2019 UDOT RESEARCH PROBLEM STATEMENT

**** Problem statement deadline is Feb. 6, 2019. Submit statements to UTRAC@utah.gov. ****

Title: Crash Analysis and Development of Surrogate Measures of Safety using Raw Detector and Signal Data
No. (Office Use): 19.03.20

Written By: Juan C. Medina **Organization:** University of Utah **Email:** juan.c.medina@utah.edu **Phone:** 801-585-1952

Submitted By UDOT Employee: Jeff Lewis **Email:** jefflewis@utah.gov **Phone:** 801-910-2180

UDOT Champion (if different): **Email:** **Phone:**

Select ONE Subject Area ☐ Materials/Pavements ☐ Maintenance ☒ Traffic Mgmt/Safety ☐ Structures/Geotech ☐ Planning ☐ Perf Mgmt/Data Analytics ☐ Public Transportation ☐ Other

1. Describe the problem to be addressed:

Availability of detailed traffic and crash data is often a limitation in roadway safety analysis, particularly when specific crash types or geometric features need to be investigated. Moreover, crash reports do not provide sufficient information to understand traffic conditions or signal states in the moments leading to the crash, and field data collection is typically limited to AADT or small sampling of traffic demands. Therefore, crash analysis has been traditionally approached from a statistical standpoint where contributing factors are based on general traffic measures (e.g. AADT) and static features (e.g. geometry), without incorporating any dynamic operational aspects that are also present during a crash (e.g. traffic conditions, signal states, and conflicts prior and at the moment of crash). Technological advancements in data collection have opened new opportunities to analyze high-resolution (individual) detector activations and changes in traffic signal states so that researchers and engineers can better understand how and when crashes occur. Such analysis can provide significant new knowledge in traffic safety and insights that may lead to direct operational recommendations for low-cost safety improvements that cannot be generated using traditional data sources. The principal investigator has already conducted preliminary data collection and analysis using detailed data (5-minute counts) from ATSPM and crash reports, as well as initial risk estimations for left-turn crashes. Such initial efforts resulted in automated scripts and data analysis showing very promising relationships between conflicting movements and risk of left-turning crashes and will serve as a baseline for the proposed research, this time using high-resolution raw vehicle activations and traffic signal states.

2. Write the project objective (25 words or less):

Analyze crash patterns and develop validated surrogate measures of safety at signalized intersections using high-resolution detector activations and signal states from ATSPM raw datasets.

3. Explain why this research is important:
(In response, consider addressing specific UDOT goals, applicability in Utah or other states, etc.)

This research will leverage existing large datasets already collected by UDOT to enhance basic and applied understanding of scenarios leading to intersection crashes. This would be the first study of such kind in the transportation community and will also result in practical tools ready for field implementation. This research will also result in direct recommendations to improve safety at the operational level (e.g. recommended signal phasing/timing strategies), aiming at high-reward low-cost countermeasures.

4. List the major tasks:

1. Formulation of detailed work plan, including identification of target locations and data availability.
2. Harness large amounts of data using automated scripts, and post-process datasets to parse variables and identify measures of interest, such as movement-specific activations and beginning and end of signal phases. Initial focus will be given to angle and rear-end crashes.
3. Analysis of data to identify patterns in the moments leading to crashes and quantify the risk of each of such patterns. Patterns will be defined considering both detector and traffic signal state data.
4. Development and validation of surrogate measures of safety and a real-time metric that can be used for continuous monitoring of crash risk at intersections.
5. Formulation of operational strategies and recommendations, and production of final presentation and report.

5. List the expected deliverables (reports, manual, specification, design method, training, etc.):

1. Definitions and descriptions of methodologies to estimate surrogate measures of safety using high-resolution data from the ATSPM system.
2. Proposed implementation of risk metrics to calculate and continuously monitor intersection crash risk. This implementation will be in the form of algorithms that can be directly implemented by UDOT.
3. Final report and a presentation with complete documentation on data collection, methodology, safety modeling, findings, and practical recommendations for safety improvements.

6. Describe how the research results will be implemented:
(In response, consider addressing UDOT leader support, process or standard improvement, etc.)

This research will not only provide new foundation to analyze high-resolution data for safety applications, but it will be also highly directed at producing application-ready tools for UDOT. The unique data sources used in this research will allow the formulation of operational-level and directly implementable metrics, algorithms, and recommendations aimed at low-cost safety improvements including signal timing setting strategies and risk monitoring applications.

7. Requested from UDOT: $30k **Other/Matching Funds:** $30k (from MPC UTC or CvEEN at UofU)
Total Cost: $60k
(or UTA for Public Transportation)

8. Outline the proposed schedule, including start and major event dates:

The proposed research will be completed in a period of 12 months, as summarized below:

- Formulation of detailed work plan (1 month)
- Harness and post-process high-resolution and crash data (2 months).
- Data analysis and identification of patterns (TAC Meeting) (3 months)
- Development and validation of risk and surrogate measures (3 months)
- Formulation of operational strategies and recommendations (2 months)
- Final presentation to TAC and submission of final report and algorithms (at the end of 11th month)
- Comments and revisions to final report (during 12th month)