Development of Metals Corrosion Maps of Arkansas and Maintenance of Cross-drains

Developing user-friendly corrosion risk maps of Arkansas based on soil resistivity

Corrosion in metallic structures is a significant problem for metal cross-drains as they are exposed to the soil, atmosphere, and/or water. An extensive literature review was conducted to collect the spatial variability of these three phases in Arkansas. In addition, soil samples have been collected for laboratory investigation of corrosivity metrics of soils. After analyses of the collected data, neural network-based models will be developed to predict the corrosion potential of the soil. Geographic Information System (GIS) based metal corrosion risk maps will be then developed for Arkansas.

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Background

Every year, the Arkansas Department of Transportation (ArDOT) spends a significant amount of money in maintenance and replacement of metal cross-drains in state highways. This cost can be reduced by proper planning and installation of cross-drains by predicting their life cycle costs. Currently, ArDOT does not have enough information about the corrosion risks of metal cross-drains, and District offices make decisions based on their local experiences. Developed corrosion risk maps can help ArDOT in selecting cost-effective cross-drain materials.

Project Summary

The main objective of this project is to develop metal corrosion risk maps, based on the available secondary data and laboratory soil investigation results. These maps will guide the selection procedure of metal cross-drains prior to new construction and maintenance. The project consists of several tasks starting with literature review related to the current guideline of highway cross-drain planning, design, construction, and maintenance. The next task is to select and collect materials for laboratory analysis. Based on the laboratory investigation results and secondary data from literature review regression and neural network models for corrosivity prediction will be developed in the next task. Corrosion risk map will be developed using ArcGIS. Later, the life cycle cost of different alternative choices of cross-drains in Arkansas will be assessed.

Status Update

A detail flow chart of the project has been developed (Figure 1). Fifteen Soil samples from ArDOT District 10 have been collected and being tested in the laboratory. Soil properties including soil resistivity, pH, chloride and sulfate contents along with other routine geotechnical properties are being evaluated. Water quality data have been collected from ADEQ. Surface soil classification maps have been developed (Figure 2). The research team has identified the risk attributes and working on developing new risk attributes applicable to the state using the fuzzification method. Risk map will be developed based on new risks estimated through neural network models.
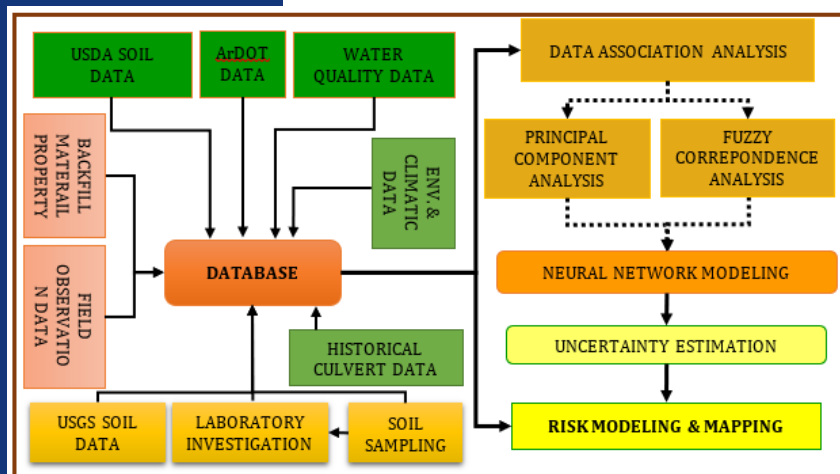

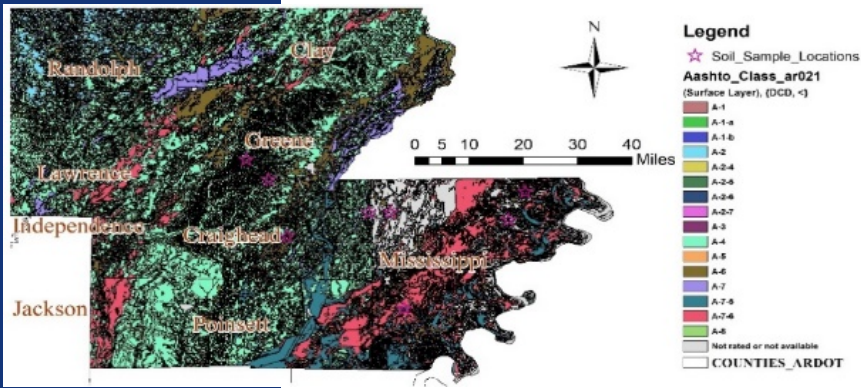**Figure 1. Flowchart of the study methodology.**

Figure 2. Soil classification maps of alluvial deposits of district 10 of Arkansas.

Impacts

Experimental and mathematical modeling data gathered from this study are expected to give some confidence to state and local transportation agencies, and contractors in the region. The design and quality-control guidelines developed from this are expected to be implemented by state and industry partners in Arkansas. The developed corrosion maps will help ArDOT in selecting suitable materials based on the lifecycle cost analysis results, and the outcomes of this project are expected to be a significant cost savings for ArDOT.

Tran-SET

Tran-SET is Region 6's University Transportation Center. It is a collaborative partnership between 11 institutions (see below) across 5 states (AR, LA, NM, OK, and TX). Tran-SET is led by Louisiana State University. It was established in late November 2016 "to address the accelerated deterioration of transportation infrastructure through the development, evaluation, and implementation of cutting-edge technologies, novel materials, and innovative construction management processes".

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