2019 UDOT RESEARCH PROBLEM STATEMENT

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

Title: Investigating bicyclist safety at roundabouts **No. (Office Use):** 19.03.17

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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:

Installing a modern roundabout is a proven safety countermeasure that has been shown to improve intersection safety—specifically, reducing overall crash frequency and severe crashes by 40% or more—as well as operational efficiency in many situations. There are more than 4,000 roundabouts in the US today, and many local jurisdictions in Utah have recently converted or are planning to convert traditional signalized or stop-controlled intersections to roundabouts.

Despite this safety success, questions remain regarding the safety performance of roundabouts for specific road users, particularly people cycling. Research from Europe—where roundabouts are more common and have been used for longer—suggests that roundabouts have mixed results for bicycling safety (depending on design characteristics) and even may yield an overall increase in vehicle–bicycle crashes. Observational before-after safety analyses in Belgium and Denmark found a roughly 40% increase in injury crashes involving bicyclists after converting traditional intersections to roundabouts. Other European research comparing different roundabout designs suggest that multilane, higher-speed roundabouts and those with bicycle lanes have more frequent and perhaps more severe bicycle crashes, while roundabouts with separated cycle paths and medium-sized central islands may perform better for bicyclists.

Unfortunately, corresponding evidence for the bicyclist safety performance of roundabouts in US contexts is extremely limited and remains an important research need. One challenge of safety analyses that rely upon historical crash data is that bicycle–vehicle collisions are relatively rare events, and bicycle crashes at roundabout are even less common. A recent (2019) national study (NCHRP Research Report 888) proposed creating robust roundabout crash prediction models for vehicle–bicycle crashes but concluded that there was an insufficient number of bicycle crashes (only 75 at the 355 roundabouts in the study) to do so. Alternative safety analysis methods that rely upon surrogate and qualitative measures of safety can be useful when quantitative safety outcomes (crash frequencies) are sparse. A companion research project (through the Mountain-Plains Consortium) is proposing to conduct a study of bicyclist safety perceptions to qualitatively evaluate the safety effectiveness of roundabouts for people bicycling.

This research project will collect surrogate measures of safety through a conflict analysis of vehicle–bicycle interactions at Utah roundabouts that will complement and supplement the qualitative safety analysis performed in the companion research project and the quantitative analysis reported in NCHRP 888. Specifically, the project will record video at a handful of roundabouts and perform a systematic conflict analysis of vehicle-bicycle interactions, including the characteristics of each interaction (or near miss), bicyclist path choice through the intersection (take the lane vs. use the sidewalk), and the influence of design characteristics. This research will inform safety analyses and intersection design practices to improve bicycling safety.

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

To evaluate bicyclist safety at roundabouts using surrogate safety measures and a conflict analysis of vehicle–bicycle interactions.

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

This research will add to very limited knowledge of the safety of roundabouts for bicyclists in the US as well as detailed information about interactions between motor vehicles and bicyclists when approaching and navigating through roundabouts. Understanding factors that contribute positively or negatively to bicyclist safety at roundabouts can yield recommended design treatments that may reduce the frequency and severity of bicycle crashes in the future. Overall, this research will support UDOT's strategic goal of "zero crashes, injuries and fatalities" and core value of "safety."

4. List the major tasks:

1. Review literature on bicyclist safety and behavior at roundabouts, as well as bicycle–vehicle conflict analysis.
2. Assemble existing data on Utah roundabouts, including bicycle crashes, bicycle volumes, geometric characteristics, and traffic conditions. Such information will likely be insufficient for quantitative crash modeling but may help to select sites.
3. Select several roundabouts for detailed conflict analysis, with input from the technical advisory committee. Sites should be representative of the variety of roundabout designs and conditions found in Utah and have a sufficient volume of bicycle traffic (e.g., determined using Strava data) to yield reliable and generalizable results.
4. Set up video cameras and record several hours of road user interactions at each site. Video recording may happen at different times of day and/or different times of year to observe varying traffic patterns, road conditions, and interactions.
5. Watch video recordings and transcribe bicycle–vehicle conflicts and bicyclist path choices. Record detailed information on near misses between motor vehicles and bicycles. Trace paths taken by bicyclists through the intersection.
6. Analyze the data collected on conflicts, near misses, and path choices for bicyclists at the study roundabouts. Compare these surrogate safety measures to roundabout design and operational characteristics.
7. Prepare a final report, presentation, and recorded webinar summarizing the project. Propose recommendations for treating bicyclists at roundabouts based on the conflict analysis and existing guidance.

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

1. Final project report summarizing the project, including the literature review, data collection procedures, conflict analysis results, path choice analysis, and recommendations.
2. Presentation and recorded webinar, summarizing the research project and the findings and recommendations.
3. Raw and processed data from the conflict analysis and path choice analysis.

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

Based on recorded field observations, this research will yield insights into bicycle–vehicle conflicts and road user behaviors that will inform design and operational recommendations to improve bicyclist safety at roundabouts. This research has implications for both short-term and long-term implementation. The research findings may recommend simple and inexpensive modifications to existing roundabout designs or operations to improve bicyclist safety in the short-term, such as additional warning or directional signage and pavement markings. In the long run, the research findings might recommend specific designs to use (such as bypass ramps, separated bicycle facilities, and/or controlled crossings) or specific designs to avoid (such as bike lanes within the roundabout) when designing or retrofitting roundabouts in the future. Thus, this research may have impacts to both safety and design processes and guidelines for state and local transportation agencies.

7. Requested from UDOT: $50,000 **Other/Matching Funds:** $50,000 from MPC related project
Total Cost: $100,000
(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:	Review literature. Assemble existing data on Utah roundabouts. Meet with technical advisory committee to refine scope, timeline, and deliverables. Select roundabouts for more detailed study.
	Sep–Oct:	Record preliminary videos of road user interactions at selected roundabout sites.
	Oct–Dec:	Perform preliminary vehicle–bicycle conflict analysis and bicyclist behavior analysis from videos.
2020	Jan–Feb:	Record additional videos of road user interactions at selected roundabout sites.
	Feb–Mar:	Prepare interim report and receive feedback from technical advisory committee.
	Mar–Apr:	Perform additional vehicle–bicycle conflict analysis and bicyclist behavior analysis from videos.
	May–Jul:	Record final videos of road user interactions at selected roundabout sites.
	Aug–Sep:	Perform final vehicle–bicycle conflict analysis and bicyclist behavior analysis from videos.
	Sep–Oct:	Prepare draft report and design recommendations, and receive feedback from technical advisory committee.
	Nov–Dec:	Revise and submit final report, and presentation and recorded webinar.

Note: The "companion research project" (and the source of the matching funds) is a proposal being submitted to USU's university transportation center, the Mountain-Plains Consortium (MPC). If funded, it would begin around late spring 2019. That synergistic MPC project would center on a qualitative analysis of bicyclist safety, involving questionnaire surveys of bicyclists and their perceptions of safety, comfort, and path choices when navigating roundabouts of various designs. This related UDOT project would focus in on several selected roundabouts in Utah, investigating operations, interactions, and conflicts between different road users, with an eye towards informing urban roundabout designs and specifically how to treat bicycle facilities approaching and proceeding through roundabouts. This UDOT project could inform the MPC project by suggesting questions about specific movements and types of conflicts. The MPC project could inform this UDOT project by suggesting perceived unsafe interactions for focus during the conflict analysis.