

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. CA17-2983	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Affordable Housing in Transit-Oriented Developments: Impacts on Driving and Policy Approaches	5. Report Date April 2017		6. Performing Organization Code
	8. Performing Organization Report		
7. Authors Marlon Boarnet, University of Southern California Raphael Bostic, University of Southern California Danielle Williams, University of Southern California	10. Work Unit No.		
9. Performing Organization Name and Address University of California, Davis University of Southern California National Center for Sustainable Transportation One Shields Ave. Davis, CA 95616	11. Contract or Grant No. 65A0527, TO 027		
	13. Type of Report and Period Covered Final Report		
12. Sponsoring Agency Name and Address California Department of Transportation Division of Research, Innovation and Systems Information MS-42, PO Box 942873 Sacramento, CA 94273-0001	U.S. Department of Transportation Office of the Assistant Secretary for Research and Technology University Transportation Centers Program 1200 New Jersey Avenue, SE Washington, DC 20590		14. Sponsoring Agency Code
	15. Supplemental Notes		
16. Abstract This paper studies the intersection of policies promoting affordable housing, transit-oriented developments (TODs), and the reduction of vehicle miles traveled (VMT) in metropolitan areas. In particular, this paper focuses on the following questions: 1. Does locating affordable units in TODs increase or decrease VMT and thus emissions? 2. Is affordable housing in TODs still affordable in the long-term, i.e., beyond the expiration of the first minimum affordability period? 3. Do the benefits of affordable housing near transit outweigh the frequently higher costs of development in TODs? 4. What policy recommendations emerge from the analysis? Existing research has shown that those who live within a TOD's radius (considered a half-mile in this paper) tend to have a lower VMT than if they lived elsewhere. Empirical data from the Los Angeles greater metropolitan area, analyzed within this paper, confirm this research finding. Nevertheless, and based on the same empirical data, the increase in transit ridership and the decrease in VMT for households living within a TOD's radius is not a straightforward relationship. For example, households with higher incomes tend to reduce their VMT by a greater amount than those with lower incomes; and households with lower incomes tend to increase their transit ridership by a greater amount than those with higher incomes. The extent to which affordable housing in TODs may contribute to VMT reduction and social welfare goals depends on the amount of affordable housing that municipalities can offer. Whether affordable housing in TODs can remain affordable after any initial covenants expire also matters. Unfortunately, existing research shows that: (a) properties located near light rail appear to be more valuable, holding all else equal; and (b) landlords in areas where prices are increasing tend to "opt out" of renewing affordability covenants, when possible. As a result, the construction of affordable housing in TODs—areas that are likely to experience rising property values—may not convey long-term affordability benefits without proper regulations in place.			
17. Key Words	18. Distribution Statement No restrictions.		
19. Security Classif. (of this report)	20. Security Classif. (of this page) Unclassified	21. No. of Pages 37	22. Price

DISCLAIMER STATEMENT

This document is disseminated in the interest of information exchange. The contents of this report reflect the views of the authors who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the State of California or the Federal Highway Administration. This publication does not constitute a standard, specification or regulation. This report does not constitute an endorsement by the Department of any product described herein.

For individuals with sensory disabilities, this document is available in alternate formats. For information, call (916) 654-8899, TTY 711, or write to California Department of Transportation, Division of Research, Innovation and System Information, MS-83, P.O. Box 942873, Sacramento, CA 94273-0001.

Affordable Housing in Transit-Oriented Developments: Impacts on Driving and Policy Approaches

April 2017

A White Paper from the National Center for
Sustainable Transportation

Marlon G. Boarnet, University of Southern California

Raphael Bostic, University of Southern California

Danielle Williams, University of Southern California

Raul Santiago-Bartolomei, University of Southern California

Seva Rodnyansky, University of Southern California

Andy Eisenlohr, University of Southern California



National Center
for Sustainable
Transportation



USC University of
Southern California

About the National Center for Sustainable Transportation

The National Center for Sustainable Transportation is a consortium of leading universities committed to advancing an environmentally sustainable transportation system through cutting-edge research, direct policy engagement, and education of our future leaders. Consortium members include: University of California, Davis; University of California, Riverside; University of Southern California; California State University, Long Beach; Georgia Institute of Technology; and University of Vermont. More information can be found at: ncst.ucdavis.edu.

Disclaimer

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the information presented herein. This document is disseminated under the sponsorship of the United States Department of Transportation's University Transportation Centers program, in the interest of information exchange. The U.S. Government and the State of California assumes no liability for the contents or use thereof. Nor does the content necessarily reflect the official views or policies of the U.S. Government and the State of California. This report does not constitute a standard, specification, or regulation.

Acknowledgments

This study was funded by a grant from the National Center for Sustainable Transportation (NCST), supported by USDOT and Caltrans through the University Transportation Centers program. The authors would like to thank the NCST, USDOT, and Caltrans for their support of university-based research in transportation, and especially for the funding provided in support of this project. The authors would also like to thank reviewers at the California Department of Housing and Community Development, California Department of Transportation, Governor's Office of Planning and Research, and the Strategic Growth Council for providing excellent review comments on preliminary versions of this white paper.

Affordable Housing in Transit-Oriented Developments: Impacts on Driving and Policy Approaches

A National Center for Sustainable Transportation Research Report

April 2017

Marlon G. Boarnet, Price School of Public Policy, University of Southern California

Raphael Bostic, Price School of Public Policy, University of Southern California

Danielle Williams, Price School of Public Policy, University of Southern California

Raul Santiago-Bartolomei, Price School of Public Policy, University of Southern California

Seva Rodnyansky, Price School of Public Policy, University of Southern California

Andy Eisenlohr, Price School of Public Policy, University of Southern California

[page left intentionally blank]

TABLE OF CONTENTS

Introduction	1
The Impact of TOD Affordable Housing on Vehicle Miles Traveled.....	2
Will Affordable Housing in TODs Remain Affordable in the Long Run?.....	7
Benefits and Costs of Affordable Housing near Transit	12
Affordable Housing Policy Approaches for Transit-Oriented Developments in California	14
Increase the Supply of Units, with a Strong Focus in TOD Areas	15
Increase Subsidies for Affordable Units in TODs and Near Transit	17
Take Steps to Reduce the Number of Affordable Units that Opt Out of Subsidies	19
Conclusion.....	19
References	21

Affordable Housing in Transit-Oriented Developments: Impacts on Driving and Policy Approaches

EXECUTIVE SUMMARY

This paper studies the intersection of policies promoting affordable housing, transit-oriented developments (TODs), and the reduction of vehicle miles traveled (VMT) in metropolitan areas. In particular, this paper focuses on the following questions:

1. Does locating affordable units in TODs increase or decrease VMT and thus emissions?
2. Is affordable housing in TODs still affordable in the long-term, i.e., beyond the expiration of the first minimum affordability period?
3. Do the benefits of affordable housing near transit outweigh the frequently higher costs of development in TODs?
4. What policy recommendations emerge from the analysis?

Existing research has shown that those who live within a TOD's radius (considered a half-mile in this paper) tend to have a lower VMT than if they lived elsewhere. Empirical data from the Los Angeles greater metropolitan area, analyzed within this paper, confirm this research finding. Nevertheless, and based on the same empirical data, the increase in transit ridership and the decrease in VMT for households living within a TOD's radius is not a straightforward relationship. For example, households with higher incomes tend to reduce their VMT by a greater amount than those with lower incomes; and households with lower incomes tend to increase their transit ridership by a greater amount than those with higher incomes.

The extent to which affordable housing in TODs may contribute to VMT reduction and social welfare goals depends on the amount of affordable housing that municipalities can offer. Whether affordable housing in TODs can remain affordable after any initial covenants expire also matters. Unfortunately, existing research shows that: (a) properties located near light rail appear to be more valuable, holding all else equal; and (b) landlords in areas where prices are increasing tend to “opt out” of renewing affordability covenants, when possible. As a result, the construction of affordable housing in TODs—areas that are likely to experience rising property values—may not convey long-term affordability benefits without proper regulations in place.

In addition, programs seeking to expand the amount of affordable housing may not offer sufficient financial incentives to real developers. A review of existing literature indicates land in TODs appears to be more expensive than land outside of TODs, which agrees with the premium of locating near light rail. Due to relatively fixed construction costs, additional up-front costs associated with affordable housing, and lower rent revenues from affordable housing than from market-rate housing, developers likely require subsidies larger than what are currently available via programs such as the federal Low-Income Housing Tax Credit (LIHTC) program.

While locating affordable housing in TODs may not provide developers with financial benefits, it appears to provide residents and their municipalities with multiple social benefits. As aforementioned, the inclusion of affordable housing in TODs appears to reduce household VMT for low-income families who otherwise would live outside TODs. It may also slow down the pace of gentrification and displacement in communities where transit stops are established. Finally, it should improve access to employment and other opportunities for lower income households.

After considering the literature and these facts presented, this paper recommends the following State policies to maximize social benefits:

1. **Increase the supply of affordable housing units, particularly in TODs**—in doing so, focus on relatively high-density figures and relatively low inclusionary zoning requirements.
2. **Offer more aggressive subsidies for the development of affordable rental housing units in TODs and near transit**—such increases could be funded by shifting existing subsidies from ownership units to rental units, or lowering the cap on mortgage interest deductions.
3. **Incentivize landlords to keep existing units affordable after initial covenants have expired**—this is especially true for Section 8 housing; potential policy changes could include: lengthening contract terms for landlords, reducing the administrative burden on landlords, and/or offering funds to defray the costs of housing Section 8 tenants.

With renewed focus on ways that housing and transportation policy intersect, and attention to the policy tools suggested in this paper, TODs can be part of the way forward toward a more environmentally friendly and economically just future California. While the low-income residents in TODs will not reduce their driving as much as higher-income residents, if both groups move to TODs from locations distant from transit, building TODs at higher densities can accommodate both low- and high-income residents and make substantial progress toward both VMT reduction and affordable housing goals.

Introduction

Transit-oriented development (TOD) is defined as “a type of community development that includes a mixture of housing, office, retail and/or other amenities integrated into a walkable neighborhood and located within a half-mile of quality public transportation” (Reconnecting America, n.d.) Affordable housing is defined by the U.S. Department of Housing and Urban Development as “housing for which the occupant(s) is/are paying no more than 30 percent of his or her income for gross housing costs, including utilities (HUD, n.d.b).” Affordable housing is frequently integrated into TODs because the two are perceived as complements for at least three reasons. First, including affordable housing presumably helps to temper the displacement and gentrification commonly assumed to follow in the wake of TOD. Second, incentivizing or mandating the inclusion of affordable housing in TODs not only provides lower-income families with particular socio-economic opportunities, such as better proximity to jobs, lower transportation costs, etc., but also increases the available stock of affordable housing, which is acutely needed in many communities.¹ Third, a policy imperative focusing on environmental sustainability has promoted the integration of affordable housing into transit-oriented developments, focusing particularly on the reduction of vehicle miles traveled (VMT).

The link between affordable housing and TOD’s environmental goals is particularly strong in California. The state Greenhouse Gas Reduction Fund, an account which receives proceeds from the state’s cap-and-trade auctions, funds the Affordable Housing and Sustainable Communities Program, which gives funding priority to producing and preserving affordable housing near transit stations as part of its efforts to reduce emissions and benefit disadvantaged communities (California Department of Housing and Community Development, n.d.). The Los Angeles Sustainability Plan (pLAn) reflects similar funding priorities (Los Angeles Office of the Mayor, 2015) and, in the Bay Area, state cap-and-trade revenues supplement the local Transit-Oriented Affordable Housing Fund which promotes equitable transit-oriented developments in part to assist low-income families reduce their transportation costs (Bay Area Transit-Oriented Affordable Housing Fund, n.d.)

This white paper reviews what is known about the relationship between TOD and affordable housing. We summarize the existing literature to determine whether the underlying assumptions that drive the inclusion of affordable housing in transit-oriented developments hold and to better understand the long-term implications of TOD-based affordable housing. We focus in particular on the following questions:

1. Does locating affordable units in TODs increase or decrease vehicle miles traveled and thus emissions?
2. Is affordable housing in TODs still affordable in the long-term, i.e., beyond the expiration of the first minimum affordability period?

¹ 5.9 million households in California are estimated to be cost burdened, i.e. they spend more than 30% of their household income in order to secure housing (Woetzel, et al., 2016). The majority of cost burdened Californian households (over 60%) reside either in the Los Angeles-Long Beach-Anaheim metropolitan statistical area (MSA) or within the Bay Area (Woetzel, et al., 2016).

3. Do the benefits of affordable housing near transit outweigh the frequently higher costs of development in TODs?
4. What policy recommendations emerge from the analysis?

This white paper is needed because, though existing research has explored various aspects of the relationship between TOD and affordable housing, the literature varies greatly in its use of methodological approaches, data, geography, and normative motivations. Furthermore, the assumptions regarding sustainability and the socio-economic benefits that underlie the linkage of these two development strategies, affordable housing and TOD, have not been fully investigated. In short, the two ideas have been linked based on intuition and common sense, but to our knowledge there have been no detailed literature reviews that have summarized what the research literature says about how affordable housing and TOD policies could or should be integrated. This paper helps bridge that gap.

The Impact of TOD Affordable Housing on Vehicle Miles Traveled

Two empirical relationships underpin the discussion of TOD, affordable housing, and VMT. First, low income persons drive less. Second, persons drive less when locating near TOD. Recently advocacy groups have put these two strands of the literature together to argue that locating affordable housing near TOD, by providing locations for low-income persons to live near rail transit, can meet two policy goals at once, reducing VMT while increasing California's supply of affordable housing (California Housing Partnership Corporation & Transform 2014; CTOD 2010a, CTOD 2010b). We first summarize the two strands of the literature, and then we note that the supposed seamless integration of VMT and affordable housing goals is not as tight as advocates had hoped. But first, let us summarize what the literature shows.

We have long known that higher income persons travel more. Santos, et al. (2011, Table 8, p. 18) use data from the Nationwide Personal Transportation and National Household Travel Surveys, from 1983 to 2009, to show that households that earn more than \$80,000 per year consistently take twice or more the number of trips that households earning less than \$10,000 per year (incomes in inflation adjusted 2001 dollars). Although more trip-making does not necessarily equate to more miles traveled, we would expect that the relationship between income and travel would be similar to the relationship between income and VMT. Data from the 2012 California Household Travel Survey, summarized in Table 1, confirm this.

The Los Angeles metropolitan area, embodied by the Southern California Association of Governments (SCAG) region², presents an excellent opportunity to analyze the intersection of affordable housing, sustainability, and TOD. The metropolitan area is rapidly growing its light rail transit system, going from: 0 stations before 1990, to 92 by 2017, to 110 anticipated by 2040.³ Concurrently, the share of housing considered affordable in the region has been

² The Southern California Association of Governments region is Imperial, Los Angeles, Riverside, Orange, San Bernardino, and Ventura Counties.

³ Per the Los Angeles Metro Transportation Authority's Projects page.

diminishing. The Los Angeles metropolitan area's median household expenditures on housing in 2013 was 30% of household income (Taylor 2015, Figure 11). This is 2%-5.5% higher than other California metropolitan areas and 7% higher than major metropolitan areas in other states (Taylor 2015, Figure 11). Similarly, other metropolitan areas that are expanding their light rail transit systems may increasingly encounter the same challenges with affordable housing as the Los Angeles metropolitan area.

Turning to VMT in the SCAG region, households earning more than \$150,000 per year have almost twice the household VMT as households earning less than \$35,000 per year. This result agrees with analyses by Newmark and Haas (2015, Table 3, p. 30), and Salon (2013, Table 11, p. 35), who show similar patterns of income and VMT analyzing, respectively, data from the CHTS for all of California and combined data from five travel surveys in California from 2000 through 2009.⁴ The second stylized result that suggests a nexus between affordable housing and VMT is the relationship between travel behavior and living near rail transit. A large literature has studied driving and transit ridership near TOD. The results document consistently strong associations between living near rail transit and both driving less and using rail transit more. Tal, Handy, and Boarnet (2013) summarize the relationship between a household's distance from rail transit and VMT, and they conclude that the literature suggests the moving a mile closer to a rail station reduces daily household VMT by from 1.3 to 5.8 percent. Bailey, Mokhtarian, and Little (2008) conclude that at a distance of 2.25 miles or less from a rail transit station, moving households a mile closer to rail transit would be associated with a 5.8 percent reduction in household VMT.

Table 1 shows data for the SCAG region that compare the travel behavior of households that live within ½ mile of a Los Angeles rail transit station to the travel behavior of households living beyond a half-mile of a rail transit station. The table shows, in columns from left to right, daily average household vehicle miles traveled, daily household rail transit trips, and daily household bus transit trips, in each case showing the difference in those values for households living within and beyond ½ mile of a Los Angeles rail transit station, using the 2012 California Household Travel Survey. Table 1 shows those within-beyond half-mile differences by income, but for now focus on the total sample values summarized on the bottom row. Households living within a half-mile of a Los Angeles rail transit station drive, on average, 16 miles less per day, take 0.19 more daily rail transit trips, and 0.4 more bus transit trips than households living beyond a half-mile from a rail station. These cross-sectional relationships compare nicely to the results from the econometric literature (e.g. Bailey, Mokhtarian, and Little, 2008; Cervero, 2007), which uses more advanced techniques to conclude that households living near rail transit drive less, and use transit more. Yet is the association between TOD residence and less driving evidence of causality?

Transportation scholars have spent decades examining whether the evidence on the relationship between land use and travel behavior shows a causal impact of TOD residence on

⁴ Salon (2013) combined travel survey data from the 2001 Caltrans statewide (California) travel survey, the 2009 California sample from the National Household Travel Survey, and metropolitan travel surveys from the San Francisco Bay Area (in 2000), the Los Angeles area (in 2000), and San Diego (in 2006).

travel. The counter argument is that persons who desire transit-oriented travel might move to TODs, and hence the effect would be residential selection rather than a causal effect of rail transit on household driving. A large literature has studied residential selection, and the issue is complicated both from an econometric and a policy perspective.⁵ Two different parts of the literature have recently pointed to the same conclusion – that the link between TOD residence and a combination of less driving and more transit use is likely largely causal. Cao, Handy, and Mokhtarian (2009) summarized evidence on residential selection and travel behavior, and they concluded that the evidence suggests that land use (including, by extension, TODs) likely plays a direct role. Cao, Xu, and Fan (2010) found that driving behavior was largely affected by residential location, rather than residential self-selection. Zhou and Kockelman (2008), in an econometric study, conclude that at least half and possibly more of the association between land use and VMT is due to direct effects of the built environment, not residential selection. In the most advanced econometric study of this sort to date, Duranton and Turner (2016) found that residential selection accounts for about one-sixth (or in some specifications less) of the association between household VMT and land use, an effect that is consistent with the upper bound of Zhou and Kockelman’s estimates of the direct effect of land use on VMT. Overall, a growing body of evidence suggests that residential selection plays only a small role in observed associations between land use and driving; the largest part of the association appears to be the direct effect of land use on reduced household VMT, rather than households with different travel preferences sorting into neighborhoods with different land uses.

Recent evidence from an experimental-control group study in Los Angeles reinforces these findings. Spears, Boarnet, and Houston (2016) studied travel behavior change among residents near Phase I of the Expo light rail line, which opened in stages in April and June of 2012. The researchers enrolled households in a seven-day travel study and categorized households as experimental households (those living within a kilometer of a new light rail station) and control households (those living from one to five kilometers of the new light rail stations.) Each group of households tracked their travel once before the new rail line opened (in Fall of 2011) and twice after opening (in Fall 2012 and Fall 2013). By studying travel changes for experimental and control group households before and after the line opened, this research design allows strong causal inference. This is particularly true given that approximately two-thirds of the study households had lived at their residence for at least five years before the first data collection (in 2011), suggesting that it is unlikely that near-rail households had been motivated to move to the study area to take advantage of the rail line. Spears et al. (2016) found that before the rail line opened the experimental and control households had no statistically significant differences in VMT or rail transit travel.

⁵ Salon (2013) combined travel survey data from the 2001 Caltrans statewide (California) travel survey, the 2009 California sample from the National Household Travel Survey, and metropolitan travel surveys from the San Francisco Bay Area (in 2000), the Los Angeles area (in 2000), and San Diego (in 2006). Also Naess (2014a and 2014b).

Table 1. Household daily VMT, rail trips, and bus per income level in the SCAG region

Income bracket	Avg. daily VMT per household			Avg. daily rail trips per household			Avg. daily bus trips per household			No. of Obs.	
	Households within station area (1)	Households outside station area (2)	(1) - (2)	Households within station area (3)	Households outside station area (4)	(3) - (4)	Households within station area (5)	Households outside station area (6)	(5) - (6)	Households within station area	Households outside station area
\$0 to \$9,999	6.7	13.7	-7.0	0.25	0.07	0.18	1.30	0.80	0.50	69	591
\$10,000 to \$24,999	11.8	25.3	-13.5	0.22	0.06	0.16	1.10	0.70	0.40	138	1721
\$25,000 to \$34,999	22.2	28.1	-5.9	0.39	0.04	0.35	1.10	0.40	0.70	85	1130
\$35,000 to \$49,999	28.2	32.9	-4.7	0.18	0.04	0.14	0.60	0.20	0.40	87	1585
\$50,000 to \$74,999	30.3	40.9	-10.6	0.27	0.03	0.24	0.20	0.10	0.10	103	2456
\$75,000 to \$99,999	34.1	44.2	-10.1	0.09	0.02	0.07	0.20	0.10	0.10	64	2158
\$100,000 to \$149,999	31.4	54.2	-22.8	0.14	0.03	0.11	0.20	0.10	0.10	58	2484
\$150,000 or more	50.2	55.6	-5.4	0.02	0.02	0.00	0.05	0.08	-0.02	47	2014
Total	24.4	40.4	-16.0	0.22	0.03	0.19	0.60	0.20	0.40	651	14139

Source: U.S. Department of Energy National Renewable Energy Laboratory (NREL) (2013): California Household Travel

Approximately 18 months after the rail line opened, the experimental households (those living within a kilometer of a new station) drove 9.75 miles less per day and took 0.21 more rail transit trips per day compared to control households.⁶ This supports the conclusion from the econometric literature that living near rail transit reduces driving.

Based on this type of evidence, advocacy and consulting groups have put forth a literature focused on environmental sustainability, TOD-area affordable housing, and reducing displacement of low-income TOD residents. The California Housing Partnership Corporation and Transform have argued that housing policy should pursue low-cost rental and ownership opportunities near transit, facilitating the linked goals of driving reduction and affordable housing (California Housing Partnership Corporation & Transform 2014). The Center for Transit Oriented Development has recommended a set of criteria to classify station areas by potential development scenarios and relate this to VMT targets to achieve GHG emission reductions (CTOD, 2010a, CTOD, 2010b). Lastly, Reconnecting America (2007) has proposed development typologies for the San Francisco Bay Area to achieve GHG emission reduction goals.

Yet if the literature is clear that the relationship between driving and TOD residence is in largest part causal, the relationship between driving changes, TOD residence, and income is not as simple as affordable housing advocates might hope. Table 1 shows that the gap between the “within half-mile” and “beyond half-mile” household VMT values is largest in the income range between \$100,000 and \$149,999, and smaller for households in income ranges below \$10,000 per year, from \$25,000 to \$34,999 per year, and from \$35,000 to \$49,999 per year. If we assume that those differences reflect driving changes that would occur if households of different income levels moved near transit, Table 1 implies that moving the relatively affluent \$100,000 to \$149,999 annual income households near rail stations will lead to the largest reduction in driving. Interpreted literally, Table 1 can be taken as evidence that high income housing near rail transit will reduce VMT more than affordable housing near rail transit. Of course, the unadjusted averages do not necessarily reflect what would happen if households moved from beyond to within a half-mile from a rail transit station, but other research using regression controls points to similar conclusions (see Boarnet et al., 2016.) The VMT data in Table 1 should give pause to persons who think that VMT reduction and affordable housing goals are seamlessly connected in TODs. Rather, we argue that the other columns in Table 1, and the state’s acute affordable housing crisis, suggest a more nuanced but every bit as urgent argument for building affordable housing in TOD neighborhoods.

The columns for average household daily rail and bus transit trips in Table 1 show that the income relationship for bus and rail ridership and near-rail residence is stronger at the lower income levels. The gap in average household daily rail and bus transit trips, for households within and beyond a half-mile from a rail transit station, is largest for households earning less than \$35,000 per year. If those patterns suggest the impacts of households moving to TOD (again, Table 1 is suggestive but not definitive in that regard), having lower income residents near rail stations may boost both rail and bus transit ridership, even if it appears that the higher

⁶ Private vehicle greenhouse gas emissions also dropped among near-rail (experimental group) households. See Boarnet, Wang, and Houston (2016).

income households will reduce driving more when living near rail. This illuminates an important argument for providing affordable housing in TOD neighborhoods – such housing can help improve the performance of California’s transit systems. Relatedly, the literature shows that changes in bus and rail trip-making do not typically result in one-for-one reductions in driving trips (see, e.g., Spears et al., 2016). Hence it is important for policy makers to understand that policies that may increase transit use, such as TOD affordable housing, while they will have an impact on transit ridership, will not result in reduction of driving that is one-for-one commensurate with increases in transit. The transit link is both vital for VMT reduction in TOD neighborhoods *and* more complex than a simply one-for-one displacement of driving for transit trips.

In addition to supporting transit, equity arguments provide a strong reason to build affordable housing near rail transit. Studies indicate that California has chronically underbuilt housing in the past three decades. Morrow (2013) notes the Los Angeles grew by 900,000 persons from 1970 to 2000, while the city’s zoning code was consistent with an increase of only 390,000 persons during that time – in effect, Los Angeles added half a million more persons from 1970 to 2000 than the zoning code anticipated, or allowed. Morrow (2013) goes into detail about how the under-supply implied by land use controls is the result of political pressures that, at their base, reflect anti-growth sentiment. Other California metropolitan areas have similarly under-supplied housing. The McKinsey Global Institute found that, from 2009 to 2014, California added 544,000 households but built only 467,000 housing units (Woetzel et al., 2016). While building by itself is unlikely to return high cost metropolitan areas to housing affordability, the law of supply and demand suggests that building must be a part of the state’s affordable housing policy. California metropolitan areas, due in part to statewide policies that include SB 375 (2008), are planning to accommodate a large fraction of the state’s future housing needs near rail transit. The SCAG 2016 Regional Transportation Plan / Sustainable Communities Strategy envisions 46 percent of all the region’s new housing during the next twenty-five years will be built within a half mile of fixed guideway rail transit or high frequency (15 minutes or less, peak hour) bus transit (SCAG, 2016, executive summary, p. 8). Building affordable housing near TOD must be an important part of the state’s housing affordability program, if for no other reason than that building near rail will be a large amount of future California residential development. Additionally, TOD affordable housing can help support the operational efficiency of the state’s massive investment in mass transit. In the next section, we discuss affordable housing programs generally, as an introduction to affordability policies that California metropolitan areas can pursue in TODs.

Will Affordable Housing in TODs Remain Affordable in the Long Run?

In this section, we consider the relationship between TOD and affordable housing over a longer time horizon. This is important because of the dynamic nature of urban economic and housing markets. Units that are affordable today could become unaffordable in the future for several reasons. Market forces associated with the introduction of new amenities could trigger increases in housing prices and rents, as the neighborhood becomes appealing to a broader, more affluent population. Further, the production and maintenance of affordable housing in

many markets is viable only if either supply- or demand-side subsidies are provided on an on-going basis. This is especially true in high cost coastal markets, but holds in many urban areas nationwide. The prospect that initially affordable TOD units may not remain affordable has important long-run implications for the successful pursuit of prevailing GHG and affordable housing goals.

Before diving into this issue more fully, it is useful to review housing affordability and the structure of the affordable housing sector so that the nature of these challenges and the potential solutions can be better illuminated. Regarding affordability, it is important to point out that the lack of affordable housing has become a more significant problem over the past 25 years. This is particularly true for renters. A recent analysis of changes in rental affordability between 2000 and 2010 found that affordability worsened for households at the 20th and 40th percentiles of the local income distribution in 236 of the 238 largest metropolitan statistical areas and worsened in every metropolitan area studied for households at the 60th and 80th percentiles of the local income distribution (Schwartz, et al., 2016). This dynamic was driven by a steady rise in rents coupled with a lack of income growth among renters. Collinson (2011) showed that these trends have been in effect since at least 1990, making it clear that the housing affordability challenge is a longer-term concern, which is why the longer-term perspective we take in this section is important.

The affordable housing stock includes both subsidized and unsubsidized units. Subsidized units are those in which the federal government provides a subsidy to either the builders, owners and operators of buildings (supply-side subsidies) or to tenants needing assistance (demand-side assistance) (Schwartz, et al. (2016). The bulk of these low-income housing subsidies – 90 percent – target renters as opposed to homeowners (Olsen, 2007). This stands in stark contrast to the distribution of federal housing subsidies more generally, where more than 70 percent target homeowners (Fischer and Sard, 2016).

Two federal housing subsidy programs, the Low-Income Housing Tax Credit (LIHTC) program and the Project-based Section 8 program, provide subsidies directly to owners of privately-owned buildings, who in turn agree to limit rents in return for the subsidy. The LIHTC program is a tax expenditure established through the tax code whereby for-profit companies receive a tax credit if they provide equity investments in projects to build or rehabilitate affordable housing (Eriksen and Rosenthal, 2010). Because of the credit, equity investors typically require lower (often zero) returns from the project on their investments, meaning that the program is providing a subsidy to the developer (and potentially owner-operator) of the housing. After defining minimum affordability and eligibility requirements, the program delegates selection criteria for projects to receive the credit to the states. In all states, developers using the LIHTC program agree to keep units rent-restricted for a minimum of 15 years, with some states requiring restrictions for over 50 years. The LIHTC program is now the primary vehicle through which rental housing (not just affordable housing) in the United States is created (Eriksen and Rosenthal, 2010). In California specifically, use restrictions on affordable units financed by the LIHTC program last for 55 years (CA Tax Credit Allocation Committee, 2017). This 55-year period applies to additional rental housing financed by other California housing programs, such as the

California Department of Housing & Community Development's (HCD) Multifamily Housing Programs (HCD, 2017).

In the Project-based Section 8 program, private owners of affordable housing are provided with subsidies to build or renovate units that will have rent restrictions. Rents are set based on prevailing rents in the market, though they cannot exceed 110 percent of the HUD-determined fair market rent (HUD, 2016). Landlords enter into contracts with local public housing contracts that specify how long the units will remain rent-restricted (currently 10 years, but it has been as long as 25 years).⁷

Tenants receive subsidies through the Public Housing and Housing Choice Voucher programs. Tenants are indirectly subsidized via the federal Public Housing program, in which the federal government, through local public housing authorities, directly manages housing units and keeps the rent burdens relatively low. Unlike the landlord subsidy programs, in which non-governmental organizations build the housing, public housing projects were built by the federal government.⁸ Tenants in public housing projects pay 30 percent of their income for rent, with the local housing authority receiving federal funds to cover any costs exceeding this. Finally, the Housing Choice Voucher (HCV) program, also known as the Section 8 voucher program, provides lower income households with a voucher that commits the federal government to provide funds to landlords to make up the difference between a maximum fair market rent and 30 percent of the household's income. The landlord in turn agrees to maintain the unit to a specified level of quality and the tenant agrees to abide by rules of tenancy established by the landlord.⁹

These four programs are the largest housing subsidy programs and account for about 5.5 million housing units (Collinson, Ellen and Ludwig, 2015, Schwartz, et al. 2016). In terms of composition, the number of subsidized units associated with the LIHTC and HCV programs has grown in the past 25 years, while the number of units covered by the Project-based Section 8 and public housing programs has remained steady (in the case of Project-based Section 8) or slightly declined (in the case of public housing) (see Figure 1) (Schwartz, et al. 2016). Importantly, these units are sufficient to house only about 30 percent of the families who face acute housing affordability challenges, defined as paying more than 30 percent of their income for housing (Dreier and Bostic, 2016). The remainder of families must seek their housing through the unsubsidized stock, the units of which will be priced according to prevailing market conditions. This means that units can either be affordable or unaffordable, depending on housing demand and supply dynamics, the economics of building housing (which is discussed more fully in the next section), and household incomes. Housing units that are unsubsidized and affordable to households below the region's median income are often referred to as "naturally occurring affordable housing." A recent study estimated that there are 5.5 million units of naturally occurring affordable rental housing in urban areas (Pyati, 2016). Those households not able to secure either a subsidized unit or a naturally occurring affordable unit

⁷ For more on the project-based voucher program, see HUD (2016).

⁸ The federal government placed a moratorium on its building of affordable housing in 1973 (Schwartz, 2015).

⁹ For more on the HCV program, see Schwartz (2015).

are left to fend in the remaining market of higher priced rental units. Choices for lower income people competing in this sector of the market include paying a larger (i.e., high) share of income for housing, living in crowded housing conditions, or perhaps homelessness.

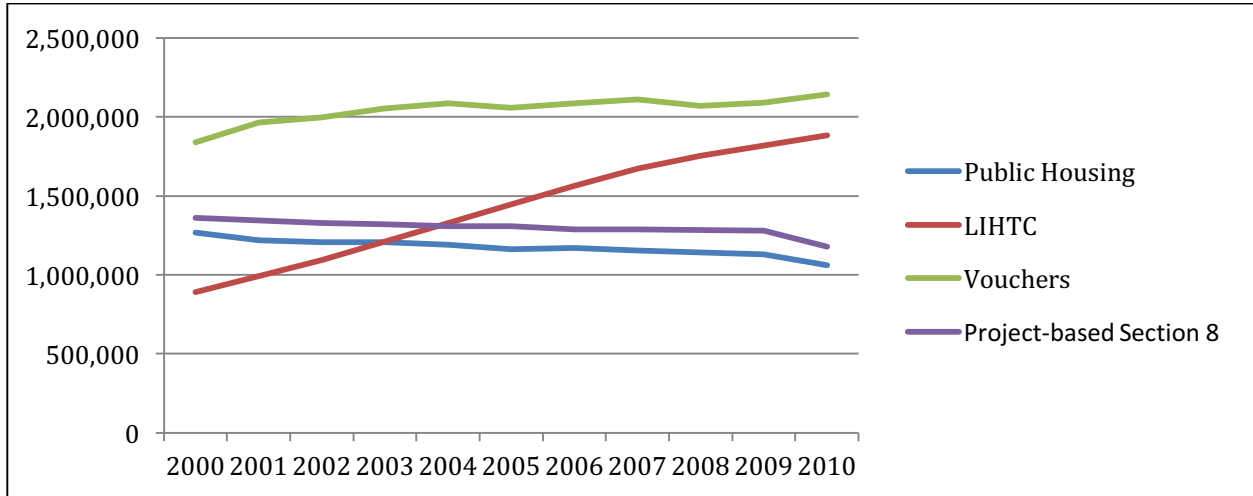


Figure 1. Units of federally subsidized housing, by program (2000-2010). Reproduced from Schwartz, et al. (2016).

With this background, we now turn to exploring what is known about local housing market dynamics upon the introduction of transit. A sizable literature has explored the relationship between housing prices and neighborhood amenities. For example, it is commonly recognized that house prices are positively associated with school quality (Jud and Watts, 1981; Ries and Somerville, 2010). Moreover, the evidence is clear that the introduction of a neighborhood amenity or elimination of a disamenity is associated with increases in housing prices. An example of the former is the introduction of new permanent parkland in a neighborhood, which has been found to increase the values of properties close to the new open space (Riddel, 2001). The remediation of brownfields – sites blighted with environmental contamination – is associated with significant increases in the values of properties proximate to the brownfield site, which is an example of the latter (Haninger, Ma and Timmons, 2012; De Sousa, Wu, and Westphal, 2009; Noonan, Krupka, and Baden, 2006).

Regarding light rail transit in particular, there is evidence suggesting that it is viewed as a neighborhood amenity in the same way. Atkinson-Palombo (2010) found that values in mixed-use walk-and-ride neighborhoods in Phoenix located near light rail transit are 6 and 20 percent higher for single-family homes and condominiums, respectively. Hess and Almeida (2007) likewise found a positive value relationship for housing in Buffalo located closer to transit stations. Looking at commercial properties, Cervero and Duncan (2002) similarly found a value premium, ranging from 23 to 120 percent, associated with proximity to transit stations. Bowes and Ihlandfeldt (2001) decomposed the overall effect to determine the contributions to value of reducing commuting costs, increasing access to retail establishments, negative station

externalities, and increased access for criminals to the neighborhood, and found all to be important, though their relative importance varies with distance to downtown and the neighborhood's median income.

Regarding the response of housing prices to the introduction of light rail, as with general amenities, the literature has found a positive relationship. Goetz, et al. (2010), for example, found positive impacts on values associated with the opening of the Hiawatha line in Minneapolis. The positive impacts were not uniformly experienced, with other land uses such as highways intervening to mitigate positive changes. Looking at three Canadian cases, Grube-Cavers and Patterson (2015) discovered positive relationships in two of the cases, consistent with the Goetz, et al. (2010) finding of some variation in effect across geographies. Immergluck (2009) found that property values increased *in anticipation* of the opening of the light rail transit associated with the Beltline redevelopment project in Atlanta, Georgia. This is consistent with many literatures that show that markets can move upon the announcement of a project or business action, before those projects and actions are consummated and completed.

The literature thus signals quite strongly that the introduction of rail transit is likely to be associated with upward pressure on house prices, meaning that there is some probability that units that are initially affordable will not be in the future. The implication of this varies with the type of housing. Unsubsidized units that were not in the affordable stock initially are very unlikely to become affordable in the future in this kind of market. Regarding naturally occurring affordable housing, one might expect these to become less affordable over time, perhaps even unaffordable, as landlords increase rents owing to their increased pricing power.

As discussed above, subsidized housing includes units that are permanently rent-restricted (via the public housing program) and that are rent-restricted for a contractually-established length of time (via the LIHTC, Project-based Section 8, and Housing Choice Voucher programs). Permanently restricted units are largely immune to these market forces, and will presumably remain affordable. However, landlords of units whose restrictions are time-limited have a choice when the restriction period ends – they can either choose to enter another contract that continues the restrictions or they can “opt out” and make their unit available to the broader market at prevailing market rents. What happens when landlords face this choice?

Though the literature on opting out is quite small, the answer that has emerged from the research is that landlords do choose to opt out, with opt out rates being significantly higher in “high opportunity” and “hot” neighborhoods. Ellen and Welescouch (2015) observed that opt out rates are larger in higher cost and higher amenity neighborhoods, for example. Reina and Begley (2014) found elevated opt out rates from a New York project-based subsidy program by landlords who own properties located in neighborhoods with high property value growth. Finally, while Lens and Reina (2016) found that opt outs from the project-based section 8 program were more common in lower-income neighborhoods, the effect was localized to improving lower-income neighborhoods. Thus this result also supports the view that the upward pricing pressure that transit will spark is likely to increase opt outs.

Reina (2016) shows that these opt outs are costly to tenants, who face the prospect of incurring moving costs and, if they are unable to find a new subsidized unit, higher ongoing housing

costs. Thus, the introduction of transit could potentially accelerate the housing affordability challenge, which works at cross purposes with one of the primary stated goals of integrating TOD and affordable housing. This body of evidence suggests that policies should be considered to ensure that any affordability gains achieved through the development of TOD are not lost as the market evolves. We review possible policy options in the closing section.

Benefits and Costs of Affordable Housing near Transit

The next issue the white paper focuses on is how to think of affordable housing near transit from a benefit-cost perspective. We first note that no formal benefit-cost analysis of locating affordable housing near transit has been conducted. This is a hole in the literature that deserves attention. Given this reality we cannot in this paper answer the question of whether the benefits of affordable housing near transit outweigh the frequently higher costs of development in TODs. Rather what we can do is outline both the benefits and costs of locating affordable housing near transit.

Much of the motivation for promoting affordable housing near transit has focused on three perceived benefits, all of which have been discussed previously. First, such housing would reduce the cost of living burden faced by lower-income households, who have to deal with covering high housing costs and getting to and from transit stations, which represent their primary mode of transportation more frequently than for higher income households. We have shown that affordable housing shortages are common in many markets and place significant burdens on households, particularly those with lower incomes. In addition, there is evidence demonstrating that the cost of getting to and from transit can place substantial burdens on households (see, for example, DeMaio, 2009). Second, an argument has been made that allowing heavy transit users to live closer to transit stops will increase ridership, thereby making operating transit more viable and profitable (see the data in Table 1).

Finally, it has been argued that locating affordable housing near transit reduces greenhouse gas emissions by causing residents to drive less, and we have presented evidence in Section 3 supporting this claim. Such evidence motivated the passage of legislation, such as California's law creating the Greenhouse Gas Reduction Fund and the Affordable Housing and Sustainable Communities program, that mandates that resources be devoted to providing such housing. Boarnet, et al. (2016) provides nuance to this finding. That analysis, and the data in Table 1, supports the view that locating affordable housing near transit does reduce driving, but further suggests that households with higher income may reduce driving even more than do lower income households when locating near rail transit (Boarnet, et al., 2016). Note, though, that Table 1 indicates a more unambiguous association between low income, residence near rail transit, and increases in transit ridership.

To consider the costs of locating affordable housing near transit, it is useful to view the housing from the perspective of developers. Unless affordable rental rates are close to the prevailing market rates, affordable units will be viewed as costly by developers because they generate less cash flow than could otherwise be achieved. If the affordable rates were not much lower than market rates, then it is possible that developers could produce affordable units and still exceed

their minimum required rates of return to remain a viable operation. However, this is often not the case, as affordable rents are often significantly lower than market rents.

In many markets, especially high cost markets, this is driven by the high price of acquiring land coupled with an inability to build at sufficient densities. A California Legislative Analyst report found that the cost of residential land in coastal California was nearly eight times the cost of residential land in the average U.S. metropolitan area (California Legislative Analyst's Office, 2015, p. 13). As noted in the report, the impact of this high cost on rents could be mitigated if buildings had significant densities that allowed the cost to be spread across many units. Unfortunately, such densities have not been realized in most California cities, causing the land cost to be applied to a smaller number of units, which in turn must carry high rents. Importantly for the current discussion, the high cost of land is an especially acute concern for TOD buildings, because evidence suggests that TOD land costs at least 23 percent more than non-TOD land (Cervero and Duncan 2002).¹⁰

Given these realities, the only way that providing affordable housing near transit is not costly is if other aspects of providing affordable housing reduce the cash flow gap between affordable and market rate development. In order to generate similar profit margins, then, affordable housing must offset the lower revenues from rent via: (1) lower development costs; (2) lower recurring/maintenance costs; and/or (3) rent subsidies, including density bonuses, not available for market-rate housing. The remainder of this section explores whether these can be achieved in the development of affordable housing in TODs.

Outside of land, the largest cost for developing new and rehabilitating existing buildings is construction, which features the deployment of labor and materials, such as bricks, steel, and concrete, to erect a structure. Unfortunately, the costs of labor and materials are largely fixed. Developers cannot differentiate labor costs by housing type, and many building standards apply regardless of housing type as well. Furthermore, if a developer of affordable housing would like to receive rent subsidies, such subsidies carry federal mandates for the building and units. These include disability accommodations (established via the Americans with Disabilities Act), energy efficiency standards (*e.g.* ENERGY STAR), and public health standards (*e.g.* lead-free environments) (WHTT; Beavers, 2015). These stipulations, while potentially resulting in lower recurring and maintenance costs and providing a number of social benefits, increase the up-front development costs of such affordable housing. As any reductions in recurring and maintenance costs that occur in the future will be discounted (from an economic and accounting perspective), it is possible that increased up-front costs will outweigh the future savings. These facts taken together strongly suggest that affordable housing will in general not have significantly lower development costs than market-rate developments and that lower recurring and maintenance costs are unlikely to meaningfully offset this.¹¹

¹⁰ One strategy some developers have employed to reduce land costs is to develop in less desirable locations (see, for example, Welch (2013)). However, this strategy adds transportation and other costs to residents that directly counteract the cost benefit of the affordable housing.

¹¹ It should be noted that rehabilitation of existing buildings is generally much more cost-effective than new construction (25 to 45 percent lower cost) for providing affordable housing (Wilkins, et al., 2015).

Current policies to produce affordable housing can widen these differentials. As one example, inclusionary zoning – a policy that requires developers to reserve a fixed percentage of all units to be affordable – has been documented to increase costs in several ways (Hickey, 2013). As another, the requirement to include parking structures for infill projects can add costs of \$15,000 to \$35,000 per space. Mandating taller buildings as opposed to wider ones forces developers to use steel and concrete frame construction as opposed to the less expensive wood construction and adds costs in terms of elevator and safety features. A National Association of Home Builders (NAHB) Research Center study and a more recent industry report found that the use of steel framing increased the cost of constructing a house by about 15 percent (NAHB Research Center, 2002; Kompareit.com, 2016).¹² Finally, to preserve affordability over the long run, some inclusionary zoning policies place caps on equity gains, which limits the resale potential of the property.

This leaves subsidies as the remaining option for reducing the cash flow disparity between market rate and affordable housing that makes the latter generally untenable from a profitability perspective. As discussed earlier, there are rental subsidies available for the production and support of affordable housing, but these have not been sufficient to fully satisfy the need for affordable housing in most markets. Thus, it is unlikely that subsidies will be sufficient to make affordable housing near transit a common reality without explicit governmental mandates that require developers to provide affordable units in their TOD projects.

To restate, this is a classic externality problem in that developers may not capture any direct monetary benefit from placing affordable housing in TODs. While there are potential social benefits from locating affordable housing near rail transit, there are likely no meaningful cost advantages for private affordable housing construction near transit. In the next section we discuss policies that can address that issue.

Affordable Housing Policy Approaches for Transit-Oriented Developments in California

This white paper has considered the implications of building affordable housing near transit in the context of environmental sustainability goals as well as housing affordability concerns by reviewing and summarizing the existing literature. Two findings emerge. First, the location of affordable housing near transit provides meaningful benefits, particularly for lower-income residents and transit operators, though there are costs to developers and environmental goals may not be achieved as fully as possible. Second, transit stations are likely to trigger market forces that place upward pressure on house prices and rents, meaning that housing

¹² These estimated cost differentials likely understate the true cost difference, as they are based on estimates of cost of building the identical house. The taller buildings arising from the application of inclusionary zoning policies will likely be larger in area than the buildings that would be developed in the absence of such policies due to the use of density bonuses, which are common in inclusionary programs, and other features (Hickey, 2013).

affordability is likely to be increasingly threatened for many families, especially those with lower incomes, who generally rely more upon transit.

In thinking about steps forward from a policy perspective, we suggest a three-pronged approach: (1) increase the supply of all units, with a strong focus in TOD areas, (2) increase subsidies for affordable units in TODs and near transit, (3) take steps to reduce the number of affordable units that opt out of subsidies. Together, these represent a comprehensive policy approach that will increase the positive impact of whatever affordable housing is produced near transit. They first recognize that California's housing markets are not currently producing enough housing, and any solution to the affordable housing problem must fix housing markets so that production more closely matches needs. Importantly, the approach embraces the fact that there are benefits to locating affordable housing near transit. Finally, it tries to reduce the pace that affordable housing units will be lost in the face of powerful and inevitable market forces.

Increase the Supply of Units, with a Strong Focus in TOD Areas

An important driver of California's housing crisis has been the fact that the production of housing units has not kept pace with the inflow of families to the state. The State Department of Housing and Community Development projects that population growth in the state requires 180,000 new homes annually, yet housing production has met that level in only 3 years since 2000 (California Department of Housing and Community Development, 2017: Figure 1.1). For the years 2008 to 2015, new annual production never exceeded 100,000 units, with production being less than 60,000 units annually each year from 2009 to 2012 (California Department of Housing and Community Development, 2017: Figure 1.1). This has created an ever-increasing shortage of housing units that, perhaps not surprisingly, has resulted in housing costs rising at a rapid pace.

A key element of this challenge is that land use decisions on development are local and cities and neighborhoods face a problem of the commons. Residents of each community are acutely sensitized to the costs of new development, especially where affordable housing is concerned, leading them to oppose such development using the argument that others in less burdensome situations can provide it. This argument is levied in virtually every community, with the result that each decides to produce fewer units, and a broad shortage results.

In California, such residents have many tools to block or substantially slow the pace of development. For example, they can drive changes in zoning codes that explicitly prevent significant new developments and any possible increases in building density (Levine, 2005). Moreover, zoning codes are changed relatively infrequently, meaning that once these provisions are established, they will prevail for many years. C.J. Gabbe (2016), in a recent UCLA Ph.D. dissertation, documented that from 2002 through 2014, Los Angeles changed the zoning on less than 0.2 percent (to reiterate, less than two-tenths of one percent) of the city's land each year. This appears to lag other cities, and may reflect the large barriers to residential building and density increases in California. New York, based on research cited in Gabbe (2016), changes the zoning on 20 percent of the city's land area from 2003 through 2009. Further, they

can use existing laws such as the California Environmental Quality Act (CEQA) to challenge projects on the grounds that they will have an adverse environmental impact. CEQA challenges can delay project for years, and often result in developers agreeing to downsize their projects or abandon them altogether (Hernandez, Friedman, and DeHerrera, 2015). Moreover, the cost of defending a CEQA challenge increases the cost of development, which reduces the likelihood that any units in such buildings will be priced affordably.

It has been long recognized that the solution to any problem of the commons is for a higher level of government to establish rules that prevent the negative outcome. In this case, we believe it is essential that the State take leadership in promoting the production of housing, with a particular focus on affordable housing. In the past year, state leadership has signaled some willingness to play this role. The legislature considered a “by right” bill proposed by Governor Brown that would have given developers an explicit right to build if the proposed building was in conformity with existing local zoning codes and reserved some units as affordable (Li, 2016). Unfortunately, the bill did not make it out of the Assembly (Li, 2016). We encourage state leadership to consider this and other measures that would have the effect of incentivizing the production of market rate and affordable housing. While we believe a “by right” type of legislation would be most effective – by right development exists in many other states – policymakers should not limit their efforts to pursuing only this policy direction. CEQA is ripe for review, and we suggest exploring policies that limit the ability to pursue CEQA challenges for certain types of development where environmental impact is effectively understood. Certain infill developments, where an existing building (often large and old) is replaced by a larger building that includes state-of-the-art environmentally friendly features, may represent one such category of developments. Strengthening the enforcement elements of the Regional Housing Needs Assessment process, by which affordable housing obligations are allocated to every jurisdiction in the state, is another possible item to explore.

One cannot discuss state leadership on a land use issue without acknowledging that this is an extremely sensitive political issue. The notion of local control of land use is widely recognized and treasured, and any encroachment on this is likely to be met with fierce resistance. However, the dire nature of the affordable housing crisis, and the fact that the crisis is steadily deepening, argues for bold measures by leading policymakers. A clear change in direction is needed.

At the local level, jurisdictions should consider how to interact inclusionary policies with baseline density allowances. As noted above, the Boarnet, et al. (2016) model estimates suggest that TODs developed with higher densities and lower inclusionary percentages have a larger positive impact in terms of both the availability of affordable housing and the reduction of VMT and GHG. A comparison of two possible scenarios considered in Boarnet et al. (2016) illustrates the importance of increasing density near rail transit stations. The authors modeled the effect of two density changes within a half mile of existing Los Angeles metro stations. Boarnet et al. (2016) found that increases in density by an average of 1.5 dwelling unit per acre (du/acre) in those half-mile areas, while requiring a very aggressive 60 percent of new development to be affordable, would reduce annual VMT by 104.8 million miles and produce 58,375 new affordable units. Modeling a more aggressive density increase, from today’s

existing station-area (half-mile) average of 8.1 du/acre to an average of 14.9 du/acre (an 84 percent increase in average TOD area density), while requiring a considerably less ambitious 20 percent of new units to be affordable, would reduce annual VMT by 641.6 million miles and produce 273,222 new affordable units. In short, increasing Los Angeles' average station area density by 84 percent with moderate affordable housing requirements produces from five to six times as much impact on key policy variables than the less impactful "low density / high inclusionary" scenario.

That noted, if California cities increased density near TOD areas (which is consistent with leveraging the state's investment in rail transit), each jurisdiction will have to assess what combination of density and inclusionary requirements is palatable in their municipality given local political dynamics. We note that density increases near stations coupled with attention to affordable housing can make progress toward both affordable housing production and VMT reduction. We believe there is an imperative for local policymakers to use political capital to make progress on this front. We also encourage state policymakers to consider ways in which they might provide incentives for localities to implement policies that allow increases in both residential building and affordable housing construction, as the commons problem makes it less likely that such approaches will be pursued at scale without either state-provided incentives, state requirements, or a combination of both.

Increase Subsidies for Affordable Units in TODs and Near Transit

In trying to craft a solution to the affordable housing crisis, one must face the basic truth that is there an imbalance between the demand for affordable housing units and the supply of affordable units. We noted earlier that the approximately 6 million subsidized units account for about one-third of the total need among lower-income, which suggests that roughly 18 million lower-priced units would be required to fully satisfy the existing need. Given the recent estimate of 5.5 million naturally occurring affordable housing units, it is clear that there is a sizable shortfall – on the order of 7 million units – of this class of housing. The distribution of excess need is likely not 36 percent (6.5/18) in all markets. Rather, there is probably relatively little excess need in many markets in the middle of the country and much higher excess need in high cost markets, many of which are in California.

While some might look to the private market as the natural leader of an effort to fix the affordable housing problem, we are skeptical. While more building can slow price appreciation, it is unreasonable to expect that building could lower prices sufficiently to allow naturally occurring affordable housing to meet all need. The gap is simply too large. Given the very slow production experience in California over the past 15 years, we see no reason to expect an explosion in new development. Further, experience internationally suggests that housing in world cities has grown more expensive likely due in large part to increasing value of major cities as centers for production and commerce (The Economist, 2015). These realities mean that we will have to look to subsidies as an important part of the solution. We note that there is also a transit justification in support of deeper provision of subsidies. Given that lower income

residents use transit more (Table 1), there is a transit system functionality argument to provide subsidies to affordable housing in TODs.

The question, of course, is where to find the additional subsidy. First, it is important to note that recent policy decisions have moved California in the opposite direction. When Governor Brown eliminated the state's redevelopment agencies, he removed nearly \$1 billion annually that was earmarked for the development and preservation of affordable housing. While clearly not sufficient to satisfy existing needs – a back of the envelope estimate suggests that a \$1 billion annual expenditure in affordable housing (Blount, et al., 2014) would produce enough units to fill the current deficit in about 50 years – its loss means that the mountain to be climbed for success is just that much steeper.

Our back of the envelope estimate on how effective the redevelopment funds would be suggests that it is highly unlikely that a single source of subsidy will be sufficient. Rather, we will need as many subsidy sources as possible. There are several possibilities that policymakers should explore. First, given that there are already significant subsidies that are targeted toward housing, policymakers could adjust the allocation such that more was targeted towards rental markets than ownership markets. The mortgage interest deduction is a good candidate for implementing such a shift, as deductions are now available for second homes and high cost homes for which there is little policy justification for providing subsidies and whose owners likely do not need the subsidies. Capping the deduction to apply to homes costing no more than, say \$500,000 (perhaps pro-rated to larger amounts for high cost markets) would free \$10 to \$15 billion that could be used for affordable housing (Lu, Rosenberg, and Toder, 2015). Regardless of federal action on this front, states could also choose to enact such a policy. California has taken a first step in this direction, with the Assembly introducing a bill that would eliminate the mortgage interest deduction on second homes and use the resulting \$300 million that would be raised for affordable housing (Egelko, 2016).

State and local jurisdictions have the means to generate funds that can be used for subsidy on their own. Affordable housing trust funds have been created in some cities, including San Francisco (via a voter proposition) and Los Angeles (via City Council direction and using federal and city funds) (Office of the Mayor of San Francisco, 2012; Los Angeles Housing and Community Investment Department, n.d.). Jurisdictions can also choose to tax themselves to raise funds for affordable housing. Los Angeles County recently did this to raise funds to address the regional homelessness problem (Holland and Smith, 2016). Local policymakers should consider pursuing all of these strategies.

Land value capture policies represent another potential source of subsidy for affordable housing. Land value capture policies are defined as policies that “mobilize for the benefit of the community at large some or all of the land value increments...generated by actions other than the landowner's” (Smolka, 2013, p.2). There are many public investments that fit this model, such as the investment in light rail transit in Los Angeles, which past experience suggests will increase the values of properties located near stations (Goetz, et al., 2010; Grube-Cowers and Patterson, 2015; Immergluck, 2009). Smolka (2013) and Ingram and Hone (2012), among others, highlight many different possible approaches to implementing land value capture

policies at the local level. We encourage policymakers to review these and other resources that offer examples of how to put such policies in place.

Take Steps to Reduce the Number of Affordable Units that Opt Out of Subsidies

One concern about the affordability challenge that we highlighted in this review is that existing affordable units might be lost due to market dynamics. One important source of affordable housing that is at risk is the units that support the Section 8 programs, because landlords can choose to opt out of their contracts and place their units on the open market. Given this is a recognized issue, we encourage policymakers at the state and federal levels to take steps to try to reduce the opt-out rate from these programs.

Reduction of the opt-out rate from these programs will require making participation in the program more attractive. The program has long been criticized for being overly bureaucratic, such that landlords spend considerable resources to comply with regulations (Marr, 2010). For example, depending on how a building is funded, a landlord can be subjected to multiple physical inspections in a year, with varying standards defining being in compliance (Rental Policy Working Group, 2011). The Obama Administration established a working group to examine many such bureaucratic disincentives to program participation, and we encourage policymakers to review the issues raised by the working group and implement solutions as possible (Rental Policy Working Group, 2011).

Similarly, there is conventional wisdom that participants in the Section 8 programs impose more wear on units than other renters (see, for example, Royal Rose Properties, n.d.). While there is not clear evidence that this is true, the belief that it is could lead some landlords to decide to opt out or not participate in the first place. One way to address such concerns is to create a fund that landlords can draw upon if the cost to renovate a unit recently vacated by a Section 8 program participant exceeds some threshold amount. This would ensure that landlords incurred no additional operating costs from participating in the Section 8 programs. Finally, in addition to considering these recommendations, we encourage policymakers to consider lengthening the contract term for landlords. This would reduce the frequency with which the opt-out issue would have to be dealt with.

Conclusion

Building affordable housing in TODs is important for two reasons. California has an affordable housing crisis, due to decades when the state has built less housing than needed to accommodate population growth and an insufficient supply of subsidies for affordable housing. At the same time, persons who live in TODs drive less and use transit more. Providing TOD housing opportunities for low-income residents can increase transit ridership, thereby support state and local goals for rail and bus transit, and provide those low-income residents with lower-cost access to employment opportunities. Therefore, the colocation of affordable housing and light rail transit stations may introduce greater equity in employment access for lower income residents. While low-income residents in TODs will not reduce their driving as much as higher income residents, if both groups moved to the TOD from locations distant from transit, building TODs at higher densities can accommodate both low- and high-income

residents and make substantial progress toward both VMT reduction and affordable housing goals.

We suggest a three-pronged policy approach that focuses on: (1) Building more housing, both market-rate and affordable, particularly in TOD areas, (2) Increasing the subsidies for affordable housing, and (3) Reducing the rate that existing affordable units will opt out of affordability programs. There are several possible policy instruments for each overall goal. We encourage state officials to recognize that local governments are trapped in a “tragedy of the commons.” At the municipal level, the possible downsides of increased density are typically most evident, leading each neighborhood to hope that needed housing is built somewhere else. When those tensions are repeated in each municipality, housing construction does not accommodate population growth, which is what has happened in California for the past few decades. State policies that either require or incentive local housing production, or both, will be necessary.

Having said that, increasing housing supply, by itself, will not solve the affordability problem. Evidence indicates that building near transit, if anything, will be more expensive than building elsewhere, and to accommodate the public interest in having affordable housing near transit California should explore ways to increase funding for affordable housing in TOD areas. Several options are possible, including land-value capture or state action that would open new funds for affordable housing subsidies. There are strong policy arguments for targeting such subsidies to TOD areas, while of course recognizing that there are needs in all parts of the state. Lastly, policy-makers should take action that reduces the incentives for property owners to opt out of affordable housing agreements when the affordability period expires – a point that requires particular and urgent attention as many TOD areas in California gentrify, making market-rate housing an attractive option for landlords.

The instinct that TODs are an opportunity to make progress on two fronts is correct. California has a housing affordability crisis and ambitious environmental goals, and policy changes can make development near rail transit an important part of the solution. Yet the policy landscape is complex, and will require coordination between state and local governments and policy innovation. With renewed focus on ways that housing and transportation policy intersect, and attention to the policy tools suggested here, TODs can be part of the way forward toward a more environmentally friendly and economically just future California. While the low-income residents in TODs will not reduce their driving as much as higher income residents, if both groups move to TODs from locations distant from transit, building TODs at higher densities can accommodate both low- and high-income residents and make substantial progress toward both VMT reduction and affordable housing goals. At the same time, a lack of affordable housing in TODs may result in the displacement of lower income residents to areas with lower levels of public transit access. This has implications for aggregate levels of VMT and transit access equity in the region. Future research should consider these additional consequences.

References

- Atkinson-Palombo, Carol. "Comparing the capitalisation benefits of light-rail transit and overlay zoning for single-family houses and condos by neighbourhood type in metropolitan Phoenix, Arizona." *Urban Studies* (2010).
- Bailey, L., Mokhtarian, P.L., and Little, A. 2008. *The Broader Connection between Public Transportation, Energy Conservation and Greenhouse Gas Reduction*. ICF International.
- Bay Area Transit-Oriented Affordable Housing. (n.d.). Bay Area TOAH fund. Retrieved on November 1, 2016 from <http://bayareatod.com>
- Blount, Casey, Wendy Ip, Ikuo Nakano, and Elaine Ng (2014). *Redevelopment Agencies in California: History, Benefits, Excesses, and Closure*, Economic Market Analysis Division working paper EMAD-2014-01, Office of Policy Development and Research, U.S. Department of Housing and Urban Development, January.
- Boarnet, Marlon G. Raphael W. Bostic, Seva Rodnyansky, Raul Santiago-Bartolomei. 2016. *Environmentally Sustainable and Affordable Housing Near Transit in Los Angeles*. Working paper, first presented at Association of Collegiate Schools of Planning conference, 2015.
- Boarnet, Marlon G., D. Houston, G. Ferguson, and S. Spears, "Land Use and Vehicle Miles of Travel in the Climate Change Debate: Getting Smarter than Your Average Bear," in *Climate Change and Land Policies*, edited by Yu-Hung Hong and Gregory Ingram, Cambridge, Massachusetts: Lincoln Institute of Land Policy, May, 2011, ISBN 978-1-55844-217.
- Boarnet, Marlon G., Xize Wang, and Douglas Houston, "Can New Light Rail Reduce Personal Vehicle Carbon Emissions? A Before-After, Experimental-Control Evaluation in Los Angeles," *Journal of Regional Science*, forthcoming, available online, early view, at [http://onlinelibrary.wiley.com/journal/10.1111/\(ISSN\)1467-9787/earlyview](http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1467-9787/earlyview), accessed Dec. 17, 2016.
- Bowes, David R., and Keith R. Ihlanfeldt. "Identifying the impacts of rail transit stations on residential property values." *Journal of Urban Economics* 50.1 (2001): 1-25.
- California Air Resources Board (ARB). (n.d.). *Sustainable Communities*. Retrieved on December 22, 2015 from <http://www.arb.ca.gov/cc/sb375/sb375.htm>
- California Department of Housing and Community Development (n.d.). *Affordable Housing and Sustainable Communities Program (AHSC)*. Retrieved on November 1, 2016 from <http://www.hcd.ca.gov/financial-assistance/affordable-housing-and-sustainable-communities/>
- California Department of Housing and Community Development (n.d.). *Multifamily Housing Program (MHP)*. Retrieved on March 27, 2017 from <http://www.hcd.ca.gov/grants-funding/active-no-funding/mhp.shtml>
- California Department of Housing and Community Development (2017), *California's Housing Future: Challenges and Opportunities – Public Draft*, January, Sacramento, CA.

California Department of Transportation (Caltrans). (2013a). 2010–2012 California Household Travel Survey. National Renewable Energy Laboratory. Retrieved from www.nrel.gov/tsdc

California Department of Transportation (Caltrans). (2013b). 2010-2012 California Household Travel Survey Final Report. Retrieved from <http://www.dot.ca.gov/hq/tsip/FinalReport.pdf>

California Housing Partnership Corporation & Transform. (2014). Why creating and preserving affordable homes near transit is a highly effective climate protection strategy. Retrieved from: <http://www.transformca.org/transform-report/why-creating-and-preserving-affordable-homes-near-transit-highly-effective-climate>

California Legislative Analyst's Office (2015), California's high housing costs: Causes and consequences, March, accessed at <http://www.lao.ca.gov/reports/2015/finance/housing-costs/housing-costs.pdf>.

California Tax Credit Allocation Committee (n.d.). Low-Income Housing Tax Credit Programs. Retrieved on March 27, 2017 from <http://www.treasurer.ca.gov/ctcac/tax.asp>

Cao, X. J., Xu, Z., & Fan, Y. (2010). Exploring the connections among residential location, self-selection, and driving: Propensity score matching with multiple treatments. *Transportation research part A: policy and practice*, 44(10), 797-805.

Carson, R. T., Jeon, Y., & McCubbin, D. R. (1997). The relationship between air pollution emissions and income: US data. *Environment and Development Economics*, 2(4), 433-450.

Center for Transit Oriented Development (CTOD). (2010a). *Performance-based transit-oriented development typology guidebook*. Retrieved from <http://www.reconnectingamerica.org/resource-center/books-and-reports/2010/performance-based-transit-oriented-development-typology-guidebook/>

Center for Transit Oriented Development (CTOD). (2010b). *Transit oriented development and the potential for VMT-related greenhouse gas emissions growth reduction*. Retrieved from http://www.cnt.org/sites/default/files/publications/TOD-Potential-GHG-Emissions-Growth.FINAL_.pdf

Cervero, Robert. (2007). Transit oriented development's ridership bonus: A product of self-selection and public policies. *Environment and Planning Part A*, 39(9), 2068–2085.

Cervero, R., & Duncan, M. (2002). Transit's value-added effects: light and commuter rail services and commercial land values. *Transportation Research Record: Journal of the Transportation Research Board*, (1805), 8-15. <http://dx.doi.org/10.3141/1805-02>

Cervero, R. & Murakami, J. (2010). Effects on built environments on vehicle miles traveled: evidence from 370 US urbanized areas. *Environment and Planning A*. 42, pp. 400-418.

Chester, M., & Horvath, A. (2010). Life-cycle assessment of high-speed rail: the case of California. *Environmental Research Letters*, 5(1), 014003. doi:10.1088/1748-9326/5/1/014003

DeMaio, Paul. "Bike-sharing: History, impacts, models of provision, and future." *Journal of Public Transportation* 12.4 (2009): 3.

- De Sousa, C. A., Wu, C., and Westphal, L. M. (2009). Assessing the Effect of Publicly Assisted Brownfield Redevelopment on Surrounding Property Values. *Economic Development Quarterly*, 23(2), 95-110.
- Dittmar, H., & Ohland, G. (Eds.). (2012). *The new transit town: best practices in transit-oriented development* (pp. 101-103). Island Press.
- Dreier, P. and R. W. Bostic (forthcoming), "A New Way to House the Working Poor," in *Anti-Poverty Policy Initiatives for the United States*, S. Nichols and S. Danziger (Eds.), Russell Sage Foundation Press.
- Duncan, M. (2011). The impact of transit-oriented development on housing prices in San Diego. *Urban Studies*, 48(1), 101-127.
- Egelko, Bob (2016), "Mortgage interest deduction may end for 2nd homes," San Francisco Chronicle, December 20, accessed at <http://www.sfgate.com/news/article/Ca-housing-plan-would-cost-second-home-10807208.php>.
- Ellen, Ingrid Gould, and Weselcouch, Max (2015). High-opportunity neighborhoods in NYC are losing affordable housing. New York: NYU Furman Center for Real Estate and Urban Policy. Retrieved from <http://furmancenter.org/thestoop/entry/report-new-york-city-losing-affordable-housing-stock-in-high-opportunity-ne>
- Ericksen, Michael D. and Stuart S. Rosenthal (2010), "Crowd out effects of place-based subsidized rental housing: New evidence from the LIHTC program," *Journal of Public Economics*, 94: 953-966.
- Ewing, R., Greenwald, M., Zhang, M., Walters, J., Feldman, M., Cervero, R., Frank, L., & Thomas, J. (2010). Traffic generated by mixed-use developments—Six-region study using consistent built environmental measures. *Journal of Urban Planning and Development*, 137(3), 248-261.
- Fischer, Will and Barbara Sard (2016), Federal housing spending is poorly matched to need: Tilt toward well-off homeowners leaves struggling renters without help, Chart Book Series, Center on Budget and Policy Priorities, Retrieved from <http://www.cbpp.org/research/housing/chart-book-federal-housing-spending-is-poorly-matched-to-need>.
- Freeman, L., & Braconi, F. (2004). Gentrification and displacement New York City in the 1990s. *Journal of the American Planning Association*, 70(1), 39-52.
- Freedman, M., & McGavock, T. (2015). Low - Income Housing Development, Poverty Concentration, and Neighborhood Inequality. *Journal of Policy Analysis and Management*, 34(4), 805-834.
- Gabbe, C.J. 2016. Where Residential Density is Allowed – and Isn't – in Los Angeles: A Fresh Look at Zoning Changes. *UCLA Economic Letter*, August, available at http://www.anderson.ucla.edu/Documents/areas/ctr/ziman/UCLA_Economic_Letter_Gabbe_08.19.16.pdf.

Goetz, Edward G., Kate Ko, Aaron Hagar, Hoang Ton, and Jeff Matson. 2010. "The Hiawatha Line: impacts on land use and residential housing value." University of Minnesota Center for Transportation Studies report.

Grube-Cavers, Annelise, and Zachary Patterson. "Urban rapid rail transit and gentrification in Canadian urban centres: A survival analysis approach." *Urban Studies* 52.1 (2015): 178-194.

Haninger, K., Ma, L., & Timmins, C. (2012). *Estimating the Impacts of Brownfield Remediation on Housing Property Values*. Nicholas Institute Working Paper (Duke University) (EE 12-08).

Hankey, S., & Marshall, J. D. (2010). Impacts of urban form on future US passenger-vehicle greenhouse gas emissions. *Energy Policy*, 38(9), 4880-4887.

Hensher, D. A. (2008). Climate change, enhanced greenhouse gas emissions and passenger transport—What can we do to make a difference?. *Transportation Research Part D: Transport and Environment*, 13(2), 95-111.

Hernandez, Jennifer, David Friedman, and Stephanie DeHerrera (2015). *In the Name of the Environment*. Holland & Knight report.

Hess, Daniel Baldwin, and Tangerine Maria Almeida. "Impact of proximity to light rail rapid transit on station-area property values in Buffalo, New York." *Urban studies* 44.5-6 (2007): 1041-1068.

Hickey, R. (2013). *After the downturn: New challenges and opportunities for inclusionary housing*. Center for Housing Policy. Retrieved from <http://www.nhc.org/after-the-downturn>.

Holland, Gale and Doug Smith (2016), "L.A. votes to spend \$1.2 billion to house the homeless> Now comes the hard part," *Los Angeles Times*, November 9, Retrieved from <http://www.latimes.com/local/lanow/la-me-ln-homeless-20161108-story.html>.

HUD (2016), Project Based Vouchers, accessed at https://portal.hud.gov/HUD?src=/program_offcies/public_indian_housing/programs/hcv/project.

HUD (2016), Project Based Vouchers - Frequently Asked Questions, accessed at <https://www.hud.gov/offices/pih/programs/hcv/pubs/pbvfaq.pdf>.

Immergluck, Dan. "Large redevelopment initiatives, housing values and gentrification: the case of the Atlanta Beltline." *Urban Studies* 46.8 (2009): 1723-1745.

Ingram, Gregory K. and Yu-Hung Hong, Value capture and land policies: Proceedings of the 2011 Land Policy Conference, Lincoln Institute of Land Policy, Cambridge, MA.

Kats, G. (2003). *Green building costs and financial benefits*. Boston, MA: Massachusetts Technology Collaborative.

Kimball, M., Chester, M., Gino, C., & Reyna, J. (2013). Assessing the potential for reducing life-cycle environmental impacts through transit-oriented development infill along existing light rail in Phoenix. *Journal of Planning Education and Research*, 33(4), 395-410.

Kompareit.com (2016). Compare steel vs wood house framing costs, accessed at <http://www.kompareit.com/homeandgarden/construction-compare-steel-vs-wood-house-framing.html>.

Lens, Michael C., and Vincent Reina. "Preserving Neighborhood Opportunity: Where Federal Housing Subsidies Expire." *Housing Policy Debate* 26.4-5 (2016): 714-732.

Levine, Jonathan (2005). *Zoned Out: Regulation, Markets, and Choices in Transportation and Metropolitan Land Use, Resources for the Future*: Washington, DC.

Li, Roland (2016). "How construction unions helped kill Gov. Brown's plan to fight the housing crisis," *San Francisco Business Times*, August 23, accessed at <http://www.bizjournals.com/sanfrancisco/blog/real-estate/2016/08/unions-against-gov-browns-as-of-right-housing-plan.html>.

Los Angeles County and Metropolitan Transportation Authority (L.A. Metro). (2012). *Metro Countywide Sustainability Planning Policy & Implementation Plan*. Retrieved from http://media.metro.net/projects_studies/sustainability/images/countywide_sustainability_planning_policy.pdf

Los Angeles County and Metropolitan Transportation Authority (L.A. Metro). (n.d). "Projects". Retrieved from <https://www.metro.net/projects>

Los Angeles Housing and Community Investment Department (n.d.). *Affordable Housing Trust Fund Pipeline*, accessed at <http://hcidla.lacity.org/Affordable-Housing-Trust-Fund-pipeline>.

Los Angeles Office of the Mayor. (2015). *pLAN: Transforming Los Angeles*. Retrieved from https://www.lamayor.org/sites/g/files/wph446/f/landing_pages/files/The%20pLAN.pdf

Lu, Chenxi, Joseph Rosenberg, and Eric Toder. (2015). Options to reform the deduction for home mortgage interest. Tax Policy Center report, Urban Institute & Brookings Institution, December 8.

Marr, Matthew D. "Mitigating apprehension about Section 8 vouchers: The positive role of housing specialists in search and placement." *Housing Policy Debate* 16.1 (2005): 85-111.

Mukhija, V., Regus, L., Slovin, S., & Das, A. (2010). Can inclusionary zoning be an effective and efficient housing policy? Evidence from Los Angeles and Orange Counties. *Journal of Urban Affairs*, 32(2), 229-252. <http://dx.doi.org/10.1111/j.1467-9906.2010.00495.x>

Naess, Petter. 2014a. Tempest in a Teapot: The Exaggerated Problem of Transport-Related Residential Self-Selection as a Source of Error in Empirical Studies. *Journal of Transport and Land Use*, 2014, vol. 7, no. 3. Available at <https://www.jtlu.org/index.php/jtlu/article/view/491>, accessed Dec. 17, 2016.

Naess, Petter. 2014b. Reaction to Van Wee and Boarnet. *Journal of Transport and Land Use*, 2014, vol. 7, no. 3. Available at <https://www.jtlu.org/index.php/jtlu/article/view/491>, accessed Dec. 17, 2016. <https://www.jtlu.org/index.php/jtlu/article/view/724>, accessed Dec. 17, 2016.

NAHB Research Center (2002). Steel vs. Wood cost comparison: Beaufort demonstration homes. Report prepared for the U.S. Department of Housing and Urban Development, the North American Steel Framing Alliance, and the National Association of Home Builders, Washington DC.

Newsham, G. R., Mancini, S., & Birt, B. J. (2009). Do LEED-certified buildings save energy? Yes, but.... *Energy and Buildings*, 41(8), 897-905.
<http://dx.doi.org.libproxy2.usc.edu/10.1016/j.enbuild.2009.03.014>

Noonan, D.S., Krupka, D.J., & Baden, B.M. (2007). Neighborhood Dynamics and Price Effects of Superfund Site Clean-Up*. *Journal of Regional Science*, 47(4), 665-692.

Office of the Mayor of San Francisco (2012), Mayor Lee announces San Francisco Housing Trust Fund to boost production of middle & low income housing, press release, May 22, accessed at <http://sfmayor.org/mayor-lee-announces-san-francisco-housing-trust-fund-boost-production-middle-low-income-housing>.

Olsen, Edgar O. (2007), Promoting homeownership among low-income households, Opportunity and Ownership Report Series, Urban Institute, Retrieved from <http://www.urban.org/sites/default/files/alfresco/publication-pdfs/411523-Promoting-Homeownership-among-Low-Income-Households.PDF>.

Pollack, S., Bluestone, B., and Billingham, C. (2010). *Maintaining diversity in America's transit-rich neighborhoods: Tools for equitable neighborhood change*. Dukakis Center for Urban and Regional Policy. Retrieved from http://nuweb9.neu.edu/dukakiscenter/wp-content/uploads/TRN_Equity_final.pdf

Pyati, Archana. 2016. "New CoStar Data Identifies 5.5 Million Units of Naturally Occurring Affordable Housing in Markets Across the United States," Urban Land Institute press release, October 18, accessed at <http://uli.org/general-posts/new-costar-data-identifies-5-5-million-units-naturally-occurring-affordable-housing-markets-across-united-states/>.

Ratner, K. A., & Goetz, A. R. (2013). The reshaping of land use and urban form in Denver through transit-oriented development. *Cities*, 30, 31-46.

Reconnecting America. (2007, October 17). *Station Area Planning Manual*. Retrieved from <http://ctod.org/pdfs/2007MTCStationAreaPlanningManual.pdf>

Reconnecting America (n.d.), "What is TOD," accessed at <http://reconnectingamerica.org/what-we-do/what-is-tod/>.

Reina, Vincent, and Jaclene Begley. "Will they stay or will they go: Predicting subsidized housing opt-outs." *Journal of Housing Economics* 23 (2014): 1-16.

Rental Policy Working Group (2011). Federal Rental Alignment: Administrative Proposals, White House Domestic Policy Council, National Economic Council, Office of Management and Budget, U.S. Department of Housing and Urban Development, U.S. Department of Agriculture, and U.S. Department of the Treasury, December 31, accessed at https://www.huduser.gov/portal/aff_rental_hsg/rpwg_conceptual_proposals_fall_2011.pdf.

Riddel, Mary. "A dynamic approach to estimating hedonic prices for environmental goods: an application to open space purchase." *Land Economics* 77.4 (2001): 494-512.

Ries, John, and Tsur Somerville. "School quality and residential property values: evidence from Vancouver rezoning." *The Review of Economics and Statistics* 92.4 (2010): 928-944.

Royal Rose Properties (n.d.), The pros and cons of going Section 8, E-newsletter post, accessed at <http://www.royalroseproperties.com/property-owner-blog/the-pros-and-cons-of-going-section-8/>.

Santos, Adela, Nancy McGuckin, Hikari Yukiko Nakamoto, Danielle Gray, and Susan Liss. 2011. Summary of Travel Trends: 2009 National Household Travel Survey. Washington, D.C. U.S. Department of Transportation. Available at <http://nhts.ornl.gov/2009/pub/stt.pdf>, accessed Dec. 17, 2016.

Schwartz, Alex F. (2015), *Housing Policy in the United States*, New York: Routledge.

Schwartz, Heather L., Raphael W. Bostic, Richard K. Green, Vincent J. Reina, Lois M. Davis, and Catherine H. Augustine (2016), *Preservation of Affordable Rental Housing*, RAND Corporation report to the MacArthur Foundation.

Smolka, Martim O. (2013), *Implementing value capture in Latin America: Policies and tools for urban development*, Policy Focus Report, Lincoln Institute of Land Policy, Cambridge, MA.

Southern California Association of Governments (SCAG). 2016. Final 2016 Regional Transportation Plan / Sustainable Communities Strategy. Los Angeles, CA: Southern California Association of Governments. Available at <http://scagrtpscs.net/Pages/FINAL2016RTPSCS.aspx#toc>, accessed Dec. 17, 2016.

Southern California Association of Governments (SCAG). (2012). *2012-2035 Regional transportation plan/sustainable communities strategy*. Retrieved from <http://rtpscs.scag.ca.gov/Pages/default.aspx>

Spears, Steven. Marlon G. Boarnet, and Douglas Houston. 2016. Driving reduction after the introduction of light rail transit: Evidence from an experimental control group evaluation of the Los Angeles Expo Line. *Urban Studies*, forthcoming, available online-first at <http://journals.sagepub.com/doi/full/10.1177/0042098016657261>, accessed Dec. 16, 2017.

Tal, Gil, Susan Handy, and Marlon G. Boarnet. 2013. Policy Brief on the Impacts of Transit Access (Distance to Transit) Based on a Review of the Empirical Literature. Sacramento, CA: California Air Resources Board. Available at https://www.arb.ca.gov/cc/sb375/policies/transitaccess/transit_access_brief120313.pdf, accessed Dec. 17, 2016.

Talen, E. (2013). Prospects for walkable, mixed-income neighborhoods: insights from US developers. *Journal of Housing and the Built Environment*, 28(1), 79-94. doi:10.1007/s10901-012-9290-9

The Economist. 2015. The Paradox of Soil. April 4. Retrieved from <http://www.economist.com/news/briefing/21647622-land-centre-pre-industrial-economy-has-returned-constraint-growth>.

Taylor, M. (2015). "California's High Housing Costs. Causes and Consequences". California Legislative Analyst's Office (LAO). Retrieved from <http://www.lao.ca.gov/reports/2015/finance/housing-costs/housing-costs.pdf>

U.S. Department of Housing and Urban Development (HUD). (n.d.a). Resources: Glossary, A. Retrieved from https://www.huduser.gov/portal/glossary/glossary_a.html

U.S. Department of Housing and Urban Development (HUD). (n.d.b). Affordable housing. Retrieved from http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/affordablehousing/

Van Wee, Bert and Marlon G. Boarnet, "Reaction to the paper 'Tempest in a Teapot: The Exaggerated Problem of Transport-Related Residential Self-Selection as a Source of Error in Empirical Studies,'" *Journal of Transport and Land Use*, 2014, vol. 7, no. 3. Available at <https://www.jtlu.org/index.php/jtlu/article/view/713>, accessed Dec. 17, 2016.

Welch, T. F. (2013). Equity in transport: The distribution of transit access and connectivity among affordable housing units. *Transport Policy*, 30, 283-293.

Wilkins, C., Brennan, M., Deora, A., Heegaard, A., Lee, A., & Lubell, J. (2015). Comparing the Life-Cycle Costs of New Construction and Acquisition-Rehab of Affordable Multifamily Rental Housing. *Housing Policy Debate*, 25(4), 684-714.

Woetzel, Jonathan, Jan Mischke, Shannon Peloquin, Daniel Weisfield. 2016. A Tool Kit to Close California's Housing Gap: 3.5 Million Homes by 2025. McKinsey & Company. Available at file:///C:/Users/boarnet/Downloads/Closing-Californias-housing-gap-Full-report.pdf, accessed Dec. 17, 2016.

Zhou, Bin and Kara M. Kockelman. 2008. Self-Selection in Home Choice: Use of Treatment Effects in Evaluating the Relationship Between the Built Environment and Travel Behavior. *Transportation Research Record No. 2077*: 54-61, 2008.