

# RESEARCH SPOTLIGHT

## Project Information

**REPORT NAME:** Leveraging Crowdsourced Data in Planning, Design, Analysis, and Evaluation of Pedestrian and Bicycle Traffic

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## Using crowdsourced data to estimate nonmotorized traffic volumes

Estimating the number of bicyclists and pedestrians that use the transportation network is essential to understanding their safety risk when interacting with other travel modes and is useful for designing safe and effective infrastructure for nonmotorized travelers. Smartphone applications enabled by GPS capabilities offer crowdsourced data as a potential new tool for estimating nonmotorized traveler volume. While concerns about the quality, coverage and representativeness of crowdsourced data persist, a new framework can help the Michigan Department of Transportation (MDOT) use the data with existing tools to better estimate bicycling and pedestrian traffic volumes.

### PROBLEM

Designing and maintaining safe and effective transportation infrastructure for all travelers require an understanding of the safety risks for bicyclists and pedestrians. MDOT needs to identify roadway and infrastructure characteristics and features that impact nonmotorized travel, such as those aspects that correlate with crashes. The first step, however, is to determine the locations and average daily volumes of bicycle and pedestrian traffic.

Monitoring pedestrian and bicyclist use with traffic counters is much more limited than observing vehicle traffic. With approximately 100 portable monitors for over 110,000 miles of Michigan roadway, understanding nonmotorized traveler volumes and patterns across the transportation system is challenging. To address this challenge, transportation and planning



Crowdsourced data from smartphone apps may supplement nonmotorized traffic volume data from traffic counters to design safer infrastructure for all users.

agencies across the country are exploring the potential of crowdsourced data gathered from bicyclists and pedestrians using the transportation network.

*“Project results will support MDOT in expanding our ability to analyze the movements of people walking or bicycling to ensure safe and efficient active transportation infrastructure.”*

**Josh DeBruyn**  
Project Manager

Various GPS-enabled smartphone apps, including fitness trackers, collect data about traveler routes and time frames that could help transportation planners expand nonmotorized traveler monitoring capacities. These mobile datasets, though, are large and may be difficult to integrate with other systems. The quality and coverage of crowdsourced data are uncertain, and travel mode may not be readily identifiable. Additionally, privacy concerns may limit data availability. MDOT wanted to explore these issues and evaluate the potential of crowdsourced data to supplement current bicycle and pedestrian monitoring tools.

## RESEARCH

To evaluate the quality and efficacy of crowdsourced mobile data for identifying nonmotorized traveler trends, researchers first examined existing research and relevant data uses. Literature reviewed covered crowdsourced data types, collection methods and data applications such as forecasting pedestrian and bicycle traffic, understanding travel behavior and analyzing user perceptions. A survey of state departments of transportation gathered information about current practices and experiences with bicycle and pedestrian monitoring in general and the use of crowdsourced data. Questions explored agency satisfaction with mobile data accuracy, coverage, representativeness, and other factors.

Nonmotorized traveler monitoring data from nearly 40 counters placed on paved or unpaved paths, sidewalks, and protected or standard bike lanes on roads across the state was compiled from 2019 to 2022. Vendors of two commonly used apps, StreetLight and Strava, provided crowdsourced data for the monitored locations. After analyzing how well the crowdsourced data matched the ground truth monitored data, researchers found that StreetLight data was the closest match. In 2022, however, StreetLight switched from providing road segment-level data to aggregating data over an entire census tract, leaving Strava as the most appropriate data source for project purposes.

A set of generalized models using crowdsourced data allowed researchers to explore variables that could explain the differences between crowdsourced data and counter data. Identifying appropriate adjustment factors would allow estimates of nonmotorized traffic volume to be generalized across the transportation network. Researchers developed models that evaluated bicyclists and pedestrians separately and in combination.

## RESULTS

The survey and review of published research indicated widespread concerns about data quality, spatial coverage and representativeness of bicyclists and pedestrians not using the apps, which are primarily used for fitness tracking. While some crowdsourced data is free to transportation agencies, survey respondents frequently cited cost as a barrier to wider use.

Privacy concerns contributed to crowdsourced data undercounting compared to counter data in many areas. Models illustrated that while Strava data had stronger correlations with counter data for bicycle traveler volume and combined bicyclist and pedestrian volumes, correlations of the crowdsourced data with pedestrian counters were weaker. Variables based on both land use and population improved the predictions of nonmotorized traveler volume using Strava data.

Although researchers do not recommend the use of crowdsourced data in place of counter data, the models developed can provide another data source for bicyclist and pedestrian volume predictions at specific locations. MDOT could also replicate the models in the future with updated crowdsourced and counter data.

## VALUE

MDOT will continue collecting data on bicycle and pedestrian traffic with portable counters while planners explore the potential applications of the traffic prediction models. Apps that track activity as travelers move through the transportation network will continue to evolve, though privacy concerns may limit data access.

## Research Administration

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**The final report is available online at**

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