In a series of NITC Research Roadmaps, we surveyed the state-of-knowledge and where we’re headed across six areas of transportation. Here we share the contributions of a decade of multimodal data and modeling research from the National Institute for Transportation and Communities (NITC). Download the full literature review from this roadmap here: https://nitc.trec.pdx.edu/nitc-research-areas

### Nonmotorized Count Data

Counts of people walking and bicycling are important for monitoring trends, planning new infrastructure, and analyzing safety. NITC research has advanced the state of the practice by improving data quality and standardization, as well as by integrating new technologies. One study fused traditional count data with emerging data sources from GPS and mobile devices to estimate network-wide bicycle volumes, and another study is looking into a similar method for crowdsourcing pedestrian data. NITC researchers have explored methods to assess passively collected and crowdsourced data for accuracy, representation, completeness, and bias. Improved sensor technology has a role to play as well: one recent NITC study developed a new intelligent multimodal traffic monitoring device using low-cost mmWave radar.

One NITC study used high-resolution bus data to create more precise and statistically valid trip time models. Another compared bus stop-level data with demand-responsive parking data to show the effect nearby parking prices had on bus ridership. A third study used built environment factors – density, diversity, and walkability – to classify neighborhoods and found that transit-oriented development residents walk more, take transit more, and spend less on transportation than their counterparts in other types of neighborhoods.

### Survey Data

Travel surveys provide information about travel patterns that is necessary for planning and policymaking. However, current survey methods do not adequately capture active transportation trips, and may not accurately represent marginalized populations. NITC researchers have significantly refined travel survey methods, improving accuracy and making the data more context-sensitive. One NITC study recommended the creation of pooled samples with comparable and consistent data from cities, which could be beneficial for understanding relationships between travel behavior and the built environment. Other NITC studies have looked at making data collection methods more inclusive of marginalized populations through strategies like increased transparency, protection of privacy, and more robust community engagement.

### Applications of Multimodal Data: Equity

Despite recent improvements in household transportation survey methodologies, people of color and immigrant groups remain under sampled and understudied. A NITC study linked census population and housing data to a stratified...
random sample of households from the Oregon Household Activity Survey and found that the survey consistently 
overrepresented white households and underrepresented nonwhite households across the greater Portland area. The 
study developed a set of recommendations to improve the 
representation of diverse populations in travel surveys.

Adoption of cashless fare systems has created barriers for 
lower-income transit riders. One NITC study explored the 
costs for agencies to maintain some cash options and found 
that simple approaches, such as cash collection onboard 
buses, can be quite cost effective at ensuring transit remains 
accessible and easy for all riders.

Transit agencies currently lack guidelines for assessing the 
social equity impacts of replacing flat fare with distance-
based fare structures. Another study found that shifting 
to a distance-based fare system may benefit low-income, 
elderly, and non-white populations; however, the effect is 
geographically uneven, and may be negative for members of 
these groups living on the urban fringe.

Applications of Multimodal Data: Safety

Signal timing treatments can improve bicycle safety. A NITC 
study analyzed the operational impacts of various signal 
timing treatments on right-hook bicycle-vehicle conflicts. 
The research found that while a split leading bike interval 
treatment was useful in mitigating conflicts during the lead 
interval, the risk for bicyclists was then shifted to the stale 
green portion of the phase. The study also revealed that 
significant confusion was exhibited by both cyclists and 
drivers in a mixing zone, where bike and car traffic merged.

The 2010 Highway Safety Manual provides methods for 
predicting the number of motor vehicle crashes on various 
facilities, but it includes a simplistic method for predicting the 
number of bicycle-related crashes. A NITC study developed 
the first bicycle-specific safety performance functions for 
segments in the U.S. and found that motor vehicle volume 
is a leading factor associated with more crashes between 
drivers and bicyclists. Bicyclist exposure, population density, 
and percent retail land use are also predictive.

Conclusion

Researchers and practitioners share common concerns 
about current data collection and processing strategies, 
especially a lack of standardization and validation. These 
limitations likely result in incomplete, inefficient, or even 
biased modeling strategies across all travel modes. 
Considering rapid changes in emerging data sources and 
technologies, as well as new travel modes, there is a clear 
need for greater scientific guidance and innovation on data 
collection, analysis, and modeling strategies.

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