# 2016 UDOT RESEARCH PROBLEM STATEMENT

****** Problem statement deadline is March 14, 2016. Submit statements to Tom Hales at tahales@utah.gov. ******

**Title:** Analysis of Left- Turn Warrants in Utah **No. (office use):** 16.03.04

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**Select One Subject Area**

- ☐ Materials/Pavements
- ☐ Maintenance
- ☒ Traffic Mgmt/Safety
- ☐ Preconstruction
- ☐ Planning
- ☐ Public Transportation

**1. Describe the problem to be addressed.**

The Utah Department of Transportation (UDOT) has established guidelines for left-turn phases at signalized intersections. The most recent (updated November 13, 2014) guidelines provide a detailed flow-chart as criteria for recommending left-turn phasing at signalized intersections. According to the guidelines a left-turn phase may be installed with left-turn volumes as low as 100 veh/hr (assuming there is a history of severe left-turn crashes), while the more common installations would occur with volumes great than 100 veh/hour and four or more opposing through lanes and/or speed limit of 60 mph or higher. The left-turn phase is recommended "after less restrictive measures to reduce delay, congestion, and crashes have been considered. The overall signalized corridor/network operations should be considered when evaluating the impacts of left-turn phasing. Even if the criteria in the flowchart are met for left-turn phasing, engineering judgment should be used to determine whether left-turn phasing is implemented." Additional guidelines are provided for installation of dual left-turn lanes. Based on the current left-turn warrant guidelines, the number of left-turn phasing installations and signal upgrades has been increasing as traffic volumes increase across the state. The costs associated with the installation of the left-turn phases are increasing with this, especially in those instances when conduit is either not available, or is in a poor state of repair and must be replaced.

The purpose of this research is to evaluate the current left-turn warrant process for UDOT in an effort to determine if the current warranting procedure may be too liberal for the current driver population in the state. Anecdotal evidence would suggest that the number of sneakers on low volume left-turn movements has increased over the years and that more left-turns are being accommodated safely than anticipated within the changing (yellow) and clearance (all red) intervals. As the number of sneakers depends on the volume of traffic in the opposing direction and the behaviors of the drivers in the opposing direction, several locations and volume scenarios would need to be evaluated. To meet the purpose of the research, the research team would complete a literature review to gain insight and understanding on changes that have been made at both the state and national level on left-turn warranting including dual left-turns and permissive dual left-turns, perform a synthesis of practice for left-turn warrants across the nation to determine best practices for left-turn warrants, complete an in-field "sneaker" study to evaluate left-turn practices in the state, perform simulation in Synchro to compare delay at intersections with and without left-turn phasing, and make limited recommendations on the current Utah policy based on these tasks.

**2. Explain why this research is important.**

UDOT will benefit from this research by gaining an understanding of the left-turn warranting process across the nation in comparison to the current left-turn warranting process in Utah. The results of the research will help to identify possible changes and new recommendations on left-turn warrant alternatives that would help to improve safety and operations on arterials across the state.

**3. List the research objective(s):**

1. Identify state of the practice for left-turn warranting across the nation.
2. Evaluate current left-turn operations in the state through a "sneaker" study and simulation of selected intersections with and without left-turn phasing.
3. Develop limited recommendations for left-turn warrant alternatives in the state.

**4. List the major tasks:**

1. Develop a project scope of work and detailed cost estimate.
2. Conduct kickoff meeting.
3. Perform literature review on safety and operations benefits of left-turn phasing warrants and operations, including dual left-

turns and permissive dual left-turn options.

4. Conduct a synthesis of practice for left-turn warrant procedures across the nation.
5. Conduct a "sneaker" study across the state to determine driver behavior for left-turn movements without left-turn phasing.
6. Perform a sensitivity analysis at selected locations in Synchro to compare delay with and without left-turn phasing.
7. Provide limited recommendations on left-turn warrant alternatives and evaluate the effect any proposed changes in warrant criteria would have made on left-turn warrants already completed across the state over the past several years.
8. Report results to UDOT in the form of a written report.

**5. List the expected results:**

1. Engineering report documenting the literature review and research results.
2. Understanding of left-turn warrant and phasing procedures across the nation.
3. Understanding of left-turn driver behavior in the state and comparison of delay with and without left-turn phasing.
4. Limited recommendations on left-turn warrant alternatives.

**6. Describe how this research will be implemented.**

This research would be implemented jointly by the UDOT Traffic & Safety Division and the Traffic Operations Center to improve the left-turn phasing warrants across the state. The results of this research would assist UDOT in future decisions on left-turn warranting procedures in the state.

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

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

It is recommended that this project begin late summer/early Fall 2016 with the project scope of work and detailed cost estimate, followed with the literature review. The work will continue with the remaining tasks as outlined. The results of the research will then be reported to UDOT in the form of a written report. The research is anticipated to take 12-16 months.