

## **Policy Brief on the Impacts of Transit Access (Distance to Transit) Based on a Review of the Empirical Literature**

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### **Policy Description**

Improving transit access has the potential to shift trips from cars to transit, which may reduce vehicle trips, vehicle miles traveled (VMT) and greenhouse gas emissions. Transit agencies can increase transit access by providing new service or reroute existing services to new areas, thereby bringing transit closer to potential users. Transit access also increases when communities increase the density of housing and other land-uses within walking distance of stations, through what is called transit-oriented development (TOD), thereby bringing more potential users close to transit. Other factors also affect access to transit. Street and network design, for example, can improve access to transit by reducing travel times and lowering physical and social barriers, such as fear of crime.

Distance to a bus stop or rail station is a key indicator of transit access and is the focus of this summary. Planners generally assume that most transit users will not walk more than 0.25 miles to bus stops and 0.5 to 0.75 miles to rail stations (O'Neill, et al. 1992; Zhao, et al., 2003; Kuby, et al., 2004). A recent study found that 75 percent of pedestrians arriving at a rail transit station walked less than one mile or 12 minutes (Schlossberg, et al., 2007). When residents are farther away from stations, they are less likely to use public transit and more likely to drive to the station when they do. Thus, reduced distances to transit can reduce vehicle trips and VMT by encouraging a shift from driving to public transit, but also by encouraging transit users to walk or bicycle to the station rather than drive.

### **Impacts of Distance to Transit**

#### *Effect Size*

Table 1 summarizes the results from recent studies that used data for individuals or households and controlled for a broad range of individual or household sociodemographic characteristics. We estimated effect sizes in terms of change in VMT per change in miles to the station, as shown in Table 1, based on the information reported in each study, as described in the background memo that accompanies this summary.

Estimated effect sizes range from a 1.3 percent decrease to a 5.8 percent decrease in VMT per mile closer to the station. This effect is likely to occur only within about 2 miles of a rail station and about 0.75 miles of a bus stop. Access to rail is likely to have a greater effect than access to a bus stop, given the higher quality of service that rail offers. However, the only study that looks separately at access to rail and access to bus

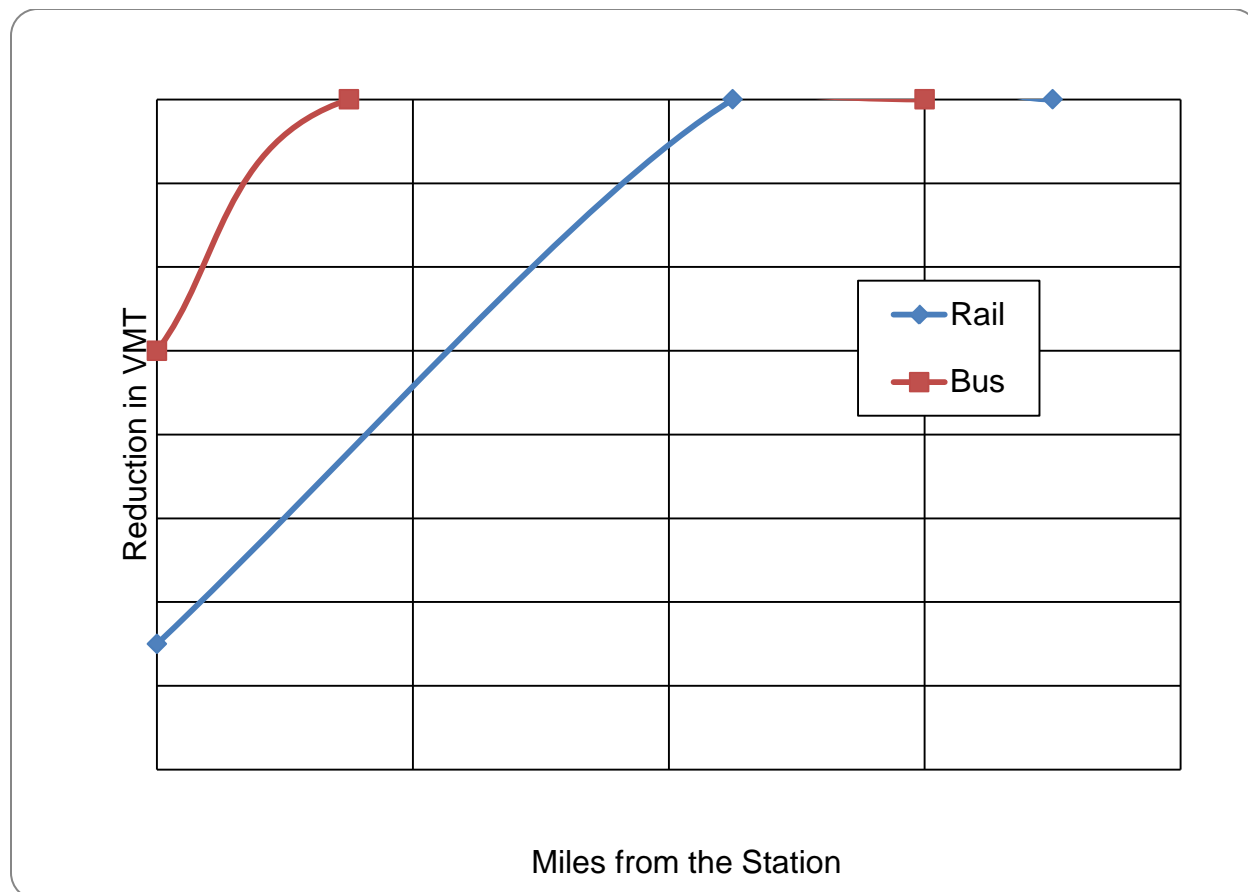
finds a slightly larger effect for access to bus, though the effect extends over a shorter distance. For most California communities, the effect is likely to be at the lower end of the range, given the more limited transit service available compared to older cities in the Northeast. The actual effect on VMT will depend on factors such as transit level of service, trip destinations, relative driving times, etc. Little is known about how the effect might vary across urban or rural areas, as the evidence in this literature is largely from urban places.

*Table 1: Distance to Transit and VMT: Results from Studies of Individual or Household Travel*

Study	Study Location	Study Year	Results	
			Distance to Transit Variable	VMT Reduction for Reduction in Distance to Transit
<b>Ewing and Cervero (2010)</b>	Multiple U.S. and international locations	Multiple years, from 1985	1 mile closer to transit, with no distinction for rail and bus, no outer distance for the effect	-2.5%
<b>Pushkar, Hollingworth, and Miller (2000)</b>	Toronto, Canada	1996	1 mile closer to rail station, from 2 miles to 1 mile from station, with no distinction for rail and bus	-1.3%
<b>Bailey, Mokhtarian, and Little (2008)</b>	U.S.	2001	1 mile closer to rail station, within 2.25 miles of station	-5.8%
			¼ mile closer to bus stop, within 0.75 miles of bus stop	-2.0%
<b>Bento, Cropper, Mobarak, and Vinha (2005)</b>	U.S.	1990	10% decrease in distance to a transit stop, with no distinction between rail and bus, no outer distance for the effect	-0.8%

Based on the evidence, a simple linear relationship between VMT reduction and distance from the station can be extrapolated, as illustrated in Figure 1. The results reported by Bailey, et al. suggest about a 6 percent decrease in VMT per mile closer to a rail station starting at 2.25 miles from the station, and a 2 percent decrease in VMT per 0.25 miles closer to a bus stop, starting at 0.75 miles from the stop. In other words, a reduction in distance from 2.25 to 1.25 miles or from 1.25 to 0.25 miles from a rail station results in a 6 percent decrease in VMT, but a reduction in distance from 3.25 miles to 2.25 miles has no impact on VMT. These effects are at the high end of the range of estimated effects. It is also important to note that in most cases, a zero travel

distance from a station is not possible and therefore the highest possible reductions, of 13 percent for rail and 4 percent for bus, are theoretical only. For that reason, the average expected VMT reduction will be lower than the mid-point suggested by Figure 1.



**Figure 1: VMT Reduction by Distance from the Station**

### *Evidence Quality*

The studies in Table 1 use accepted statistical methods to analyze high quality data for individual households. Although they provide the best available evidence of the effect of distance to transit on VMT, the cited studies have notable limitations. Three of the cited studies do not distinguish between distance to bus stops versus rail stations, although Bailey, et al. (2008) show that the effect is substantially different. Two studies do not specify a starting distance for the effect, i.e. the point beyond which a reduction in distance to transit has no effect. None of the four studies uses data from California only, and thus the estimated effect sizes may not be accurate for California communities. Effect sizes are not reported in a consistent form across the four studies, necessitating some estimation on our part to attain the numbers reported in Table 1.

As with other potential strategies for reducing VMT, there is some question about whether access to transit in fact causes a reduction in VMT or is simply associated with

lower VMT. Of particular concern is the possibility that residents living closer to transit have chosen to live there because they plan to use public transit, a phenomenon known as self-selection. If so, the estimated effect sizes are likely to overstate the effect of providing new transit service to an existing residential area where current residents might not be inclined to use it. Only Bailey, et al. (2008) partially control for self-selection.

### *Caveats*

Policies that increase access to transit by reducing distances to transit are generally implemented as part of a larger package of land use and transportation measures, making it difficult to isolate the effect of transit access. Evidence on the effect of distance to transit presented here is based on current travel behavior and is highly dependent on transit level of service, travel times by car, local land use patterns, and location within the region. External factors such as gas prices and the local and global economy may change the reported effect significantly. Overall, we believe that, in most cases, the VMT reduction presented here is the upper limit or the maximum potential of the policy in the current conditions. Local conditions should be considered when choosing a specific effect size from within the range reported here.

It is important to note that the effects reported here are based on distance from home to the transit station. More than one study argues that distance to the destination and specifically to the work place may have a much higher impact on VMT, given that workers generally do not have access to a car to get from the transit station to the worksite. As a result, transit use may depend on work places being within walking distances of stations and on other conditions that facilitate walking, even when the home is within walking distance of transit. Despite the likely importance of workplace distance from transit, no studies are available that quantify this effect. It is reasonable to assume that the effect will be at least similar to the effect of distance to transit from home.

### **Greenhouse Gas Emissions**

No available studies provide direct evidence of the effect of distance to transit on greenhouse gas (GHG) emissions. However, to the extent that it leads to reduced vehicle use, improving transit access may help reduce GHGs.

### **Co-benefits**

Improved transit access, in the form of reduced distances to transit, offers many potential benefits beyond a reduction in VMT. Improved access to transit means improved access to jobs and services for segments of the population without access to cars, thereby producing important equity benefits. To the degree that improved transit access leads to increased transit use and particularly if it leads to increased walking to and from transit stations, it can increase levels of physical activity and yield significant health benefits (Besser, et al. 2005). Shifting trips from cars to transit has many

environmental benefits beyond a reduction in greenhouse gas emissions, including less air pollution, and may help to alleviate congestion, particularly in urban centers.

## Examples

Examples of transit service expansions designed to increase access to transit are numerous, though their effects on VMT are rarely studied. In San-Francisco for example, the municipal transportation agency (SFMTA) initiated a transit effectiveness project that aimed to improve transit service through strategies that included new routes and route extensions (<http://www.sfmta.com/cms/mtep/teprecs.htm#about>). Examples of transit-oriented development, which brings more residents within close proximity to transit, are better documented. The *California Planners' Book of Lists 2010*, published by the Governor's Office of Planning and Research, lists 52 local jurisdictions in California that have planned for TOD in their General Plans (<http://www.opr.ca.gov/planning/publications/2010bol.pdf>). Policies that support and promote transit-oriented development (TOD) are common in California, particularly in the San Francisco Bay Area and the Los Angeles region. For example, the Metropolitan Transportation Commission adopted a TOD policy in 2005 that sets standards for minimum levels of development around transit stations in new transit corridors and supports TOD planning around stations ([http://www.mtc.ca.gov/planning/smart\\_growth/tod/TOD\\_policy.pdf](http://www.mtc.ca.gov/planning/smart_growth/tod/TOD_policy.pdf)). The agency's 1998 Transportation for Livable Communities program awards funding to projects that help to create TOD. Examples of TOD in the region are documented in a 2006 report, *New Places, New Choices* (<http://www.mtc.ca.gov/library/TOD/index.htm>). No studies of the effects of these examples are available.

## Suggested Further Reading

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