2019 UDOT RESEARCH PROBLEM STATEMENT

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

Title: Systemic analysis of bicycle and pedestrian safety in Utah **No. (Office Use):** 19.03.18

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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 number and share of pedestrian and bicyclist injuries and fatalities has been increasing, both in the US and in Utah. According to the National Highway Traffic Safety Administration, there were more than 6,800 pedestrian and bicyclist deaths in traffic crashes in 2016, representing over 18% of all traffic fatalities. This was a substantial increase since 2007, when there were only 5,400 deaths (13%). Although Utah has seen decreases in bicyclist crashes and injuries in recent years, pedestrian crashes and injuries have increased. In 2016, 44 deaths (representing nearly 17% of all fatal crashes) and more than 1,500 injuries to people walking and bicycling on Utah streets and highways were reported. These statistics highlight the need to focus on pedestrian and bicyclist safety.

Transportation agencies can approach the roadway safety management process in two general ways. Traditionally, a *crash-based approach* selects sites (through network screening) and identifies site-specific safety issues (through diagnosis) using historical data on reported crashes and local conditions at sites, informing the selection of site-specific safety countermeasures and treatments. While useful, this crash-based approach has limitations for addressing bicycle and pedestrian safety concerns. Crashes involving people walking and bicycling are (compared to motor vehicle crashes) highly-dispersed, with many sites that have only a few crashes. Such highly-dispersed crashes are difficult to address using site-based crash histories. Similarly, such site-based methods may not be able to address specific crash types (like bicycle & pedestrian crashes) due to their low frequencies. Finally, many performance measures used in the crash-based approach require exposure data, which remain difficult to obtain for walking and bicycling.

An alternative and often complementary approach, the *systemic approach*, may be better suited for tackling many bicycle and pedestrian safety issues in a state like Utah. Rather than relying upon reported crashes to select and apply treatments to high-crash sites, a systemic approach to safety management instead first selects crash type(s) of interest and identifies geometric and operational risk factors across a network that are associated with those crash type(s), using crash data from a variety of sites and prior knowledge. Then, these risk factors guide the selection of sites with higher-risk characteristics, informed by but without having to rely upon site-specific crash histories or requiring exposure data. Systemic safety analysis is proactive, identifying potential improvements without waiting for crash histories and trends to develop. Systemic safety programs often recommend lower-cost proven countermeasures that can be applied to a larger number of sites, potentially increasing returns on investment. A recent (2018) NCHRP report (893: "Systemic Pedestrian Safety Analysis") demonstrates how to apply the systemic approach to pedestrian safety analysis.

Given the highly-dispersed nature of bicycle and pedestrian crashes and the relative lack of exposure data for these modes, the systemic approach is a promising way to meet the need to address bicycle and pedestrian safety issues throughout the state of Utah. This research will apply the data-driven systemic approaches described in NCHRP 893 to address both pedestrian and bicyclist safety on Utah roadways.

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

To conduct a systemic analysis of bicycle and pedestrian safety in Utah (to identify risk factors, potential treatment sites, and potential countermeasures).

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

This systemic analysis of bicycle and pedestrian safety offers an improvement over existing crash-based safety analysis methods, by identifying risk factors and considering many high-risk locations and broadly applicable countermeasures, not just high-crash sites and site-specific countermeasures. The focus on walking and bicycling safety also meets the timely need to address rising numbers of bicycle and pedestrian deaths and injuries. Pedestrian safety is one of the safety emphasis areas in the Utah Strategic

Highway Safety Plan (Version 4.0, 2016–2021).

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." Applying a systemic approach to bicycle and pedestrian safety will help to identify risk factors and potential treatment sites and countermeasures that can reduce the number and severity of crashes involving people walking and bicycling on Utah roadways. Such efforts will help to elevate UDOT's already strong safety analysis capabilities for creating a fully safe and integrated transportation system for all modes. This research will also continue to position UDOT as an innovative leader in applying cost-effective safety management processes such as systemic safety analysis.

4. List the major tasks:

1. Conduct a literature review of systemic bicycle and pedestrian safety analyses. Review academic research, government reports, and case studies to determine innovative and best practices in systemic safety analysis for walking and bicycling.
2. Meet with the technical advisory committee to refine the scope, timeline, and deliverables of this research. Define the scope of the systemic safety analysis, including target crash types and specific roadway networks or study areas.
3. Compile necessary and available data for the systemic analysis. Data will include:
    a. Bicycle and pedestrian crashes (frequencies, types, contributing factors, and locations) from existing UDOT and Utah crash databases;
    b. Any available measures of bicycle and pedestrian exposure (such as Strava data, permanent non-motorized counters, and pedestrian push-button data at traffic signals);
    c. Geometric and operational characteristics of selected roadway facilities (speeds, # lanes, shoulders, bike lanes, sidewalks, access points, horizontal/vertical curves, pavement conditions, crossing treatments, traffic control devices, etc.) and/or characteristics of the surrounding community (sociodemographics, land uses, etc.) from existing UDOT and Utah GIS databases.
4. Determine risk factors for bicycle and pedestrian crashes. Risk factor determination will likely involve the development of safety performance functions (SPFs) predicting bicycle and pedestrian crash frequencies as a function of potential risk factors identified in Task 3, but could also include cross-tabulations and/or incorporate prior research and expert knowledge.
5. Identify potential treatment sites with high risk for bicycle and pedestrian crashes. NCHRP 893 list several site selection approaches that could be utilized, including: filtering and sorting based on risk factor presence, ranking based on estimated crashes, or a combination of the two.
6. Recommend potential systemic countermeasures to apply at the treatment sites. Countermeasures will be related to the target crash types and roadway facilities, have a documented safety effectiveness, and be cost-effective and feasible to implement across a number of potential treatment sites in the study network. Resources for countermeasure selection include the FHWA's Crash Modification Factor Clearinghouse and the PEDSAFE and BIKESAFE Guides and Countermeasure Selection Systems, among others.
7. Prepare an interactive web map highlighting the potential treatment sites and countermeasures to improve bicycle and pedestrian safety in Utah. For example, this could be an ArcGIS Story Map.
8. Prepare a final report, presentation, and recorded webinar summarizing the project.

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

1. Final project report, detailing the systemic analysis of bicycle and pedestrian safety and identifying next steps.
2. Presentation and recorded webinar, summarizing the research project and the potential treatment sites and countermeasures.
3. Interactive web map highlighting the potential treatment sites and countermeasures.

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

Systemic safety analysis is a proven approach that has been utilized in dozens of states, including in Utah. This research will generate lists (and an interactive web map) of potential treatment sites and proven systemic countermeasures to address bicycle and pedestrian safety on Utah roadways. Such information can be implementable by UDOT Traffic & Safety Division as part of the roadway safety management process and the highway safety improvement program. Engineers and analysis can take these

recommendations and further refine the treatment plan, perform economic benefit-cost assessments, and prioritize systemic deployment of bicycle and pedestrian safety countermeasures.

This research is anticipated to consider all areas of Utah and all UDOT regions. Bicycle and pedestrian safety issues are not limited to urban and suburban areas; small towns and rural areas also see non-motorized travel, often for recreation. Different kinds of countermeasures could be recommended for urban and suburban arterials, (un)controlled crossings, school zones, small towns, and rural recreational hot-spots (for instance). Furthermore, a systemic analysis of bicycle and pedestrian safety is expected to apply to a wide set of UDOT Divisions and activities including and beyond safety—such as planning, design, construction management, and maintenance—as potential countermeasures are funded and constructed.

7. Requested from UDOT: $60,000 **Other/Matching Funds:** $0 **Total Cost:** $60,000
(or UTA for Public Transportation)

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

This research is anticipated to take approximately 18 months to complete, according to the following schedule:

2019	Jul–Aug:	Meet with technical advisory committee to refine scope, timeline, and deliverables.
	Jul–Sep:	Conduct literature review of systemic bicycle and pedestrian safety analyses.
	Aug–Dec:	Compile necessary and available data for the systemic analysis.
2020	Jan–May:	Determine risk factors for bicycle and pedestrian crashes.
	Apr:	Prepare interim report and receive feedback from technical advisory committee.
	Jun–Aug:	Identify potential treatment sites with high risk for bicycle and pedestrian crashes.
	Sep–Oct:	Recommend potential systemic countermeasures to apply at the treatment sites.
	Nov:	Prepare draft report and interactive web map, and receive feedback from technical advisory committee.
	Dec:	Revise and submit final project report, interactive web map, and presentation and recorded webinar.