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Authors
Passmore, Reid
Guensler, Randall
Watkins, Kari E

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BikewaySim Expected to Improve Bicycle Infrastructure Planning Process

Reid Passmore and Randall Guensler, *Georgia Institute of Technology*
Kari E. Watkins, *University of California, Davis*

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Issue

Many US cities aim to increase environmentally sustainable modes of transportation, such as cycling or public transit. However, the current built environment in many of these cities does not adequately support cyclists or public transit riders. Research shows that to promote cycling, cities need low-stress routes and cycling infrastructure, such as bicycle lanes. Bicycle infrastructure can minimize cyclists' exposure to high-speed automobile traffic and increase the actual and perceived safety of cycling. Bicycle infrastructure can also potentially improve connections to public transit stops and stations. However, planners lack the tools to effectively measure where bicycle infrastructure improvements will yield the best outcomes.

New research from Georgia Tech addresses this problem by developing two new modeling tools, BikewaySim and TransitSim, to assess how bicycle infrastructure can affect cycling and public transit access. Using BikewaySim, the researchers modeled over 28,000 potential cycling trips, calculating the impacts of two proposed cycling infrastructure projects in Atlanta, Georgia. Using TransitSim, the researchers modeled combined cycling and transit trips from four distinct locations in Atlanta, Georgia.

- **BikewaySim** is a shortest path calculator for cycling. Cities can use this tool to more strategically allocate limited resources for building cycling infrastructure. Planners and engineers can use BikewaySim to assess the impacts of proposed cycling infrastructure projects. This can include identifying projects that are most likely to make more destinations easily accessible by bicycle, which will in turn encourage cycling and improve mobility. Additionally, this tool may aid in communicating these impacts to decision-makers and the public.
- **TransitSim** is a shortest path calculator for public transit. When combined with BikewaySim, this tool can aid practitioners and public transit agencies in determining where to encourage cycling to public transit trips. In cities with sprawling land uses, transit users may have to endure long walking trips to access public transportation service. Bicycles can potentially extend the service area of public transportation by allowing transit users to cover a greater distance in the same amount of time.

Together, these new tools can improve bicycle and public transit infrastructure planning.

Key Findings

Cyclists do not always choose the most direct route and planning tools must consider several nuances in how cyclists route their trips with respect to elevation, obstacles, and other preferences. Previous research shows that cyclists often choose a more circuitous route to avoid steep hills and stressful road sections, like those with high-speed vehicle traffic or a high number of vehicle travel lanes. Cyclists are also shown to detour towards road sections with bicycle lanes or multi-use paths that provide dedicated space for cycling. The BikewaySim model incorporates these preferences, building a more nuanced and accurate model of bicycle routing. BikewaySim provides planners with an improved picture of how elevation, speed limit, bicycle infrastructure, and number of vehicle travel lanes, among other factors, impact cycling accessibility.

BikewaySim can assist practitioners in ranking and prioritizing new bicycle infrastructure based on estimates of reduction in *impedance*. *Impedance* is the relative cost of making a journey, typically expressed in units of time or money. For car travel, this includes travel time, parking costs, tolls, etc. For cycling, it includes travel time and the perceived cost of the cycling route based on cyclists' preferences for road attributes, among other preferences. Cycling infrastructure can reduce impedance by reducing the perceived cost, making a ride feel safer or more comfortable.

Cycling accessibility can be expanded by the addition of new bicycle infrastructure. New cycling infrastructure can be shown to increase the area that cyclists would be willing to travel to. BikewaySim (see Figure 1) can demonstrate this by showing which neighborhoods or areas can benefit from a given improvement, with respect to a given set of impedance constraints. These visualizations can be used to communicate to the public how new bicycle infrastructure can increase the number of destinations that people can access by bike.

Cycling to public transportation can reduce transit travel times and increase accessibility to destinations. BikewaySim in combination with TransitSim (see Figure 2) shows the extent of what is accessible from a given point in the Atlanta region, shown here as a traffic analysis zone (TAZ). Given a time constraint, TransitSim shows the locations people can access using a combination of walking, cycling and public transit.

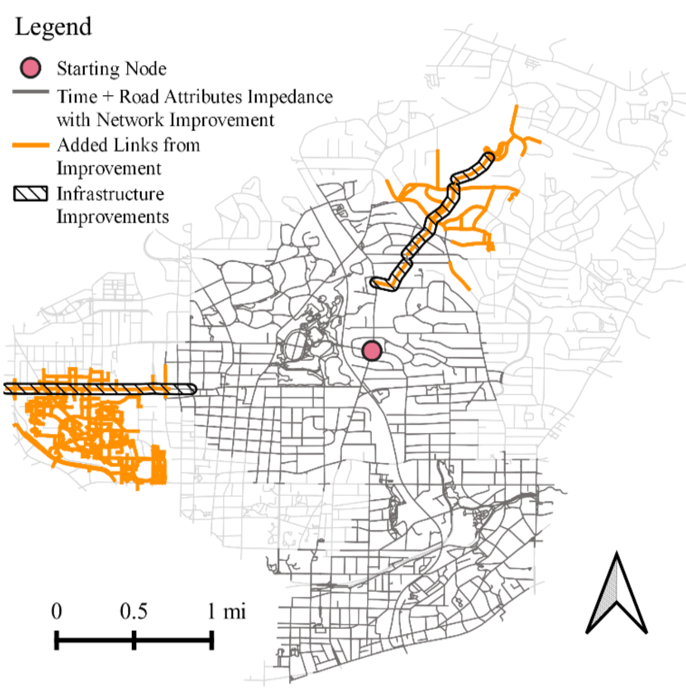

Figure 1. BikewaySim displays the study area in Atlanta, GA, showing (in orange) the increase in accessibility by bike after the installation of new cycling infrastructure.

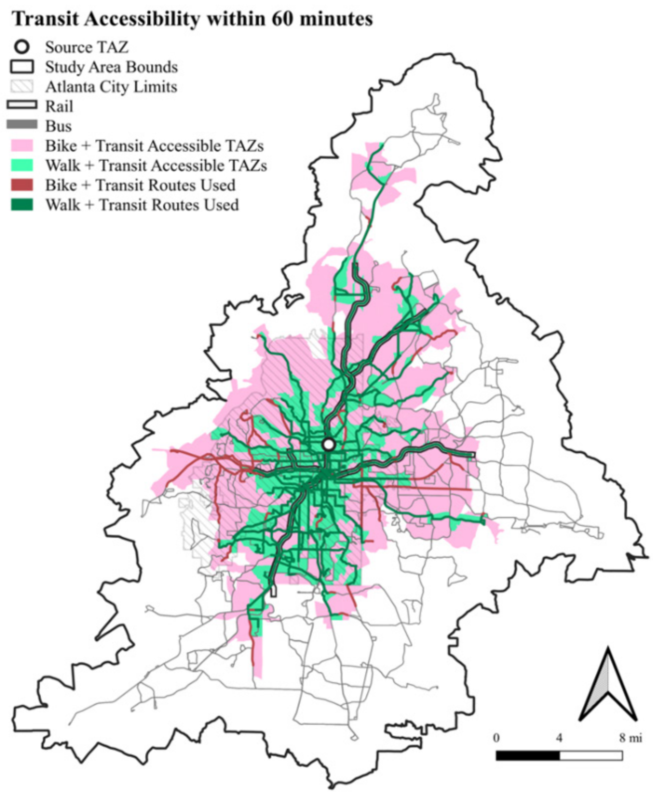

Figure 2. Area in Atlanta, GA accessible by walking, cycling, or either in combination with public transit.

More Information

This policy brief is drawn from "Simulating Bike-Transit Trips using BikewaySim and TransitSim," a report from the National Center for Sustainable Transportation, authored by Reid Passmore and Randall Guensler of the Georgia Institute of Technology and Kari E. Watkins of the University of California, Davis. The full report can be found on the NCST website at https://ncst.ucdavis.edu/project/simulating-bike-transit-trips-through-bikewaysim-and-transitsim.

For more information about the findings presented in this brief, contact Kari Watkins at kewatkins@ucdavis.edu.

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