

Research Need Statement 616

I. Need Statement Champions and Information

I.A. Need Statement Champion Information

- I.A.1. First and Last Name of Research Champion: **Michael Petesch**
- I.A.2. Research Champion's Office: **Transit and Active Transportation**
- I.A.3. Research Champion's Phone Number: **651/366-4197**
- I.A.4. Research Champion's Email: Michael.Petesch@state.mn.us

I.B. Research Co-Champion

- I.A.1. First and Last Name of Research Co-Champion: **Jake Schutt**
- I.A.2. Research Co-Champion's Office: **Transit and Active Transportation**
- I.A.3. Research Co-Champion's Phone Number: **651/366-4194**
- I.A.4. Research Co-Champion's Email: Jake.Schutt@state.mn.us

I.C. Research Needs Title (115 Characters):

Understanding how mobile device data can supplement MnDOT's Bicyclist and Pedestrian (permanent and portable) Counting Program and be used to inform bicyclist and pedestrian investment decisions statewide.

I.D. Project Sponsor: **MnDOT Research Program**

II. Research Need Background and Description

II.A. Research Need Background

- II.A.1. Describe the problem or opportunity.

MnDOT's Pedestrian and Bicyclist Data Program relies on fixed and portable automated people counters for gathering non-motorized volume and travel pattern data. This information is useful for assessing risk exposure and other characteristics where a count is taken, but it's not capable of assessing walking and bicycling networks. To improve this program, MnDOT proposes conducting a review and synthesis of which mobile device data platforms and related datasets allow additional bicyclist and pedestrian travel info to be gathered and analyzed. This synthesis would break down the benefits and challenges of using each data source based on MnDOT's desired applications so that MnDOT can better inform future bicyclist and pedestrian safety, risk assessments, investment needs and funding decisions along and across trunk highways, and local road. Additionally, this synthesis would develop methodologies for using the data to show where

people are bicycling and walking, identify gaps where facilities do not currently exist, and inform where safety counter measures are most effective for the greatest number of people.

II.A.2. If applicable, describe how this project will build on previous research.

We are not aware of any current research completed at MnDOT, but a literature review did reveal some applicable research that is listed below.

MnDOT will begin development of a Minnesota specific data warehouse with Minnesota IT Services in 2020. This warehouse will allow MnDOT and state and local partners to store, analyze and access all active transportation count data in MN. To inform the build, the project team will be accessing databases developed by [TxDOT](#), [FHWA](#), [WsDOT](#), [Portland State University](#), [NC ITRE](#), and [DVRPC](#). This mobile data research will help inform the capabilities of the MN warehouse and vice versa.

II.A.3. If applicable, include the title/s or previous research.

Here are a few related previous studies from the literature review:

- Ongoing efforts to evaluate the accuracy of mobile source data for motorized vehicles since this research could build off those findings
 - Federal Project Number MP-20(001): Validating AADT Estimates from Mobile Device Data (MnDOT Contract No. 1003324, Work Order No. 8) - MnDOT is conducting a project comparing StreetLight's AADT against our continuous counters as well as a subset of lower volume short duration sites (i.e. sites where a factor is applied to a 48hr count to get an AADT).
 - [MnDOT Contract No. 1003324](#) - Previous study completed by Texas A&M Transportation Institute that they are now doing again with 2019 data
 - FHWA pooled fund study TPF-5(384): Exploring Non-Traditional Methods to Obtain Vehicle Volume and Class - Simultaneously, a national study is trying to answer essentially the same questions using data from several states
- Michael Lowry at the University of Idaho has created methodology to [estimate Annual Average Daily Bicyclists](#) on every road segment in the state of Washington using origins, destinations, volume data from permanent and portable people counters, etc.
- ["Trip Distribution Modeling Using Mobile Phone Data: Emphasis on Intra-Zonal Trips."](#)
- ["Disaggregation of aggregate GPS-based cycling data - How to enrich commercial cycling data sets for detailed cycling behaviour analysis."](#)
- ["Assessing the Potential of Big Mobility Data to Improve Transport Modelling for Cyclists."](#)
- ["NCHRP 08-36, Task 141 – Evaluation of walk and bicycle demand model practice"](#)
- ["NCHRP Project Panel on State DOT usage of bicycle and pedestrian data: practices, sources, needs, and gaps/Practices and Recommendations in Reporting and Integrating Non-Fatal Injury Data for Active Travel Modes"](#)

- [“NCHRP Project Panel on Enhancing Pedestrian Volume Estimation and Developing HCM Pedestrian Methodologies for Safe and Sustainable Communities”](#)

II.A.4. What is the **objective** of the proposed research?

The main objective of this research is to identify a preferred and available mobile big data platform to “field test” a model for forecasting pedestrian and bicyclist volumes and travel patterns along roads and other facilities in Minnesota where MnDOT has not performed any people counting. The modeling would involve assessing the trustworthiness and validity of the preferred platform against local and regional data from MnDOT’s people counters. These forecasts would then be used to inform state, regional, and local planning and engineering initiatives, assess transportation policies and programs such as Complete Streets and Toward Zero Deaths, and inform future bicyclist and pedestrian safety and risk assessments, investment needs and funding decisions.

Additional objectives and outcomes include:

- Understand how each dataset accounts for demographic information of the mobile data so we know who the data represents and realize who is missing so we can address those gaps. This is critical to ensure MNDOT and locals have the best tools with data that is representative of all people in Minnesota so that we are equitably addressing the diversity of populations and routes regardless of personal access to smartphones, GPS devices, etc.
- Determine any dependencies a mobile data source has on other MnDOT or external data sources. For instance, does the data source rely on MnDOT’s automated people counters to train their data models, therefore requiring that those devices be maintained by MnDOT.
- Compare mobile device volume data and weather data to evaluate weather related effects on active transportation volumes and travel patterns. This would allow us to create weather adjustment factors for better estimating annual traffic from short duration counts and data. Table 4-5 in [NCHRP 797](#) details some of these effects.
- Evaluate how easy the mobile sourced data is to import into MnDOT systems. For instance, some sources associate their data with Open Street Maps and not the MnDOT LRS system, which makes it difficult to import large datasets directly into our LRS based systems
- Understand the limitation of the data from each mobile source. Is it good for looking at overall increases in walking and bicycling vs. producing regional and seasonal adjustment factors? What about detail at different time interval (i.e. can we look at distribution across and hour, day, week, month, decade, etc.?)
- Understand how well the accuracy of the mobile sourced data compares to other data sources (ie. MnDOT counter data, Strava heat maps, etc.) for a city or handful of small geographic areas before scaling up to a MnDOT district or the state. The data should also be compared to local plans to “ground-truth” it and see how well it matches up with reality and public comment so we can whittle out areas that have a 5k, but otherwise

aren't popular running routes or a lake that people boat across but they show up as bicycling trips.

- Understand strengths and weaknesses of the mobile datasets and how they can or cannot address the points above and the goals, strategies, and objectives outlined in [MnDOT's Strategic Plan for counting People Walking and Bicycling](#).

III. Strategic Priorities, Benefits, and Expected Outcomes

Section III. is for MnDOT sponsored and co-sponsored projects only; all LRRB projects proceed to section IV.

III.A. MnDOT Strategic Priorities

Instructions: Briefly describe how the project aligns with the following MnDOT Research Strategic Priorities. Complete all that apply.

III.A.1. Innovation & Future Needs:

- Informs future pedestrian and bicyclist investment needs and funding decisions for several MnDOT plans including the [Statewide Multimodal Transportation Plan](#) and the [State Highway Investment Plan](#) which will both be updated in 2022.

III.A.2. Advancing Equity:

- Informs more equitable and transparent provision of resources for multi-modal infrastructure needs in a systematic way. Knowing AADT's for people walking and bicycling in all MN roads would also allow for more complete risk assessments and analysis which could inform counter safety measures.

III.A.3. Asset Management:

- In the short-term, there is value in having a mix of assets/data to inform data-driven decision making. Long-term the results of this and subsequent research could mean abandonment of permanent counters and transition to full mobile data. This has yet to be determined.

III.A.4. Safety:

- Informs future bicyclist and pedestrian safety and risk assessments by providing volumes and travel patterns that facilitate calculations of exposure levels.

III.A.5 Climate Change & Environment:

- Supports active transportation mode infrastructure decisions, which improve the health of Minnesota's environment, economy and people.

III.B. Expected Outcomes

Instructions: Check all expected direct outcomes of this research.

- New or improved technical standard, plan, or specification
- New or improved manual, handbook, guidelines, or training
- New or improved policy, rules, or regulations
- New or improved business practices, procedure, or process
- New or improved tool or equipment
- New or improved decision support tool, simulation, or model/algorithm (software)
- Evaluation of a new commercial product
- New or improved technical standard, plan, or specification
- Other. Please specify below:

III.C. Expected Benefits

Instructions: Select all expected benefits that may be realized if the findings and recommendations from this research is adopted or implemented

III.C.1. Construction Savings Other Construction Savings. Please describe below

- This project will kickoff MnDOT's ability to accurately model active transportation across Minnesota's entire transportation network. Then, there is potential for cost savings by using the information to make data-driven decisions to efficiently and equitably allocate resources to support bicycling and walking.

III.C.2. Decrease Engineering/Administrative Costs Other engineering or administrative cost. Please specify.

- This project could provide better quantitative and qualitative data about routes people walking and bicycling are actually taking, where network gaps exist, travel patterns and volumes that could inform plans and projects so they better address the needs of the community up front and reduce the resources needed to make corrections in the future.

III.C.3. Environmental Aspects Other environmental impact. Please describe below.

- Creating an environment and systemic structure at MnDOT that supports active transportation and dedicates resources to making walking and bicycling safe, easy and convenient means to move around Minnesota will reduce all forms of pollution, while improving the health and wellness of people and the economy.

III.C.4. MnDOT Policy Changed or inform a policy

- Provides information to assess important transportation policies and programs such as Complete Streets and Toward Zero Deaths.

III.C.5. Lifecycle Reduce maintenance cost

- This research may identify opportunities that move MnDOT and other partners away from permanent automated people counters that require ongoing resources to operate and maintain the physical equipment in a cold climate with frequent freeze/thaw conditions.

III.C.6. Operations and Maintenance Savings Other operationa dn maintenance savings. Please describe below.

- This research may identify opportunities that move MnDOT and other partners away from permanent automated people counters that require ongoing resources to operate and maintain the physical equipment in a cold climate with frequent freeze/thaw conditions.

III.C.7. Reduce Risk Other reduced risk. Please describe below

- Understanding travel behavior will support creating safer facilities and more connected networks that reduce the risk for people walking and bicycling along and across Minnesota highways and roads.

III.C.8. Reduce Road User Cost Other reduced road user cost. Please describe below.

- Better understanding where people are walking and bicycling, and the accessibility of destinations will inform how resources should be allocated to make active transportation safer, easier and more convenient transportation options. By making active transportation options more attractive, people begin shifting from their private automobiles to walking, bicycling and micromobility options which create less pollution, kill and maim fewer people, decrease congestion and travel times for all modes.

III.C.9. Safety Reduction of crash frequency and severity

- Mobile device data will help provide the denominator that pedestrian and bicyclist crash volumes can be compared too which will inform future bicyclist and pedestrian safety and risk assessments, investment needs and funding decisions.

III.C.10. Technology New method of using technology

- Provides replicable methods to model big data which can be refreshed periodically when new data is available.

III.C.11. Other, please describe below:

IV. Technical Advisory Panel

Instructions: Please list the name and affiliation of individuals to consider for the Technical Advisory Panel.

- OTSM - Ian Vaagenes and Sandy Yassin
- OTAT – Michael Petesch, Jake Schutt, Kirby Becker, Amber Dallman, Hannah Pritchard
- Metro Bike and Ped – Mackenzie Turner Bargaen, Jesse Thorsen
- Districts – Mary Safgren (D4)
- Regional Development Commission (RDC) - Charlie Moore (ARDC), Wayne Hurley (WCI)
- Metropolitan Planning Organization (MPO) – Heidi Schallberg (Met Council), St Cloud APO, Fargo / Moorhead
- MnIT – John Solberg, Stephen Palka (OTSM MnIT)
- Cities and Counties – St Paul, Minneapolis, Hennepin County

Your assigned Project Advisor is available to answer questions and provide guidance (assigned by the Office of Research & Innovation).

Your Project Advisor is: Brent Rusco, brent.rusco@state.mn.us