2020 UDOT RESEARCH PROBLEM STATEMENT

Problem Statement deadline is March 16, 2020. Submit statements to UTRAC@utah.gov

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Title: Overhead Sign Corrosion **No. (Office Use): 20.04.11**

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Select ONE Subject Group ☐ Materials/Pavements ☐ Maintenance ☐ Traffic Mgmt/Safety ☒ Structures/Geotech ☐ Planning ☐ Aeronautics ☐ Public Transportation ☐ Other

1. Write a brief research project objective:

The research proposed herein will (a) determine the cause of the corrosion on galvanized column knee of overhead signs; (b) determine the remaining life of the corroded galvanized overhead signs; (c) propose remediation methods for the corroded overhead signs and (d) evaluate UDOT galvanization standards and specifications to determine if they need to be revised.

2. Explain the problem and why this research is important: (*Importance reflects 50% of the statement score*)

Several UDOT overhead sign structures have begun to corrode even though these structures are galvanized. The overhead signs experiencing corrosion are cantilevered structures with tubular columns and beams. Although only overhead signs having a cantilevered configuration have been examined, overhead signs having a frame configuration could also be experiencing corrosion.

Since zinc corrosion presents a different discoloration than that of steel corrosion, it appears that, in some parts of the structure, the zinc coating (galvanization) has been totally corroded and that the structural steel is now being affected. Corrosion is evident on the column of the cantilevered signs and appears to be more prominent on the knee (bent part) of the column; the beams don't show any sign of corrosion. Cantilevered overhead signs will have the largest bending moment and tensile stresses at the knee of the column. As corrosion of the structural steel progresses, the cross-section area of the column will decrease, and the tensile stresses will increase.

The overhead signs could be experiencing uniform corrosion, but they could also be experiencing pitting corrosion. Pitting corrosion is localized and forms cavities or holes. Pitting corrosion is more dangerous than uniform corrosion, and even a small, narrow pit (hole) with minimal overall metal loss can lead to catastrophic failure.

The research herein proposed is extremely important because it will help UDOT (a) determine if urgent action is required to prevent a catastrophic failure of a corroded overhead sign, (b) determine if its galvanization standards and specifications need to be revised to prevent future corrosion of overhead signs, (c) determine the remaining life of the corroded overhead signs and (d) determine the best course of action to repair corroded overhead signs.

3. Describe how the research results will be implemented and benefit Utah: (*Implementation reflects 50% of the statement score*)

The results of the research presented herein can be implemented immediately since it will determine if urgent action is required to prevent a catastrophic failure of a corroded overhead sign. In addition, the results of the research can assist UDOT determine if its galvanization standards and specifications will need to be revised to prevent future corrosion of overhead signs. Furthermore, the results will include remediation methods for the corroded overhead signs and the expected remaining life of these signs.

4. List the major research tasks:

Conduct a literature review on the galvanization process and causes for galvanization failure.
Determine when, where, and how the corroded overhead signs were manufactured and if they share the same manufacturer.
Conduct a thorough examination of the overhead signs experiencing corrosion to determine if pitting corrosion is occurring.
Determine the remaining galvanization thickness, where appropriate, of overhead signs using magnetic measurements.
Determine if there were unusual or extreme circumstances that could have caused the galvanization to wear off faster than usual.
Determine the loads applied to a typical overhead sign structure.
Develop a model and conduct structural analyses of the overhead sign structures.
Examine remediation and mitigation schemes for the corroded overhead signs.
Examine UDOT galvanization standards and specifications to determine if they need improvement.

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

A written research report and an oral presentation that will include how the results can be implemented and benefit UDOT.

6. Requested from UDOT: $100,000 to S150,000 **Other/Matching Funds:** $ **Total Cost:** $

Briefly explain funding sources:

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

Conduct a literature review – approximately 2.0 months.
Determine the history of the corroded overhead signs – approximately 2.0 months.
Conduct a thorough examination of the overhead signs experiencing corrosion – approximately 4.0 months.*
Determine the remaining galvanization thickness – approximately 4.0 months.*
Determine any unusual or extreme circumstances – approximately 1.5 months.
Determine the loads applied to a typical overhead sign structure – approximately 1.5 months.
Develop a model and conduct structural analyses of the overhead sign structures – approximately 3.0 months.
Examine remediation and mitigation methods – approximately 3.0 months.
Examine UDOT galvanization standards and specifications – approximately 1.0 months
Preparation of deliverables – approximately 2.0 months.

*the time necessary to complete these tasks will depend on the number of overhead signs experiencing corrosion as well and the location of and accessibility to the sites.