2019 UDOT RESEARCH PROBLEM STATEMENT

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

Title: Safety in numbers? Developing improved safety predictive methods for pedestrian crashes at signalized intersections in Utah using push button-based measures of exposure **No. (Office Use):** 19.03.16

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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:

The primary motivation for this research is the troubling trend of *increasing numbers and shares of pedestrian injuries and fatalities*, both nationally and in Utah. According to the National Highway Traffic Safety Administration, there were nearly 6,000 pedestrian deaths in traffic crashes in 2016, representing 16% of all traffic fatalities. This was an increase from 4,700 and 11% in 2007. Utah is not immune to this issue and has also seen increases in the number and rates of pedestrian fatalities and injuries over the last 10 years. In 2016, nearly 40 deaths and 900 injuries to people walking on Utah streets and highways were reported. As vulnerable road users, pedestrians are more likely to be injured or killed when involved in a collision.

Given these trends, there is a need for *improved pedestrian crash prediction methods* to better understand (geometric, traffic, operational, and other) factors associated with pedestrian safety and also to assist in the prioritization and selection of countermeasures to improve pedestrian safety at signalized intersections. Specifically, safety predictive methods—safety performance functions (SPFs) and crash modification factors (CMFs)—traditionally require the use of exposure data for estimation and application. While motor vehicle volumes are often available, pedestrian volumes rarely are, thus limiting the development, use, and accuracy of pedestrian safety predictive methods. SPFs and CMFs could greatly benefit from the inclusion of more robust data on pedestrian exposure, which is typically the biggest barrier to overcome for pedestrian safety analysis.

A secondary motivation for this work is to *examine the "safety in numbers" hypothesis* for walking. This concept suggest that pedestrian (and bicycle) crash rates decrease with increasing volumes of people walking and bicycling. Potential explanations for this concept assume that the more often drivers see people walking and bicycling, the more likely they are to expect and look out for them, and the more experience they have driving safely around non-motorized users. While a safety in numbers has been identified for bicycling, similar studies of pedestrian safety find mixed results and are mostly limited to European contexts. There is a need to understand whether the safety in numbers concept applies to pedestrian safety in the US. If so, then efforts to increase walking will likely yield safety benefits as well. As with SPFs, the challenge with studying the "safety in numbers" concept is the lack of pedestrian exposure data.

This research project will address both of these needs for incorporating measures of pedestrian exposure into pedestrian safety predictive methods at signalized intersections. Luckily, another UDOT research project (18.602) is currently utilizing archived pedestrian traffic signal data as a proxy for walking activity at signalized intersections and developing methods for converting pedestrian push-button actuations into pedestrian volumes. This project will utilize archived traffic signal data and pedestrian-involved crash data to develop Utah-specific SPFs and CMFs for pedestrian-vehicle collisions at signalized intersections. These locally-calibrated models and methods can be incorporated into UDOT's safety performance management processes. This project will yield a report and manual summarizing the newly developed safety predictive methods, including example applications.

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

To develop improved pedestrian crash prediction models at signalized intersections using pedestrian push-button measures of exposure, and to test the safety in numbers concept.

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

This research will provide pedestrian safety analysis methods that improve upon existing practices, particularly with respect to the use of measures of pedestrian exposure at signalized intersections. The *Highway Safety Manual* does contain an SPF for pedestrian–vehicle crashes at signalized intersections on urban/suburban arterials, but this was estimated using data in Toronto and Charlotte; it would be useful to calibrate such models to local Utah conditions. Furthermore, the methods do not address turning vehicle volumes and include only three CMFs (for bus stops, schools, and alcohol establishments). Making use of more detailed

local data could generate more useful models that can consider a wider range of potential safety countermeasures and treatments. Additionally, UDOT could make use of traffic signal data for performance measures tracking pedestrian intersection crashes/fatalities at different levels of walking activity: low, medium, and high pedestrian volume intersections.

Overall, this research will support UDOT's strategic goal of "zero crashes, injuries and fatalities," core value of "safety," and emphasis areas of "integrated transportation" and "innovation." Determining the factors that contribute to greater or fewer numbers of pedestrian crashes, injuries, and deaths will help UDOT to evaluate and implement countermeasures to improve pedestrian safety. Furthermore, improving pedestrian crash prediction models will help to elevate UDOT's safety analysis capabilities for investigating a fully integrated, multimodal transportation system. Finally, this research will continue to position UDOT as an innovative leader in the novel utilization of traffic signal data for multiple purposes, including pedestrian safety analysis.

4. List the major tasks:

1. Select a set of signalized intersections in Utah to study. The selection of study intersections will be based on data availability and feedback from the technical advisory committee. Several hundred signalized intersections may be studied.
2. Obtain and assemble pedestrian crash data for these signalized intersections. These data will come from existing UDOT and Utah crash databases.
3. Obtain and assemble other information for these signalized intersections. Such necessary data will include geometric, traffic, and operational characteristics (# legs, # lanes, speed limits, motor vehicle volumes & turning movements, etc.). These data will come from existing UDOT and Utah databases.
4. Calculate measures of pedestrian exposure (estimates of pedestrian volumes) at these signalized intersections. These estimates will be calculated by applying the factoring methods developed in a previous UDOT project to archived pedestrian push-button data from traffic signal controllers.
5. Perform crash data modeling to generate SPF and CMFs for pedestrian crashes at signalized intersections. The models will include measures of pedestrian exposure to test the "safety in numbers" hypothesis. The analyses will follow best-practice guidelines for crash data modeling and CMF development.
6. Prepare a final report, manual, and presentation and webinar summarizing the project.

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

1. Final project report, detailing the methods/models developed to model pedestrian crashes at signalized intersections.
2. Presentation and recorded webinar, summarizing the research project and the methods/models developed.
3. Manual detailing the SPF and CMFs for pedestrian crashes at signalized intersections, with instructions for applying the safety predictive methods.

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

This research is anticipated to be implementable upon completion. The pedestrian SPF and CMFs developed from this project will be ready to use by UDOT safety analysts, project managers, designers, and consultants when conducting spot, corridor, or larger-scale safety analyses or when considering safety-driven or other improvements at signalized intersections. This will help UDOT to analyze the safety effectiveness and cost-benefit analyses of various proposed safety countermeasures. A manual and presentation/webinar will be produced providing detailed step-by-step instructions for obtaining archived pedestrian push-button traffic signal data from the ATSPM, calculating the measure of pedestrian exposure (estimated pedestrian volumes), and applying the predictive methods (SPF and CMFs). The research results will be applicable to all areas of Utah and UDOT regions with signalized intersections, particularly in large and small urban areas.

7. Requested from UDOT: $50,000 **Other/Matching Funds:** $0 **Total Cost:** $50,000
(or UTA for Public Transportation)

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

This research is anticipated to take approximately 15 months to complete, according to the following schedule:

2019	Jul–Aug:	Meet with technical advisory committee to refine scope, timeline, and deliverables.
	Aug–Dec:	Select list of signalized intersections in Utah to study. Obtain and assemble pedestrian crash data and other information (geometric, traffic, & operational characteristics) for these intersections.
	Nov–Dec:	Calculate measures of pedestrian exposure (estimates of pedestrian volumes) at these intersections.
2020	Jan–Mar:	Perform preliminary crash data modeling to generate SPF and CMFs for pedestrian crashes.
	Mar:	Prepare interim report and receive feedback from technical advisory committee.
	Apr–Jun:	Finish crash data modeling to generate SPF and CMFs for pedestrian crashes at signalized intersections.
	Jul–Aug:	Prepare draft report and manual, and receive feedback from technical advisory committee.
	Sep:	Revise and submit final project report, manual, and presentation and recorded webinar.

Note: This project will make use of the results from a current UDOT project, 18.602: "Utilizing archived traffic signal performance measures for pedestrian planning & analysis." That project is developing methods to take pedestrian actuation data and estimate the number of people walking/crossing at an intersection, by validating push-button actuations with observed pedestrian counts. Such methods will provide a valuable measure of pedestrian exposure at signalized intersections that could be very useful for safety analysis.