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UTC Spotlight

University Transportation Centers Program

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What Makes a Successful Transit Investment?

The University of California University Transportation Center (UCTC) at the University of California, Berkeley, recently completed a study focused on the factors that characterize the most successful transit investments—specifically new rail transit systems.

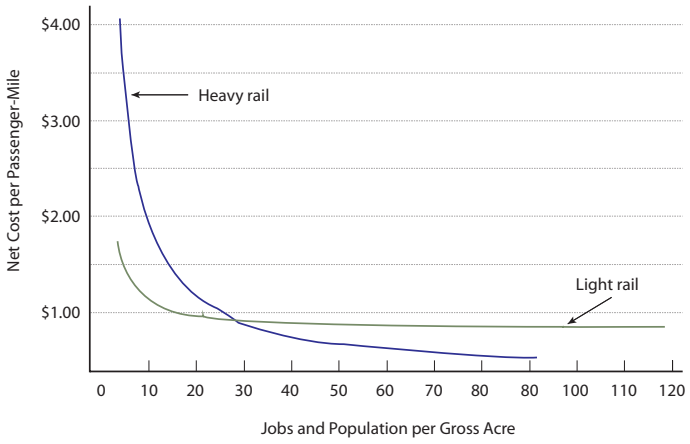
As may be expected, capital costs are the biggest deterrent to constructing new rail transit in the United States. Sections of the Los Angeles Red Line subway would cost $750 million per mile in today's dollars. Even less costly surface light rail projects can cost as much as $200 million per mile.

UCTC looked at the investment costs of 59 high-capacity U.S. transit investments built since 1970. Collectively, after adjusting for inflation, they cost $68 billion in 2008 dollars and include 768 transit stations and 740 route miles. Fifty-four of these investments were matched with available information on annual operating costs and passenger trips, creating a cost-effective index of capital and operating costs for fare revenues per passenger mile. There is wide variation in cost-effectiveness. The worst-performing project cost 50 times more than the best-performing project.

However, much more than capital costs, transit use drives this cost-effectiveness index. The benefits of low capital costs are often offset by low passenger numbers. Heavy rail projects, more than four times as expensive to construct as light rail projects, were more cost effective per passenger-mile due to higher patronage. For example, the Los Angeles Red Line cost more to build per route-mile than any other investment in the study but had below average costs per passenger-mile. Because of its low ridership, San Jose light rail had among the highest costs per passenger-mile despite well-below average investment costs per route-mile. What factors distinguish the most successful transit investments?

Dense concentrations of jobs and people around transit are particularly important. UCTC looked at how the number of people and jobs around transit stations influenced investment costs and passenger numbers. As densities increase, both investment costs and ridership also tend to increase. High ridership, however, can offset high investment outlays. Using statistical regression analyses of capital costs, operating costs, and passenger miles, UCTC modeled the relationship between cost-effectiveness and job and population densities in an average city (figure 1). Light rail was more cost effective than heavy rail up to a density of 28 jobs and people per gross acre. This threshold suggests that Atlanta, Miami, and Baltimore are better suited for light than heavy rail, while heavy rail is the appropriate choice for the San Francisco Bay Area and Washington, D.C. UCTC also estimated a cost-effectiveness threshold, based on the amount it would cost to increase ridership by reducing transit fares.

Figure 1. Net Cost Per Passenger-Mile by Job and Population Density

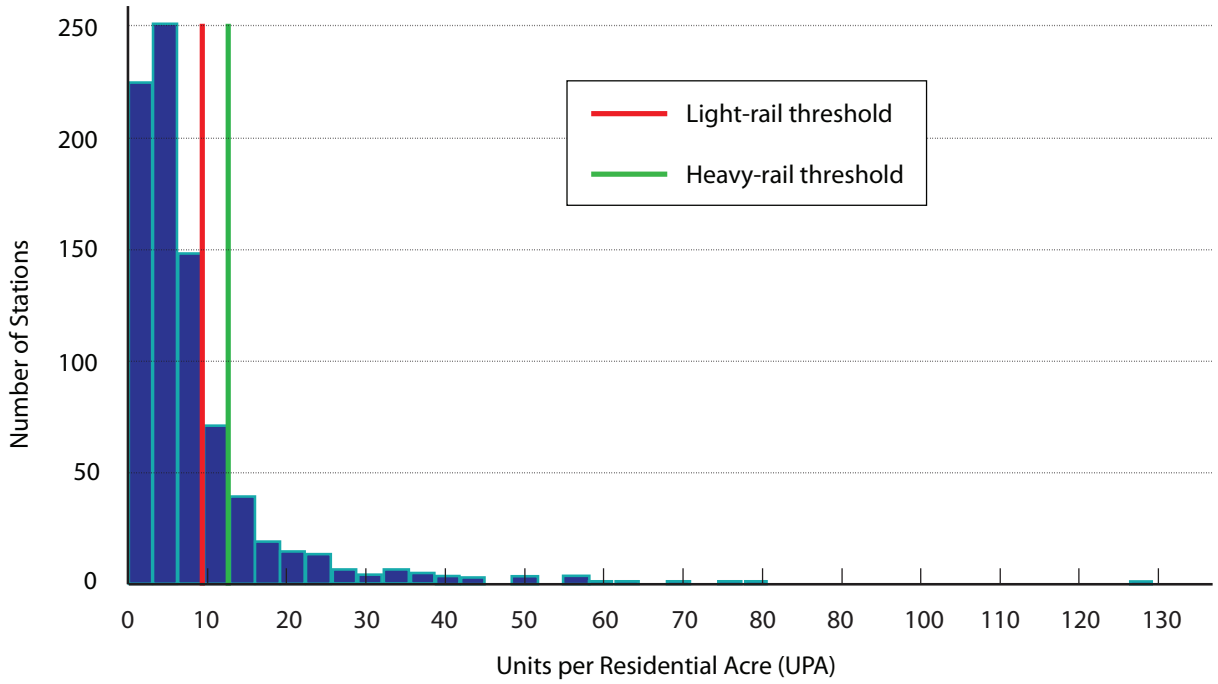


Despite an academic and journalistic emphasis on investment costs, UCTC found that it is low densities, resulting in a shortage of trip origins and destinations around transit, that have most hindered recent transit performance. Figure 2 plots the average gross residential density of 526 light-rail and 261 heavy-rail stations that have opened since 1972 against minimum density

thresholds, established by Boris Pushkarev and Jeffrey Zupan in the 1970s. The average rail investment of the past four decades has fewer surrounding households than this recommended minimum. Just 26 percent of heavy-rail station areas and 19 percent of light-rail station areas surpass the minimum recommended thresholds.

Investing in high-capacity transit in low-density areas will require large subsidies per passenger trip and produce few tangible benefits. If costly rail and bus rapid transit investments are to pay off, larger shares of growth must be concentrated around transit stops. In addition to local land use policies, this will require a significant reorientation of funding priorities in favor of investments in areas that meet, or have credible plans to meet, minimum density thresholds.

Figure 2. Density (units per residential acre) Around Light- and Heavy-Rail Stations Opened Since 1972.



About This Project

Research for this project was conducted by Robert Cervero (robertc@berkeley.edu), director of the University of California Transportation Center and Professor and Friesen Chair of City and Regional Planning, and Erick Guerra of the Department of City and Regional Planning at the University of California, Berkeley. A full description of the project methods are published in E. Guerra and R. Cervero (2011), "Cost of a Ride: The Effects of Densities on Fixed-Guideway Transit Ridership and Costs," *Journal of the American Planning Association*, vol. 77 (3), 2011, pp. 27-290. An accessible summary of the work is available through *ACCESS: the Magazine of the University of California Transportation Center* at http://www.uctc.net/access/40/access40_transitanddensity.shtml.

This newsletter highlights some recent accomplishments and products from one University Transportation Center (UTC). The views presented are those of the authors and not necessarily the views of the Research and Innovative Technology Administration or the U.S. Department of Transportation, which administers the UTC program.

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