. However, this estimate makes uniform assumptions about income and affordability levels and is derived only in relation to income without incorporating the effects of transit access or demand management strategies such as free transit passes for residents or car sharing at a building site. As a result this estimate may not fully account for the GHG reductions of Affordable TOD.
- **CHPC and Transform Embark on New Research Effort:** Further research is needed to quantify the interaction between affordability, transit access, and demand management strategies. Given low income households' heightened transit use and lower rates of car ownership, this interaction is likely to result in even more substantial VMT and GHG reductions than has been previously estimated. For this reason, the California Housing Partnership Corporation, in partnership with California-based transportation nonprofit Transform, is embarking on a more extensive study of the VMT and GHG reduction benefits of Affordable TOD.

#### **Gentrification in Transit Accessible Areas Diminishes the GHG Reduction Benefits of TOD**

- Proximity to transit is linked to increasing property values and rents, typically 10- 20 percent above similar rental buildings that are further from transit.
- New transit stations tend to attract new residents with higher incomes and higher car ownership.
- Evaluations of smart growth plans that emphasize TOD and other infill development have found reduced affordability and loss of lower income households in TOD areas.
- If housing around transit becomes too costly for low income people, some of the transit ridership and GHG reduction benefits of TOD will be lost.



## Introduction

A growing body of evidence demonstrates that investment in affordable housing that is transit accessible is an important greenhouse gas (GHG) reduction strategy for California. Simply put, lower income people are more likely than other income groups to walk or take transit and less likely to own a car. Access to high quality transit lowers transportation costs compared to driving, yielding the greatest proportional savings to low income households and freeing up scarce financial resources for other important needs. By preserving and building affordable housing as part of the mix of commercial and residential development around transit, California can ensure that the people most likely to use transit and benefit from its presence are able to live nearby, maximizing the GHG reduction potential of transit infrastructure and transit oriented development.

In 2006, the California legislature passed the Global Warming Solutions Act (AB 32), setting a goal for the year 2020 of reducing total statewide GHG emissions to the levels of 1990 or below. The transportation sector is the largest contributor to California's GHG emissions at 38 percent of the total<sup>1</sup>. Because transportation needs are driven in large part by where people want - and can afford - to live, housing affordability affects the sector's emissions.

Three main strategies have been identified for reducing transportation's GHG emissions: increasing vehicle fuel efficiency; reducing the carbon content of fuels; and reducing the amount of driving or vehicle miles traveled (VMT)<sup>2</sup>. This third strategy, reducing VMT, depends in part on better integration of land use and transportation planning that increases the convenience of other transportation options such as walking, biking, and transit. Transit-oriented development (TOD) helps achieve this goal because it concentrates residential and commercial development around transit lines, often at greater densities than those found in typical auto-oriented development, allowing residents to access shopping, services, and jobs on foot, bicycle, or transit rather than by automobile.

In order to realize the emissions reduction potential of integrated land use, housing, and transportation planning that emphasizes alternatives to driving, the California Legislature passed the Sustainable Communities and Climate Solutions Act (SB 375) in 2008. The law requires metropolitan planning organizations (MPOs), the agencies charged with transportation planning for metropolitan areas, to create sustainable community strategies that integrate planning for land use and housing with transportation in order to reduce GHG emissions. As a result, many MPOs in California are working with cities and counties in their metropolitan areas to develop land use and transportation plans that expand transit and encourage growth in transit-accessible areas.

California has already laid more miles of urban rail track over the last three decades than any other state,<sup>3</sup> constructing new rail transit in all of its largest metropolitan areas including Los Angeles, Sacramento, San Diego, and the San Francisco Bay Area. These expanding transit systems offer substantial opportunities for growth in transit-accessible areas. However, proximity to rail transit

---

<sup>1</sup> California Air Resources Board, "Greenhouse Gas Inventory 2009 GHG emissions by Sector (from 2000-2009 emission inventory)" Data. <http://www.arb.ca.gov/cc/inventory/data/graph/graph.html>

<sup>2</sup> Reid Ewing, Keith Bartholomew, Steve Winkelman, Jerry Walters, Don Chen, *Growing Cooler: The Evidence on Urban Development and Climate Change* (Urban Land Institute, 2007), 11.

<sup>3</sup> Robert Cervero, "Transit Oriented Development's Ridership Bonus: A Product of Self-Selection and Public Policies," *Environment and Planning* 39, (2007): 2068



stations often increases land values and rents, making it more difficult for people with low incomes to live near these growing transit systems. In part for this reason, California’s GHG reduction laws contain equity measures designed to assist low income people. SB 375 calls for measures that meet the housing and transit access needs of all income groups and AB 32 specifically calls for directing “public and private investment toward the most disadvantaged communities in California” and for providing “an opportunity for small businesses, schools, affordable housing associations, and other community institutions to participate in and benefit from statewide efforts to reduce greenhouse gas emissions”<sup>4</sup>.

California affordable housing programs aim to supplement the supply of homes available in the market for low income households by providing safe, healthy housing that these households can rent without spending more than 30 percent of their income. According to federal guidelines, low income households are defined as earning less than 80 percent of a metropolitan area’s median income while very low income households are defined as earning 50 percent of the median or below. Affordable housing is funded through a number of programs including Low Income Housing Tax Credits sold to investors, direct public investment, and loans that may be government-subsidized or market rate. Unfortunately, funding for affordable housing in California has declined precipitously in recent years even as efforts to construct transit and reduce transportation related GHG emissions have increased.

### Lower Income Households Own Fewer Cars, Use Transit More, and Drive Less

A University of South Florida analysis of the 2009 National Household Transportation Survey (NHTS) found that **lower income households form a disproportionately large share of transit ridership**. Households earning less than \$50,000 a year make up 47.1 percent of the U.S. population, yet they account for 68.8 percent of transit riders.<sup>5</sup> Very low income households (those earning less than \$15,000 a year) are only 11.7 percent of the national population, yet they comprise 28.9 percent of transit riders. In related findings, surveys of public transit riders conducted between 2000-2005 found that their median household income was 12 percent lower than the national median.<sup>6</sup> The table below is taken from *The Socioeconomics of Urban Travel*, a report by Pucher and Renne that examined the 2001 NHTS for data related to income and transportation behavior. The table shows that public transit use is much greater among lower income households, especially in large metropolitan areas. **Nationwide, low income households use transit more than four times as much as those with higher incomes.**

Public Transit’s Market Share by Metro Population Size and Household Income						
Metropolitan Area Population	Household Income					
	Less than \$20,000	\$20,000 to \$39,999	\$40,000 to \$74,999	\$75,000 to \$99,999	\$100,000 and over	All
Less than 250,000	1.1%	0.4%	0.1%	0.1%	0.1%	0.4%
250,000 – 499,999	2.2%	0.3%	0.4%	0.1%	0.3%	0.6%
500,000 – 999,999	1.8%	0.9%	0.1%	0.1%	0.1%	0.6%
1,000,000 – 2,999,999	5.4%	0.6%	0.6%	0.3%	0.3%	1.1%
3 million or more	10.6%	3.4%	2.3%	1.5%	2.2%	3.4%
Nation	4.8%	1.1%	0.9%	0.7%	1.1%	1.6%

Source: Pucher and Renne, “Socioeconomics of Urban Travel: Evidence from the 2001 NHTS”

<sup>4</sup> California Global Warming Solutions Act of 2006, AB 32, California Health and Safety Code, 2006, §38500 -38599.

<sup>5</sup> Xuehao Chu, Ph.D., *An Assessment of Public Transportation Markets Using NHTS Data*, (National Center for Transit Research at CUTR University of South Florida, Tampa, March 2012), 30-32.

<sup>6</sup> APTA, *A Profile of Public Transportation Passenger Demographics and Travel Characteristics Reported in On-Board Surveys*, (American Public Transit Association, 2007), 7.



**Lower income people are much less likely to own a car than other income groups, and not owning a car is strongly associated with higher transit use.** In fact, according to analysis of the 2009 NHTS, households with no vehicle make up only 6.1 percent of the general population yet they are 48.5 percent of transit riders.<sup>7</sup> A study of the San Francisco Bay Area found that zero-car households are highly likely to commute by rail, while “adding one car results in probabilities plummeting”<sup>8</sup>. Pucher and Renne’s report drawn from the 2001 NHTS found that 26.5 percent of households earning less than \$20,000 had no vehicle. For households earning between \$20,000 and \$40,000, the percentage with no car dropped to five percent, while for those households with higher incomes the percentage with no car was 2.3 percent or less.<sup>9</sup>

Vehicle Ownership by Income (percentage distribution within income groups)						
Vehicles Per Household	Household Income					
	Less than \$20,000	\$20,000 to \$39,999	\$40,000 to \$74,999	\$75,000 to \$99,999	\$100,000 and over	All
0	26.5%	5.0%	2.3%	0.9 %	1.5%	8.3%
1	48.3%	44.1%	26.8%	13.1%	10.7%	33.2%
2	17.5%	35.6%	45.6%	50.6%	49.3%	37.4%
3 or more	7.7%	15.3%	25.3%	35.4%	38.5%	21.1%
Total	100%	100%	100%	100%	100%	100%

Source: Pucher and Renne, “Socioeconomics of Urban Travel: Evidence from the 2001 NHTS”

No doubt in part because low income households’ car ownership is lower than average and transit ridership higher, **low income households’ daily per capita VMT and number of trips per day is much lower than that of higher income households.**

Daily Travel per Capita by Income Group		
Household Income	Trips per Day, per Person	Miles Traveled per Day, per Person
Less than \$20,000	3.2	17.9
\$20,000 to \$39,999	3.9	26.4
\$40,000 to \$74,999	4.2	30.2
\$75,000 to \$99,999	4.3	30.7
\$100,000 and over	4.8	31.8
All	4.0	26.9

Source: Pucher and Renne, “Socioeconomics of Urban Travel: Evidence from the 2001 NHTS”

## TOD Shapes Travel Behavior and Lowers VMT and GHG Emissions

TOD neighborhoods’ physical features combine with demographic factors such as household income and personal preferences to shape travel choices and resulting VMT.<sup>10</sup> While some residents of TOD may live in transit-accessible neighborhoods in part because they prefer taking transit, walking, or biking, rather than driving, research has shown that the physical features of a neighborhood are more influential in

<sup>7</sup> Xuehao Chu, Ph.D, “An Assessment of Public Transportation Markets Using NHTS Data,” 34.

<sup>8</sup> Cervero, “Transit Oriented Development’s Ridership Bonus,” 2082, 2083.

<sup>9</sup> John Pucher and John L. Renne, “Socioeconomics of Urban Travel: Evidence from the 2001 NHTS,” *Transportation Quarterly*, 57, No. 3, (2003): 56

<sup>10</sup> John Holtzclaw, Robert Clear, Hank Dittmar, David Goldstein, and Peter Haas, “Location Efficiency: Neighborhood and Socio-Economic Characteristics Determine Auto Ownership and Use - Studies in Chicago, Los Angeles and San Francisco,” *Transportation Planning and Technology* 25, No.1, (2002)

Reid Ewing and Robert Cervero, “Travel and the Built Environment A Meta-Analysis,” *Journal of the American Planning Association* 76, No.3 (2010): 10 URL: <http://dx.doi.org/10.1080/01944361003766766>



determining walking, biking, transit ridership, and resulting VMT, than personal attitudes or preferences.<sup>11</sup> **Even among those with a preference for driving, research has found that living in more transit and pedestrian oriented areas results in reduced VMT<sup>12</sup>.** As a result, growing in a more compact, transit-oriented way as a region can make big differences in per capita VMT. **Comparing the ten most compact large metro areas in the country with the ten that are most sprawling reveals that VMT per capita is 22 percent less in the more compact metros.<sup>13</sup>**

The Urban Land Institute's extensive report on reducing GHG emissions through land use and transportation planning, *Growing Cooler*, recommends increasing housing development near transit that connects to job centers and other major destinations. The report specifically calls for the use of cap-and-trade revenue or other state funding to support TOD through planning and infrastructure investment.<sup>14</sup>

### **Income and Transit Proximity Influence Transportation Choices in California**

Research on transit-oriented development in California over the past two decades has found that, even in a state famous for its freeways and car use, **proximity to transit encourages transit use and reduces VMT.** A 1993 study of California TODs showed that of residents who had previously "lived away from transit, 52.3 percent switched to transit commuting upon moving within ½ mile walking distance of a rail station."<sup>15</sup> Another study from the early 1990s using surveys "of residents of multi-family complexes near suburban rail stations in the San Francisco region showed upwards of 45 percent took rail-transit to work, much higher than the regional average of 9 percent."<sup>16</sup> In the 2007 research paper "Transit Oriented Development's Ridership Bonus", Robert Cervero used "before-and-after" surveys of 226 residents who had moved to California TODs from areas with poor transit access. The study found that residents' average daily VMT dropped 42 percent in the new TOD location<sup>17</sup>. The study found additional benefits for new TOD residents including reduced commute times, lowered commute costs, and more job access.

U.S. Census data shows that both income and living near transit strongly influence commute choices in California's four largest metropolitan areas: the Los Angeles region, the Sacramento area, San Diego County, and the San Francisco Bay Area. The graphs that follow present the percentage of workers in different income groups that commute by transit, walking, or biking in each of these four metro areas. The graphs also contrast workers living within a half mile of transit with workers in the region taken as a whole. This data shows that living within a half mile of transit increases transit use, as well as walking and biking, for all income groups in all four of the metro areas. However, **workers earning less than \$25,000 take transit, walk, or bike to work to a greater degree than higher earners** in both transit accessible areas and the broader metro area in all of the metro areas examined.

---

<sup>11</sup> Ewing and Cervero, "Travel and the Built Environment", 2,3.

<sup>12</sup> Ewing, et al., *Growing Cooler*, 97-100.

<sup>13</sup> Ibid., 15,16.

<sup>14</sup> Ibid., 112, 119, 125.

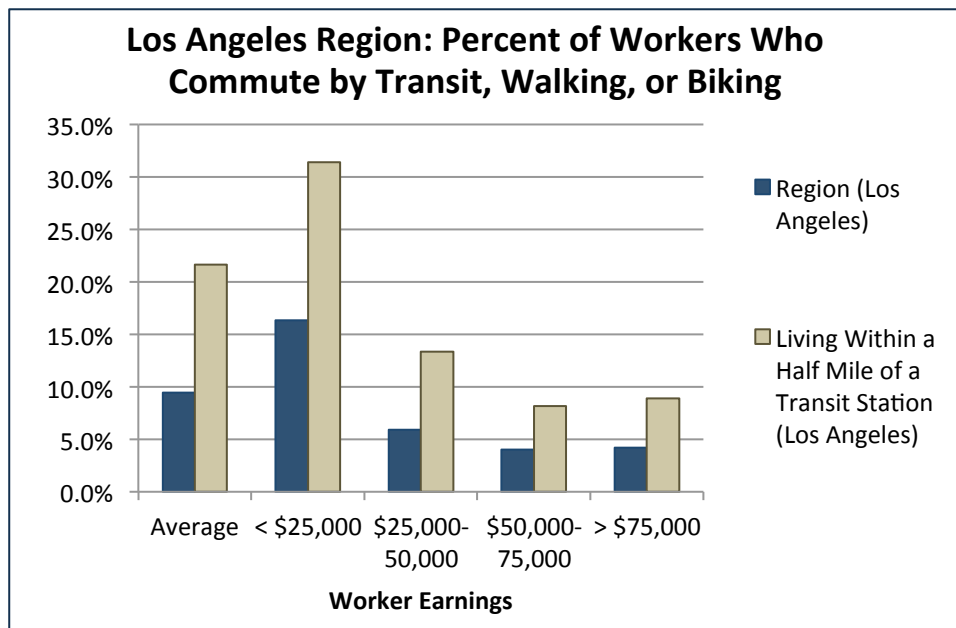
<sup>15</sup> Cervero, "Transit Oriented Development's Ridership Bonus," 2069.

<sup>16</sup> Ibid., 2069.

<sup>17</sup> Ibid., 2074, 2075.

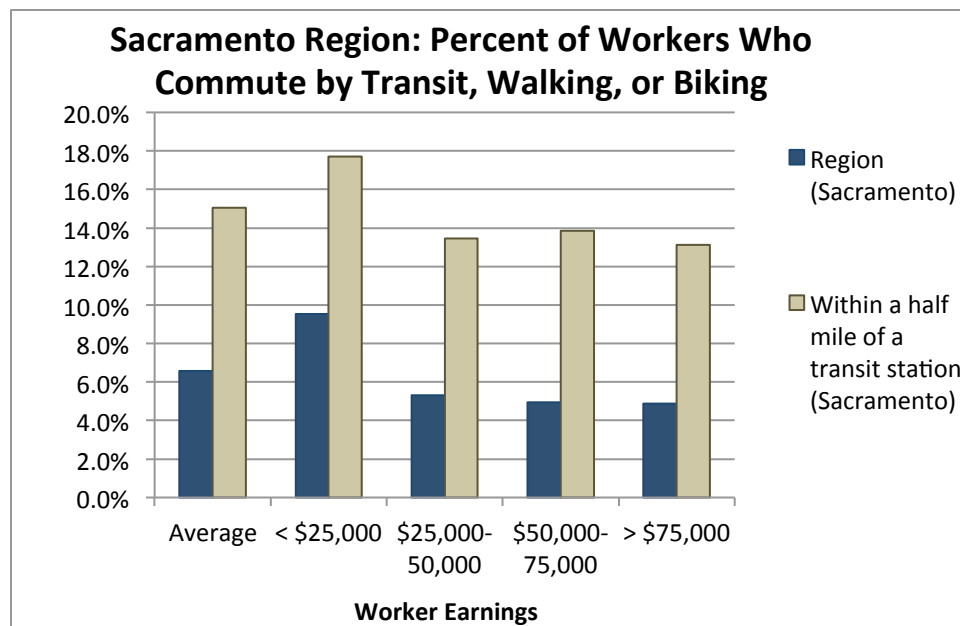


**Los Angeles Region:** Nearly 10 percent Los Angeles area workers commute by transit, walking, or biking. This percentage more than doubles among people living near transit. Workers earning less than \$25,000 take transit, walk, or bike to work more than twice as much as higher earners- a contrast particularly noticeable in transit accessible areas.



Source: 2005-2009 ACS Data aggregated using the TOD Database, a project of the Center for Neighborhood Technology (CNT) and Center for Transit-Oriented Development (CTOD)

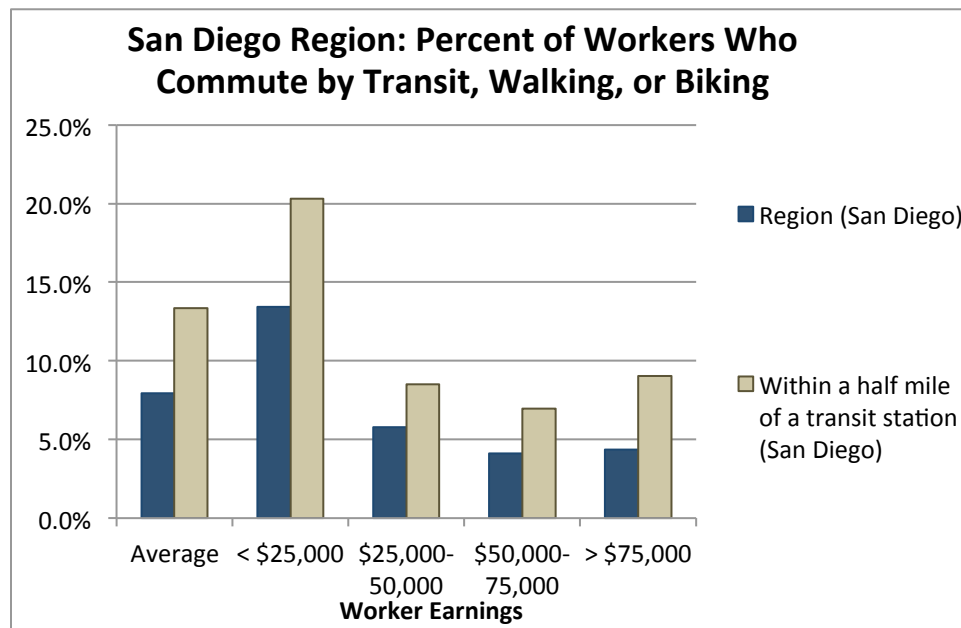
**Sacramento Area:** In the Sacramento area fewer workers take transit, walk, or bike to work than in Los Angeles but the percentage of workers who do so more than doubles among those who live near transit. Workers earning less than \$25,000 commute by transit, walking, or bicycle more often than workers with higher earnings.



Source: 2005-2009 ACS Data aggregated using the TOD Database, a project of the Center for Neighborhood Technology (CNT) and Center for Transit-Oriented Development (CTOD)

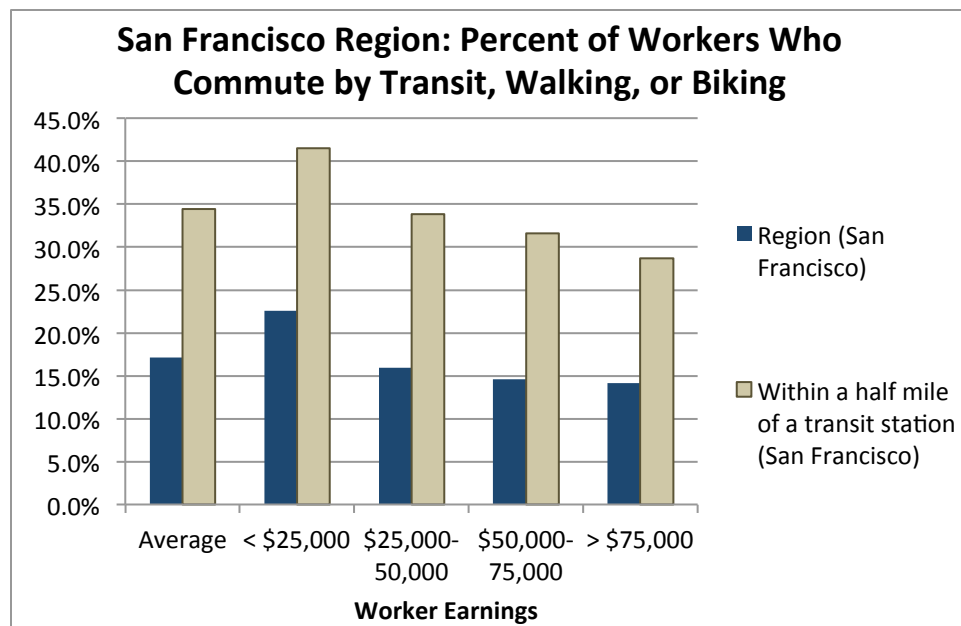


**San Diego County:** Workers of all incomes in the San Diego region take transit, walk, or bike to work more often when they live near transit. Like the Los Angeles Region, a much higher percentage of workers earning below \$25,000 take transit, walk, or bike to work than those with higher earnings whether they live near transit or not.



Source: 2005-2009 ACS Data aggregated using the TOD Database, a project of the Center for Neighborhood Technology (CNT) and Center for Transit-Oriented Development (CTOD)

**San Francisco Bay Area:** The San Francisco Bay Area has the most developed transit system in California and workers of all incomes take transit, walk, or bike to work more than any metro area in the state. Even with high transit ridership across incomes, workers earning less than \$25,000 are still the most likely to commute by transit, walking, or biking.



Source: 2005-2009 ACS Data aggregated using the TOD Database, a project of the Center for Neighborhood Technology (CNT) and Center for Transit-Oriented Development (CTOD)





## Affordable TOD Helps Low Income People Reduce their Two Largest Expenses, Housing and Transportation Costs, While Lowering Greenhouse Gas Emissions

Low income households use transit more than average in part because it reduces travel costs and the expenses associated with vehicle ownership. Car ownership can cost thousands of dollars per year with much of this cost due to non-fuel expenses such as insurance, financing, and maintenance.<sup>18</sup> **A recent Brookings Institution analysis of commute costs for the working poor (people earning up to twice the federal poverty level) found that their commutes consumed 60 percent more of their incomes than the national average.**<sup>19</sup> This study also found that the working poor who drove to work spent more of their income on commuting than any other income group. The working poor who commuted by transit spent 44 percent less than those who drove. The Center for Housing Policy's report, *A Heavy Load*, measured combined housing and transportation costs in the 28 largest U.S. metro areas, and found that working families earning between \$20,000 to \$50,000 spent an average of 57 percent of their income on housing and transportation.<sup>20</sup> In the California metro areas included in the study—Los Angeles, San Diego, and San Francisco—the share of income consumed by these combined costs exceeded the national average.

Because transit access can reduce travel costs substantially and low income households devote a larger share of income to transportation, these households have a particular incentive to seek housing near transit and to make use of transit access. **A study of eighty-six U.S. metropolitan areas found that in two thirds of them, low income people paid more for housing in central city areas than they would in nearby suburbs, largely because of the need for access to transit.**<sup>21</sup> An analysis of Bay Area rail stations found that people making under \$40,000 a year tended to be drawn to station areas.<sup>22</sup> **Research on the combined household costs of housing and transportation has found that living in central areas with access to frequent and effective transit provides the lowest combined housing and transportation costs for working families.**<sup>23</sup> In contrast, areas at the suburban edge, where housing tends to be cheaper and transportation much more costly, produce the highest combined household costs.<sup>24</sup>

In fact, research shows that **residing in compact, transit accessible areas can cut transportation costs in half** when compared to auto-dependent areas, potentially saving thousands of dollars a year.<sup>25</sup> *Windfall for All*, a report by California transportation non-profit Transform, describes the potential household financial benefits of improved land use and transportation planning under SB 375. **The report finds that areas with high transit access have both the lowest transportation costs and lowest GHG emissions in all of California's four largest metro areas.**<sup>26</sup>

---

<sup>18</sup> Transform, *Windfall For All: How Connected, Convenient Neighborhoods Can Protect Our Climate and Safeguard California's Economy*, (Transform, 2009): 7. <http://www.transformca.org/windfall-for-all>

<sup>19</sup> Elizabeth Roberto, *Commuting to Opportunity: The Working Poor and Commuting in the United States*, (Brookings Institution, 2008).

<sup>20</sup> Barbara J. Lipman, *A Heavy Load: The Combined Housing and Transportation Burdens of Working Families*, (Center for Housing Policy, 2006): 2,3.

<sup>21</sup> Edward L. Glaeser, Matthew E. Kahn, and Jordan Rappaport, *Why Do the Poor Live in Cities?*, (Harvard Institute of Economic Research, 2000): 13.

<sup>22</sup> Cervero, "Transit Oriented Development's Ridership Bonus," 2080.

<sup>23</sup> Lipman, *A Heavy Load*, 6.

<sup>24</sup> Peter M. Haas, Ph.D. Carrie Makarewicz, Albert Benedict, Thomas W. Sanchez, Ph.D., and Casey J. Dawkins, Ph.D., *Housing & Transportation Cost Trade-offs and Burdens of Working Households in 28 Metros*, (Center for Neighborhood Technology, 2006): 24, 25.

<sup>25</sup> Cervero, "Transit Oriented Development's Ridership Bonus," 2070.

<sup>26</sup> Transform, *Windfall For All*, 20,21.



## Assessing the GHG Reduction Benefits of Affordable TOD

Because of the ample evidence that low income people living in transit accessible areas use transit more and drive less than other income groups, Affordable TOD is likely to reduce VMT and GHG emissions to a greater degree than other types of residential development. The California Air Pollution Control Officers Association (CAPCOA) has compiled a resource book for quantifying GHG mitigation measures across multiple sectors and recognizes both transit access and housing affordability as lowering a development's VMT and GHG impact.

**VMT and GHG Reduction Benefits of TOD:** CAPCOA predicts a range of possible GHG reductions resulting from TOD, depending on the features of the development and its surrounding neighborhood including density, mix of uses, and proximity and quality of transit connections.<sup>27</sup> Because these features vary from one TOD to another, it is difficult to estimate an average level of VMT and GHG reduction per TOD unit. However, the "Transit Oriented Development Ridership Bonus" study mentioned earlier used surveys of TOD residents in California who moved from housing that was not near transit and found that their daily VMT dropped 9.8 miles on average, from 33.3 to 23.5 VMT per day<sup>28</sup>. Assuming average CO<sub>2</sub> emissions per passenger mile of .916 pounds<sup>29</sup>, these **TOD residents have reduced average daily CO<sub>2</sub> emissions by nearly 9 pounds, and annual CO<sub>2</sub> emissions by over 3 tons per year.**

Average Daily VMT and GHG Reduction for TOD Movers			
	Living Far from Transit	Living in TOD	Change living in TOD
Average Daily VMT	33.3 miles	23.5 miles	-9.8 miles
Average Daily CO <sub>2</sub> Emissions*	30.5 lbs.	21.52 lbs.	-8.98 lbs.

VMT reduction averages from survey of TOD movers in Robert Cervero, "Transit Oriented Development's Ridership Bonus: A Product of Self-Selection and Public Policies," \*assumes 0.916 lbs of CO<sub>2</sub> per mile using EPA guidelines

**VMT and GHG Reduction Benefits of Affordable Housing:** Due to the lower car ownership and higher transit use among low income households, affordable housing is recognized as generating fewer trips and less traffic, as well as lower VMT and GHG, than market-rate housing. In order to estimate the GHG reduction benefits of affordable housing, CAPCOA uses the air quality and GHG emissions analysis tool URBEMIS.

Based on a formula for the relationship between income and VMT developed from census tract level research by Holtzclaw, et al.<sup>30</sup>, URBEMIS estimates a 4 percent reduction in VMT and GHG per affordable unit. However, the 4% reduction estimate has important limitations. First, it assumes a set level of affordability and static income when in reality levels of affordability and area median incomes vary. Second, the strictly income-based formula does not account for the full reduction in trips and VMT provided by affordable housing with high quality transit access or demand management strategies such as free transit passes for residents or car sharing on site. As a result, the 4% estimate undervalues the decrease in VMT associated with affordable housing. The City of San Diego's *Affordable Housing Parking Study* provides evidence that car use is substantially lower at affordable housing developments, finding

<sup>27</sup> Barbara Lee, *Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures*. California Air Pollution Control Officers Association (CAPCOA) with Northeast States for Coordinated Air Use Management, National Association of Clean Air Agencies, Environ, and Fehr & Peers August, 2010.

<sup>28</sup> Cervero, "Transit Oriented Development's Ridership Bonus," 2075.

<sup>29</sup> US EPA. Average Annual Emissions and Fuel Consumption for Passenger Cars and Light Trucks 2000.

<sup>30</sup> Nelson\Nygaard Consulting Associates, *Crediting Low-Traffic Developments: Adjusting Site-Level Vehicle Trip Generation Using URBEMIS*, (San Francisco: Nelson\Nygaard Consulting Associates, August, 2005): 15.



that the parking utilization rate in affordable housing developments was “about one half of that of the typical rental units in San Diego; almost half the units surveyed had no vehicle”.<sup>31</sup> Given the consistent research findings on heightened transit use among low income households and the disproportionate costs that driving and car ownership impose on these households, the VMT and GHG reduction benefits of Affordable TOD are likely to be greater than currently estimated.

**New Initiatives Needed to Quantify the VMT and GHG Reduction Benefits of Affordable TOD:** In response to the limitations of current estimates of the VMT and GHG reduction benefits of Affordable TOD, California Housing Partnership Corporation (CHPC), in partnership with California-based transportation nonprofit Transform, is promoting an empirical data gathering effort, including household surveys, to better quantify the impact of affordability, transit access, and demand management strategies on trip generation and VMT. CHPC and Transform hope to build on recent work by Caltrans, California’s statewide transportation agency that assesses the trip and traffic generation of TOD and infill development.<sup>32</sup>

### **TOD Can Reduce Parking Needs But Political and Market Barriers Remain**

Residents of TOD can carry out many of their daily activities, from going to work to shopping for groceries, without a car. Reduced driving among TOD residents potentially means less car ownership and less need for parking on site. In fact, a 2012 review of research on TOD parking policy concluded that the amount of parking required for a TOD could be reduced by 20 to 50 percent below parking amounts required for similar developments farther from transit.<sup>33</sup> Lower Parking requirements are important because parking is expensive, accounting for 10 to 20 percent of construction costs depending on land values, type of construction, and number of spaces per unit.<sup>34</sup> Reduced parking costs make housing cheaper to build and purchase. Land and money not used to build parking can instead be used to add additional units, retail, community areas, or open space to a development. A 2008 report on TOD found that reducing parking requirements for residential TOD to reflect actual parking needs, could result in a 20 to 33 percent increase in density in the form of additional units or other community serving uses.<sup>35</sup>

Unfortunately, market perceptions and local politics can undermine the potential for reduced parking and more efficient use of transit accessible sites. Community groups and elected officials may not believe that developments near transit need less parking than traditional auto-oriented developments. Fears of congestion and reduced availability of street parking may prevent approvals of lowered parking requirements for TOD. In areas that traditionally have been car dependent but where new or existing transit infrastructure presents opportunities for TOD, market-rate developers may still view substantial amounts of parking as necessary to attract tenants. A comprehensive report on TOD in the U.S. from 2004 found that “many developers relate to the idea that parking standards should be lowered to the

<sup>31</sup> Wilbur Smith Associates, *San Diego Affordable Housing Parking Study*, (Submitted to the City of San Diego, 2011): ES-2.

<sup>32</sup> Caltrans, Kimley-Horn and Associates, Inc., Economic & Planning Systems, and Gene Bregman & Associates *Trip-Generation Rates for Urban Infill Land Uses in California Phase 2: Data Collection Final Report*, (Caltrans Headquarters Divisions of Transportation Planning and Research & Innovation, June 15, 2009); Caltrans, Fehr & Peers, SACOG, and UC Davis ULTRANS, *Improved Data and Tools for Integrated Land Use-Transportation Planning in California Final Overview Report* (Caltrans, September 24, 2012).

<sup>33</sup> Ming Zhang, Katie Mulholland, Jane Zhang, and Ana J.Gomez-Sanchez, *Getting the Parking Right for Transit-Oriented Development*, (Center for Transportation Research at the University of Texas at Austin sponsored by the Southwest Region University Transportation Center, 2012): 23.

<sup>34</sup> Todd Litman, *Parking Requirement Impacts on Housing Affordability*, (Victoria Transport Policy Institute, 2011): 9,28.

<sup>35</sup> GB Arrington and Robert Cervero, PhD, principal Investigators, *TCRP Report 128: Effects of TOD on Housing, Parking, and Travel* (Transit Cooperative Research Program, Federal Transit Administration, 2008): 114.



degree that significant numbers of residents, shoppers, and workers ride transit. On the other hand, many have embraced the principle that parking is an effective marketing tool and can sometimes make or break a project.”<sup>36</sup>

For market-rate developers, building TOD, like any development, means forecasting the needs and desires of potential tenants and minimizing risk to the project and its investors. As formerly auto-oriented areas around new transit stations see increasing development and the emergence of a more transit-oriented lifestyle, builders may still decide to include extensive parking in deference to the historic dominance of the automobile or the perceptions of retail tenants, brokers, and financial backers.

### **Affordable TOD Can Reduce Parking and Increase Efficient Use of TOD Sites**

Affordable TOD is often in a better position than market rate development to reduce parking while increasing the total number of units or community-serving uses. Affordable housing developers are usually eager to reduce parking because they know that low income tenants own fewer cars and use transit more than higher income people. Financing for affordable housing, while still subject to market forces, is different than market-rate development. Low Income Housing Tax Credits, a common means of financing affordable housing, are allocated in California in part based on access to transit and neighborhood services such as schools, parks, and grocery stores rather than parking supply. Affordable housing developers prefer to add additional units or other community amenities in place of parking, knowing that such changes lower development costs, increase the number of units, and make a development more attractive to tenants and funders.

While new affordable housing developments may face political resistance, municipalities increasingly recognize that affordable housing needs less parking than typical development. The City of San Diego *Affordable Housing Parking Study*, referenced earlier, found that all of the affordable housing developments studied, whether housing for seniors or large families, had more parking than they needed even for peak demand.<sup>37</sup> The study also showed a decreased need for parking at developments with “many walkable destinations and more transit service” compared to other affordable properties. Cities throughout California have reduced parking requirements for affordable housing developments and many also offer reduced parking for TOD.<sup>38</sup> With these shifts, Affordable TOD is poised to make the most of building sites near transit through decreased parking and increased unit counts and community amenities.

---

<sup>36</sup> Robert Cervero, G. B. Arrington, Janet Smith-Heimer, Robert Dunphy, and others. *TCRP Report 102: Transit Oriented Development in America: Experiences, Challenges, and Prospects*. (Transit Cooperative Research Program, Federal Transit Administration, 2004) S-4.

<sup>37</sup> Wilbur Smith Associates, *San Diego Affordable Housing Parking Study*, ES-2.

<sup>38</sup> “Parking Requirements Guide For Affordable Housing Developers,” Southern California Association of Non-Profit Housing (SCANPH) accessed October 16, 2012, <http://www.scanph.org/node/82>.



## Gentrification Threatens the GHG Reduction Benefits of TOD

Some of the VMT and GHG reduction benefits of new transit investment and transit-oriented development will be lost without investment in preservation and construction of Affordable TOD. A recent review of the literature on the effect of transit proximity on housing costs finds that, in general, property values rise with proximity to a transit station.<sup>39</sup> Rents are typically 10-20 percent higher in TOD rental buildings when compared to similar neighborhoods within the metro area but further from transit.<sup>40</sup> In addition, the market for denser development that is walkable and transit accessible is undersupplied nationwide, given future market demand. Major demographic trends, including increasing numbers of people over 65 and growing numbers of singles and childless couples, will provide growing demand for residential units in walkable neighborhoods with greater proximity to jobs, services, activities, and transit.<sup>41</sup> **Greater market demand will put increasing price pressures on existing housing near transit.**

A nationwide study of the impact of new transit stations on surrounding neighborhoods found that **the most common result after a new transit station opened was that, on average, wealthier residents moved there and housing became more expensive.**<sup>42</sup> In three quarters of the station area neighborhoods studied, rents increased more than in the surrounding metropolitan areas and in 90 percent, housing prices increased by a greater margin. **Most critically, in nearly three quarters of these neighborhoods with new transit stations, car ownership also increased,<sup>43</sup> no doubt because TOD residents with higher incomes are more likely than lower income residents to own and use a car.** Without policies and funding for preservation and development of affordable TOD, increasing gentrification of TOD neighborhoods will reduce transit access for low income renters and limit the VMT and GHG reduction potential of transit investment.

California is already seeing evidence of gentrification around transit in its metropolitan areas. A recent study on gentrification trends in the San Francisco Bay Area by Karen Chapple and the Center for Community Innovation at UC Berkeley, found that transit proximity and neighborhood amenities were the attributes most strongly correlated with neighborhood gentrification.<sup>44</sup> Recent research on neighborhoods surrounding rail transit in Los Angeles has found evidence that gentrification is occurring, with rents, median incomes, and the number of people with college degrees increasing faster around rail stations than in the metropolitan area in general.<sup>45</sup> A 2012 Study completed by Reconnecting America and the Los Angeles Housing Department (LAHD) identified priority areas for preservation of affordability around new and existing transit lines in Los Angeles.<sup>46</sup> These transit-oriented districts

---

<sup>39</sup> Keith Wardrip, *Public Transit's Impact on Housing Costs: A Review of the Literature*, (Center for Housing Policy, 2011).

<sup>40</sup> *Ibid.*, 5.

<sup>41</sup> Ewing, et al., *Growing Cooler*, 33-37.

<sup>42</sup> Stephanie Pollack, Barry Bluestone, and Chase Billingham, *Maintaining Diversity In America's Transit-Rich Neighborhoods: Tools for Equitable neighborhood Change*, (Dukakis Center for Urban and Regional Policy, 2010): 25.

<sup>43</sup> *Ibid.*, 24.

<sup>44</sup> Karen Chapple, *Mapping Susceptibility to Gentrification: The Early Warning Toolkit*, (University of California at Berkeley Center for Community Innovation, 2009).

<sup>45</sup> Erin Coleman, "Evaluating Relationships Between Rail Development and Neighborhood Change: *Heavy Rail* in the City of Los Angeles" and Pamela Stephens, "Evaluating Relationships between Rail Development and Neighborhood Change: *Light Rail* in the City of Los Angeles" (Comprehensive projects submitted in partial satisfaction of the requirements for the degree Master of Arts in Urban Planning, UCLA Luskin School of Public Affairs, prepared for Southern California Association of Non-Profit Housing, 2012); James Pappas, "A Place in the Center: Preservation and Production of Affordable Housing around Rail Transit in Central Los Angeles" (A Client Report in Satisfaction of the Master's of City Planning Degree Requirement of the UC Berkeley Department City Planning prepared for Reconnecting America, 2012).

<sup>46</sup> Reconnecting America and The City of Los Angeles Housing Department, *Preservation in Transit-Oriented Districts: A Study on the Need, Priorities, and Tools in Protecting Assisted and Unassisted Housing in the City of Los Angeles*, (Reconnecting America and LAHD, May, 2012)



contain a large concentration of the City's rent stabilized and restricted affordable units and are already experiencing a growing pressure on rents that is putting the affordability of these units at risk, making it more difficult for residents with low incomes to live in these central, transit accessible areas even as the transit system continues to expand.

### **Encouraging Growth in Transit Accessible Areas Will Disproportionately Affect Low Income People**

Evidence of growing gentrification pressures in neighborhoods served by transit has raised equity concerns around market rate TOD as a VMT and GHG reduction strategy. Recently, the Metropolitan Transportation Commission (MTC), the San Francisco Bay Area's regional transportation planning agency, conducted an equity analysis of its Plan Bay Area regional growth scenarios. Plan Bay Area, created in response to SB 375, emphasizes growth in Priority Development Areas (PDAs), zones targeted for denser development typically centered around transit. As part of its equity analysis the MTC identified Communities of Concern, that had larger shares of people of color and low income people. The MTC found that many Communities of Concern overlapped with the PDAs and will face increased pressure on rents and more risk of displacement for low income households.<sup>47</sup> Low income households living in PDAs have the lowest projected VMT per capita of any group in the metropolitan area and less than half the projected VMT of other households living in PDAs,<sup>48</sup> yet they are most likely to be pushed out by rising housing costs and increasing development in PDAs without government intervention.

The projected effects of the Plan Bay Area are consistent with results from other parts of the country. An analysis of smart growth plans implemented in states around the U.S. found loss of affordability with increased percentages of both owners and renters paying more than 30 percent of their income in housing costs.<sup>49</sup> An exception among the states studied was New Jersey where existing affordable housing requirements and funding programs accompanying smart growth plans produced thousands of affordable units and slowed declines in affordability. While greater emphasis on TOD as a smart growth strategy can help reduce VMT and GHG, these efforts may be partially undermined if affordable housing is lost in TOD areas and lower income households, transit's most consistent riders and lowest VMT generators, can no longer afford to live close to transit.

Recent reductions in affordable housing funding have jeopardized plans for TOD that includes housing affordable to lower income households. For example, in 2008 Los Angeles released its Housing that Works plan, which states that, "Building affordable housing along public transit corridors and close to job centers must be a corner-stone of LA's future development. It means shorter commutes for workers, less pollution from cars stuck in rush-hour traffic, lower greenhouse gas emissions, and a higher quality of life for local families."<sup>50</sup> Los Angeles has opened multiple rail lines and rapid bus transitways since 1990 and has sought to plan for transit-oriented districts that include substantial affordable housing. However, the Housing that Works plan depended on funds from Los Angeles's Community Redevelopment Agency to help finance Affordable TOD. The loss of this and other funding sources make the need for new resources to build and preserve Affordable TOD housing even more important.

---

<sup>47</sup> Metropolitan Transportation Commission and Association of Bay Area Governments, *Plan Bay Area Equity Analysis Overview*, (MTC and ABAG, 2011).

<sup>48</sup> Alex Karner and Deb Niemeier, *Alternative Scenarios, Affordable Housing, and Vehicle-miles Traveled in the Bay Area: a Memorandum to Parisa Fatehi-Weeks at Public Advocates*, (Department of Civil and Environmental Engineering, UC Davis, 2012): 4.

<sup>49</sup> Gregory K. Ingram, Armando Carbonell, Yu-Hung Hong, and Anthony Flint, *Smart Growth Policies : an Evaluation of Programs and Outcomes*, (Lincoln Institute of Land Policy, 2009): 85, 86.

<sup>50</sup> Los Angeles, *Housing that Works*, (City of Los Angeles, 2008): 16.





## Conclusion

As California undertakes an ambitious effort to lower green house gas emissions across all polluting sectors, transportation, as the largest category of emissions, will be a major focus. While making vehicles and fuels less polluting will be an important part of lowering transportation's GHG impact, reducing vehicle miles traveled by better integrating land-use and transportation planning will also be crucial. Achieving these aims will mean planning for communities where people can take transit, walk, or bike for many of their trips. Increased spending on transit infrastructure, and efforts to focus development along transit corridors, will result in new investment, new commercial development, and new residents flowing into transit-accessible areas.

Low income households already provide transit's most consistent riders and transit access is often a key consideration in their residential choices. Plans to coordinate transportation and land use in ways that encourage transit-oriented growth and development must include policies and funding to preserve and build affordable housing in transit-oriented corridors or risk seeing transit accessible areas become out of reach for low income households. This outcome would not only diminish the potential ridership of expanding transit systems and lessen the GHG reduction resulting from TOD, it would also reduce access and opportunities for some of California's most vulnerable residents. Ensuring that affordable housing is preserved and developed in emerging transit oriented corridors will allow California to maximize the GHG reduction benefits of the state's expanding transit systems and integrated land use and transportation planning, while guaranteeing low income residents share in the benefits of these efforts.



## Bibliography

Arrington, GB, and Robert Cervero, PhD, principal Investigators. *TCRP Report 128: Effects of TOD on Housing, Parking, and Travel*. Transit Cooperative Research Program, Federal Transit Administration, 2008.

APTA. *A Profile of Public Transportation Passenger Demographics and Travel Characteristics Reported in On-Board Surveys*. American Public Transit Association, 2007.

Bento, Antonio M., Maureen L. Cropper, Ahmed Mushfiq Mobarak, and Katja Vinha. "The Effects of Urban Spatial Structure On Travel Demand In The United States." *The Review of Economics and Statistics* 87, No. 3 (2005): 466-478.

California Air Resources Board. *Greenhouse Gas Inventory 2009 GHG emissions by Sector (from 2000-2009 emission inventory)*. Accessed October 16, 2012.  
<http://www.arb.ca.gov/cc/inventory/data/graph/graph.html>

California Global Warming Solutions Act of 2006. California Health and Safety Code, 2006. AB 32, §§38500 -38599.

Caltrans, Kimley-Horn and Associates, Inc., Economic & Planning Systems, and Gene Bregman & Associates. *Trip-Generation Rates for Urban Infill Land Uses in California Phase 2: Data Collection Final Report*. Caltrans Headquarters Divisions of Transportation Planning and Research & Innovation, June 15, 2009.

Caltrans, Fehr & Peers, SACOG, and UC Davis ULTRANS. *Improved Data and Tools for Integrated Land Use-Transportation Planning in California Final Overview Report*. Caltrans, September 24, 2012.

Cervero, Robert. "Transit Oriented Development's Ridership Bonus: A Product of Self-Selection and Public Policies." *Environment and Planning*, 39, (2007): 2068-2085.

Cervero, Robert, G. B. Arrington, Janet Smith-Heimer, Robert Dunphy, and others. *TCRP Report 102: Transit Oriented Development in America: Experiences, Challenges, and Prospects*. Transit Cooperative Research Program, Federal Transit Administration, 2004.

Chapple, Karen, *Mapping Susceptibility to Gentrification: The Early Warning Toolkit*. University of California at Berkeley Center for Community Innovation, 2009.

Chu, Xuehao, Ph.D. *An Assessment of Public Transportation Markets Using NHTS Data*. National Center for Transit Research at CUTR University of South Florida, Tampa, March 2012.

City of Los Angeles. *Los Angeles: Housing that Works*. 2008.

Coleman, Erin. "Evaluating Relationships Between Rail Development and Neighborhood Change: Heavy Rail in the City of Los Angeles." A comprehensive project submitted in partial satisfaction of the requirements for the degree Master of Arts in Urban Planning, UCLA Luskin School of Public Affairs, prepared for Southern California Association of Non-Profit Housing, 2012.



Ewing, Reid, Keith Bartholomew, Steve Winkelman, Jerry Walters, and Don Chen. *Growing Cooler: The Evidence on Urban Development and Climate Change*. Urban Land Institute, 2007.

Ewing, Reid and Robert Cervero. "Travel and the Built Environment A Meta-Analysis," *Journal of the American Planning Association*, 76, No.3 (2010):1-30. URL: <http://dx.doi.org/10.1080/01944361003766766> .

Glaeser, Edward L., Matthew E. Kahn, and Jordan Rappaport. *Why Do the Poor Live in Cities?* Harvard Institute of Economic Research, 2000.

Haas , Peter M., Ph.D. Carrie Makarewicz, Albert Benedict, Thomas W. Sanchez, Ph.D., and Casey J. Dawkins, Ph.D. *Housing & Transportation Cost Trade-offs and Burdens of Working Households in 28 Metros*. Center for Neighborhood Technology, 2006.

Holtzclaw, John, Robert Clear, Hank Dittmar, David Goldstein, and Peter Haa., "Location Efficiency: Neighborhood and Socio-Economic Characteristics Determine Auto Ownership and Use - Studies in Chicago, Los Angeles and San Francisco," *Transportation Planning and Technology*, 25, No.1, (2002): 1-27. <http://dx.doi.org/10.1080/03081060290032033> .

Ingram, Gregory K., Armando Carbonell, Yu-Hung Hong, Anthony Flint. *Smart Growth Policies : an Evaluation of Programs and Outcomes*. Lincoln Institute of Land Policy, 2009.

Kahn, Matthew. "Gentrification Trends in New Transit Oriented Communities: Evidence from 14 Cities That Expanded and Built Rail Transit Systems," *Real Estate Economics*, 35, No. 2, (2007):155-182.

Karner, Alex and Deb Niemeier. *Alternative Scenarios, Affordable Housing, and Vehicle-miles Traveled in the Bay Area: a Memorandum to Parisa Fatehi-Weeks at Public Advocates*. Department of Civil and Environmental Engineering, UC Davis, 2012.

Lee, Barbara. *Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures*. California Air Pollution Control Officers Association (CAPCOA) with Northeast States for Coordinated Air Use Management, National Association of Clean Air Agencies, Environ, and Fehr & Peers August, 2010.

Lipman, Barbara J. *A Heavy Load: The Combined Housing and Transportation Burdens of Working Families*. Center for Housing Policy, 2006.

Litman, Todd. *Parking Requirement Impacts on Housing Affordability*. Victoria Transport Policy Institute, 2011.

Metropolitan Transportation Commission and Association of Bay Area Governments. *Plan Bay Area Equity Analysis Overview*. MTC and ABAG, 2011.

Nelson\Nygaard Consulting Associates. *Crediting Low-Traffic Developments: Adjusting Site-Level Vehicle Trip Generation Using URBEMIS* San Francisco: Nelson\Nygaard Consulting Associates, August, 2005.



Pappas, James. "A Place in the Center: Preservation and Production of Affordable Housing around Rail Transit in Central Los Angeles." A Client Report in Satisfaction of the Master's of City Planning Degree Requirement, UC Berkeley Department City Planning, prepared for Reconnecting America, 2012.

Pollack, Stephanie, Barry Bluestone, and Chase Billingham. *Maintaining Diversity In America's Transit-Rich Neighborhoods: Tools for Equitable neighborhood Change*. Dukakis Center for Urban and Regional Policy, 2010.

Pucher, John, and John L. Renne, "Socioeconomics of Urban Travel: Evidence from the 2001 NHTS," *Transportation Quarterly*, 57, No. 3, (2003): 49-77.

Reconnecting America and The City of Los Angeles Housing Department. *Preservation in Transit-Oriented Districts: A Study on the Need, Priorities, and Tools in Protecting Assisted and Unassisted Housing in the City of Los Angeles*. Reconnecting America and LAHD, May, 2012.

Roberto, Elizabeth. *Commuting to Opportunity: The Working Poor and Commuting in the United States*. Brookings Institution, 2008.

Stephens, Pamela. "Evaluating Relationships between Rail Development and Neighborhood Change: Light Rail in the City of Los Angeles." A comprehensive project submitted in partial satisfaction of the requirements for the degree Master of Arts in Urban Planning, UCLA Luskin School of Public Affairs, prepared for Southern California Association of Non-Profit Housing, 2012.

Southern California Association of Non-Profit Housing (SCANPH). "Parking Requirements Guide For Affordable Housing Developers." Accessed October 16, 2012. <http://www.scanph.org/node/82>.

Transform. *Windfall For All: How Connected, Convenient Neighborhoods Can Protect Our Climate and Safeguard California's Economy*. Transform, 2009. <http://www.transformca.org/windfall-for-all>

US Environmental Protection Agency. Average Annual Emissions and Fuel Consumption for Passenger Cars and Light Trucks 2000.

Wardrip, Keith. *Public Transit's Impact on Housing Costs: A Review of the Literature*. Center for Housing Policy, 2011.

Wilbur Smith Associates. *San Diego Affordable Housing Parking Study*. Submitted to the City of San Diego, 2011.

Zhang, Ming, Katie Mulholland, Jane Zhang, and Ana J.Gomez-Sanchez. *Getting the Parking Right for Transit-Oriented Development*. Center for Transportation Research at the University of Texas at Austin sponsored by the Southwest Region University Transportation Center, 2012.

