Research Need Statement 621

I. Need Statement Champions and Information

I.A. Need Statement Champion Information

I.A.1. First and Last Name of Research Champion: Steven Misgen
I.A.2. Research Champion's Office: MnDOT Metro District Traffic Engineering
I.A.3. Research Champion's Phone Number: 651-234-7835
I.A.4. Research Champion's Email: Steve.Misgen@state.mn.us

I.B. Research Co-Champion

I.A.1. First and Last Name of Research Co-Champion: Derek Lehrke
I.A.2. Research Co-Champion's Office: MnDOT Metro District Traffic Engineering
I.A.3. Research Co-Champion's Phone Number: 651-234-7828
I.A.4. Research Co-Champion's Email: Derek.Lehrke@state.mn.us

I.C. Research Needs Title (115 Characters): Evaluating Different Detection Technologies for Signalized Intersections

I.D. Project Sponsor: Joint MnDOT and Local Road Research Board

II. Research Need Background and Description

II.A. Research Need Background

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

MnDOT and many local MN agencies have traditionally used imbedded loop detectors in the pavement for detecting vehicles at signalized intersections. A properly placed detection loop can last the life of a signal (30+ years) if placed correctly beneath the entire roadway surface. Limitations of these systems include that they cannot be moved once placed and also only detect large metal objects. When signals are replaced or modified with no associated pavement replacement, the loops must be cut into the pavement which reduces the signal loop lifespan.

Additionally, as MnDOT has deployed Automatic Traffic Signal Performance Measures (ATSPM) the need to detect all lanes of approach can become cost prohibitive due to the required number of detector loops.

Newer detection technologies, such as video and radar, address some of these concerns. Furthermore, with the rise in connected vehicles some of these detection technologies have shown the ability to detect not only cars but vulnerable road users, such as bikes and pedestrians, which could be used to alert other drivers or allow the traffic signal to modify its timing to better serve them.

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

Signalized intersection technology, both hardware and software, is continually evolving. MnDOT has not conducted any evaluations of newer technologies.

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

Expanding the Capabilities of Radar-Based Vehicle Detection Systems: Noise Characterization and Removal Procedures (Santiago-Chaparro, Kelvin R.; Noyce David A., University of Wisconsin, Transportation Research Record: Journal of the Transportation Research Board, Volume 2673, Issue 11, 2019, pp 150-160)

Using ATSPM Data for Traffic Data Analytics (Chamberlin, Robert; Fayyaz, Kiavash, Resource System Group; Utah Department of Transportation; Federal Highway Administration, 2019)

Impact of Traffic Signal Controller Settings on the Use of Advanced Detection Devices (Sunkari, Srinivasa; Bibeka, Apoorba; Chaudhary, Nadeem; Balke, Kevin. Texas A&M Transportation Institute; Texas Department of Transportation; Federal Highway Administration, 2019, 82p)

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

This project would evaluate all available signal-connected vehicle detection systems based on multiple characteristics, including, but not necessarily limited to:

- Costs (both capital & maintenance)
- Anticipated life-cycle of product/technology
- Ease of installation and operation
- Weather
- Performance related to detection of various vehicle types and also pedestrians and bicycles
- Features related to ATSPM and Connected Vehicle readiness

The project should also include surveys of detection systems currently in use in signal operations both nationally and within Minnesota (MnDOT, county, and city). A summary of the evolution of signal detection technology will providing understanding of why previously-used systems were discontinued.

The goal of the project would be develop a decision tool (i.e., matrix or decision tree) to guide signal design by MnDOT and other public works entities in Minnesota in order to accommodate all transportation system users at the intersection.

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: **Technology for vehicle detection at signalized intersections is evolving at a rapid pace and costs of new technology are falling so they may be cost effectively implemented.**

IIIA.2. Advancing Equity: **New vehicle detection technologies are often more capable of detecting more modes of transportation, including pedestrians and bicyclists.**

III.A.3. Asset Management:

III.A.4. Safety: I**mproved vehicle detection will allow traffic signals to function better**

III.A.5 Climate Change & Environment: **Improved detection at signalized intersections often leads to fewer vehicles idling and shorter wait times.**

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.
Reduced material needed with potential for no pavement disruption. May also require less labor

III.C.2.Decrease Engineering/Administrative Costs Choose an item.

III.C.3. Environmental Aspects Air Pollution
Potential for reduced idling at signalized intersections

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

III.C.5. Lifecycle Choose an item.

III.C.6. Operations and Maintenance Savings Reduced equipment cost
Newer detection technology for traffic signals may perform better at same or reduced costs

III.C.7. Reduce Risk Choose an item.

III.C.8. Reduce Road User Cost Choose an item.

III.C.9. Safety Other safety benefit.
Improved operations of traffic signals due to better detection of all roadway users

III.C.10. Technology New technology
Technology to detect vehicles at traffic signals is evolving and current decision guides do not address

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.

Derek Lehrke, MnDOT Metro Traffic

Steve Misgen, MnDOT Metro Traffic

City and County Traffic Engineers

Consultants

Your assigned Project Advisor is available to answer questions and provide guidance (assigned by the Office of Research & Innovation).
Your Project Advisor is: Beth Klemann Email: beth.klemann@state.mn.us