2019 UDOT RESEARCH PROBLEM STATEMENT

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

Title: Influence of Cracking on Chloride Ion Ingress in Concrete Bridge Decks and Parapets **No. (Office Use):** 19.04.08

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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:

Cracking in concrete bridge decks and parapets can provide a direct pathway for the entry of chloride ions, which, depending on the width (and depth) of the crack, can greatly accelerate corrosion of embedded reinforcing steel. Direct application of chloride-based deicing salts to bridge decks and subsequent splash and spray onto adjacent parapet walls lead to high exposures of these bridge components to chloride ions during especially the winter months in northern Utah. Previous research indicates that exposures of parapets (vertical surfaces) from splash and spray can be about 50 percent of the exposures associated with direct application of deicing salt to main lanes (horizontal surfaces), depending on the shoulder width. Visual inspection of concrete bridge decks and parapets in northern Utah indicates that cracking is very prevalent, with a variety of crack widths having been reported in previous research. While different crack widths are expected to correspond to different levels of chloride ion ingress and also potentially warrant different types of repair, the relationship between crack geometry and chloride ion ingress has not yet been quantified.

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

Quantify the influence of crack width (and depth) on chloride ion ingress in concrete bridge decks and parapets in northern Utah.

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

A majority of the highways in Utah require deicing operations during winter. As a result, a high number of bridges, including decks and parapets, are subject to significant chloride ion exposures on a regular basis. New research is needed to quantify the effect of crack width (and depth) on chloride ion ingress in order to improve understanding of the severity of the problem and to guide maintenance and rehabilitation actions designed to preserve the infrastructure, which is one of UDOT's strategic goals.

4. List the major tasks:

1. Perform a comprehensive literature review on the subject of chloride ion ingress in cracked concrete.
2. Design and execute a field experiment in which chloride concentration profiles measured at locations of cracks (for which widths and depths would be measured) would be compared with those measured at adjacent locations of intact concrete (for bridge decks and parapets).
3. Prepare and deliver a written report and a presentation documenting the findings.

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

1. Written research report
2. Oral presentation

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

This research may yield results that warrant specifications of concrete mixture designs that are less susceptible to cracking and/or applications of surface treatments to seal cracks of certain widths, for example, against chloride ion ingress in existing

infrastructure. Understanding the relationship between crack geometry and chloride ion ingress may also assist with estimations of internal infrastructure condition during inspections.

7. Requested from UDOT: $40,000 **Other/Matching Funds:** $TBD **Total Cost:** $
(or UTA for Public Transportation)

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

1. Literature review: 2 months
2. Field experimentation, including identification of candidate bridge decks and parapets: 7 months
3. Preparation of deliverables: 3 months