

How transit scaling shapes cities

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The research, published in *Nature Sustainability*, analyzed data collected from 48 metropolitan areas in the United States, including New York, Boston, Minneapolis and Atlanta, which showed a positive correlation between ridership, residential density, and the convenience of using public transport.

The research drew on data collected by the University of Minnesota, measuring the number of jobs over 48 [metropolitan areas](#) that were accessible by [public transport](#). Efficiency was measured by assessing whether improvements to public [transport](#) influenced residential [density](#).

It also revealed it was more beneficial for transport operators to expand in [big cities](#) than launch into greenfield markets (undeveloped areas), as larger cities yield a greater return on [transit](#) improvement than smaller towns.

"Larger cities have a greater ridership return on transit improvement than smaller cities, so transit improvement should focus on strong but improvable systems instead of greenfield markets," said transport expert, Professor David Levinson, from the University's School of Civil Engineering. Professor Levinson conducted the research in conjunction with Civil Engineering Ph.D. candidate, Hao Wu and Dr. Somwrita Sarkar from the School of Architecture, Design and Planning.

"Public transport is relatively sustainable and is more suited to grow in larger cities than smaller ones. For example, accessibility improvement on the same scale would likely induce more transit patronage and residential land use intensification in New York City than in Las Vegas," said Mr Wu.

Dr. Somwrita Sarkar believes learnings from the research could be adopted in Australia's major cities.

"These findings are very relevant to Australia, as large cities like Sydney and Melbourne plan to accommodate future population growth," said Dr. Sarkar.

"The current scenario, which sees low density, suburban sprawl surrounding jobs located in CBD areas is inefficient. Instead, residential

and employment density growth must be paired with planned and prioritized growth in transit infrastructure," she said.

Car use declines with higher transit accessibility

Using a scaling model, the researchers found that with increased residential density, coupled with better public transport accessibility, the density of car commuters leveled-off and began to decline.

"Our paper finds that while public transport intensifies residential density, fewer people use cars," said Mr Wu.

"With an increase in transit accessibility, transit commuter density catches up to, and begins to exceed, auto commuter density. This was most apparent in the New York City," he said.

Residential location and commute mode choice are affected by accessibility of transport to jobs

The researchers' models were derived from a database that measured each minute of the morning peak period (between 7am—9am) over 11 million areas in the United States. They found that jobs within a 45 minute commute from home most affected transit rider density. The findings support that transit investment should focus on mature, well-developed regions such as Sydney or Melbourne, which would attract proportionally more ridership than smaller cities.

"The choice on where to live, and how one goes to work are generally intertwined, and are not usually separate decisions," said Mr Wu.

"Our research analyses the residential density of the working population, and transit commuters to reflect that joint decision process," he said.

Transit rider density rises faster than population density with increasing transit accessibility

Efficiency was measured by "returns of scale," assessing whether improved access to public transport influenced residential density.

The research found that residential density did increase with improvements to the transport network, but not at the same rate as the take up of public transport.

"There is a paradigm shift which indicates commuters favor public transport in areas that are well serviced. Residential density increases in places with convenient transport and a higher percentage of commuters switch to public transport to go to work," said Mr Wu.

"Improvements to transit accessibility, such as increasing the number of jobs that can be reached within 30 minutes using public transport, increases the number of commuters faster than it does residential density," he concluded.

More information: Hao Wu et al. How transit scaling shapes cities, *Nature Sustainability* (2019). [DOI: 10.1038/s41893-019-0427-7](https://doi.org/10.1038/s41893-019-0427-7)

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