

Study finds income affects bus ridership in bad weather

May 14 2019, by Jim Barlow



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Temperature extremes and heavy rain reduce weekday bus ridership in Lane County, except in low-income neighborhoods where residents have few alternatives for transportation, according to a University of Oregon

study.

When broken down, subtleties in the findings may help mid-sized communities consider how they might need to adjust their bus services in the face of climate forecasts that call for an increase in [extreme weather events](#), said Nicole Ngo, a professor in the UO's School of Planning, Public Policy and Management.

"I think this study is a starting point, especially with the income effects that we found," Ngo said. "In Eugene, university students get easy access to bus service, but other people without access to private vehicles rely on bus service. It is especially important on days of heavy precipitation, especially in Eugene when bike paths are flooded and riding is dangerous."

The study looked at Lane Transit District data from some 32 million observations, based on automatic passenger counters, at more than 1,300 bus stops in 2012-17. It was a stable period in which major adjustments did not affect the LTD's 62 routes. The dataset, Ngo said, allowed her to make associations based on the locations of bus stops in different income areas.

Because of the region's temperate climate, Ngo focused on days in which temperatures fell below 50 degrees or rose above 85 degrees. Rainfall was considered heavy if more than one-half inch fell in a day. Because major snow events are rare, they were not analyzed in the study.

On cold weekdays, bus [ridership](#) decreased by 5.7 percent, while on cold weekends the overall dip was less than 1 percent. On hot weekdays, overall ridership fell 2.2 percent; on weekends, hot-weather reduced ridership fell by 1.1 percent. Income factors made for differences.

"I wanted to explore the effect of extreme weather on ridership, and how

where you live, in respect to income, influences the relationship," Ngo said. "I did find that bus ridership is more sensitive to bad weather in low-income areas than in neighborhoods of higher-income."

For the study, ridership in neighborhoods in which households earned below \$50,000 were compared to those with incomes over \$75,000. Ridership in low-income neighborhoods rose by 2.7 percent on days of heavy rain but dipped by 1.6 percent on hot days.

The study – published online in the journal *Transportation Research Part D: Transport and Environment* – also found that weekend bus ridership rose during days of heavy rainfall, suggesting that leisure-time pursuits give residents more flexibility in their schedules.

"In a mid-sized city like Eugene, buses don't operate as frequently as they do in large cities," Ngo said. "There can be 30 minutes to an hour of waiting for a bus. It could be that heavy rain or icy conditions discourage people from traveling. They don't want to wait for a bus in those conditions."

Bus stops in commercial districts and near municipal parks were busier on days of heavy rain, the study found. Because both leisure and business uses are likely in play, the study noted, understanding travel purposes around commercial zones or parks could have meaningful economic and recreational implications.

In a literature review, Ngo found that most studies on bus ridership have looked at large metropolitan areas where buses often run more frequently. Such ridership data for midsized cities has been overlooked, she said.

The study suggests that as climate changes take hold, midsized communities may need to monitor ridership to see if they may need to

adjust the frequency of bus service in some areas. More research is needed, she added, to be able to compare her local findings with other comparably sized cities, especially those that don't have a major university where students' access can affect ridership numbers.

"As [heat waves](#) and days of heavy precipitation are expected to increase in the Pacific Northwest, these changes in bus ridership could have meaningful implications for transit agencies," Ngo wrote in her conclusion.

More information: Nicole S. Ngo. Urban bus ridership, income, and extreme weather events, *Transportation Research Part D: Transport and Environment* (2019). [DOI: 10.1016/j.trd.2019.03.009](https://doi.org/10.1016/j.trd.2019.03.009)

Provided by University of Oregon

Citation: Study finds income affects bus ridership in bad weather (2019, May 14) retrieved 8 April 2024 from <https://phys.org/news/2019-05-income-affects-bus-ridership-bad.html>

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