

UC Berkeley

Earlier Faculty Research

Title

Mass Transit & Mass: Densities Needed to Make Transit Investments Pay Off

Permalink

<https://escholarship.org/uc/item/8qs6x14s>

Authors

Guerra, Erick
Cervero, Robert

Publication Date

2010-08-01

Mass Transit & Mass: Densities Needed to Make Transit Investments Pay Off



Erick Guerra and Robert Cervero, University of California, Berkeley

ISSUE

Capital costs are the biggest deterrent to constructing new rail transit in the U.S. today. In recent decades, they have skyrocketed: sections of Los Angeles’s Red Line subway ran to over \$750 million per mile; less complex systems can require \$200 million per mile.

This study examined factors that are associated with cost-effective transit investments. By “cost-effective” we mean projects with low capital cost per rider on an annual basis. To address this question, we obtained data for 59 transit investments—33 light-rail (LRT), 23 heavy rail (HR), and four bus rapid transit (BRT) systems—across 19 metropolitan areas in the United States. Collectively, they comprise 768 stations on 740 miles of fixed guideway, built at a total cost of \$68 billion (in 2009 dollars).

RESEARCH FINDINGS

As densities rise, so do both ridership and construction costs. Which rises more? Ridership does, such that higher



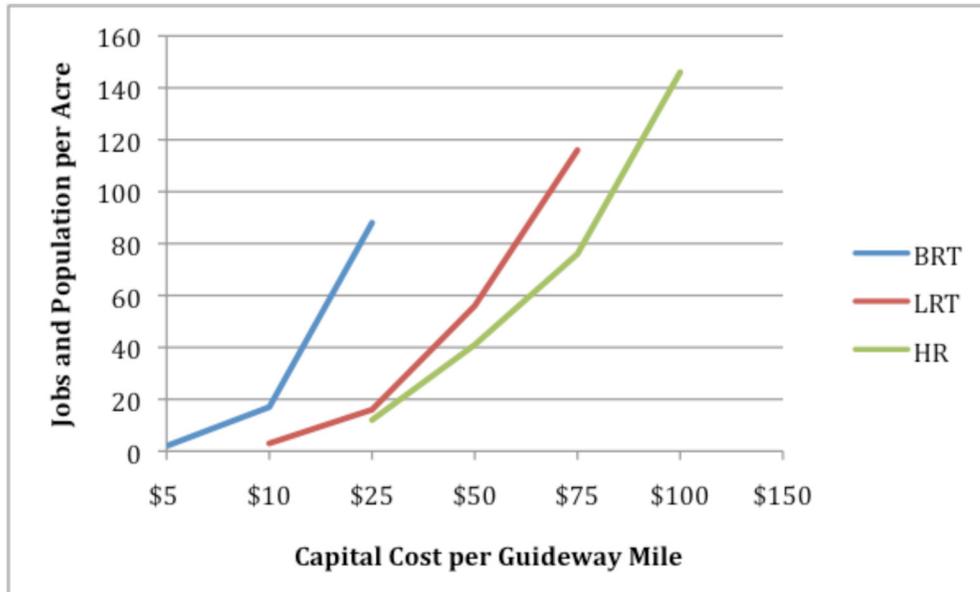
densities tend to improve transit’s cost-effectiveness, despite higher costs. Experience across the 59 projects we studied showed that a 10 percent increase in total population per acre corresponded with a 3.2 percent drop in capital costs per rider. The same 10 percent increase in jobs per acre resulted in per-rider capital costs falling 1.5 percent.



A question often asked by elected officials facing the prospect of funding a transit project is: “What densities should we zone for to ensure this investment pays off?” Setting variables in our model to reflect “typical” conditions, we explored what might be considered density thresholds. These represented combined job and population densities that would be needed to produce a capital cost-per-rider in

Rail transit’s success abroad relies heavily on achieving high-enough job and residential densities.

the top 25 percent of recent LRT, HR, and BRT investments. For example, the graph indicates that a light rail system (LRT) with capital cost of \$50 million per mile would need a combined density of 60 jobs and residents per acre within a half mile of its stations. In actuality, the majority of sampled transit stations in the 59 corridors we studied had fewer than 19 jobs and persons per acre near stations. If there is a density threshold needed to make transit investments pay off, most transit investments made in the U.S. over the past two decades fall significantly short of it.



Minimum densities needed across a range of fixed-guideway capital costs. Graph reveals densities it would take for a project to be in the top 25 percent of past fixed-guideway investments in terms of cost-effectiveness under "typical" conditions.

RECOMMENDATION

Rail transit has become a political lightning rod. Critics view rail proposals as among the most flagrant forms of pork barrel politics today. Advocates counter-argue that expanding the nation's rail transit offerings will yield many under-appreciated environmental and societal benefits, including reduced carbon emissions and dependency on foreign oil supplies.

If fixed-guideway transit is to yield appreciable dividends, there must be a close correspondence between transit investments and urban development patterns. All too often, rail transit investments in the U.S. have been followed by growth that is oriented to highway rather than transit corridors. Put simply, "mass transit" needs "mass"—i.e., density. For investments to pay off, there must be an unwavering local commitment to substantially raise population and employment densities along transit corridors. While dense areas average higher transit capital costs as well as higher ridership, our analysis suggests that many transit stations in the U.S. have nearby job or population densities that are too low to support cost-effective transit service. The thresholds in this study can provide cities and towns with targets for zoning around existing and proposed transit stations based on projected costs.

