



FY 2025 Annual Program Research Project Statement 25-080

Title:	Improve Utility Investigations through AI Data Fusion and Reliable Quality Assessments
The Problem:	<p>Existing utility location in the right of way and infrastructure is crucial for successful project delivery. Districts can conduct their own utility investigation in-house, use consultants (including subsurface utility engineering [SUE] consultants) as part of a project's development budget, or use a separate contract through PEPS that is unassociated with that budget.</p> <p>There is a need to combine different technologies in order to leverage each technology's strengths and minimize weaknesses for a more robust and reliable determination of utility location:</p> <ul style="list-style-type: none">• Ground penetrating radar (GPR) can detect plastic pipes reliably but is sensitive to soil characteristics and moisture conditions.• Electromagnetic induction (EMI) is effective at detecting metal pipes, but technological challenges remain regarding depth measurements.• Geophysical techniques are limited in their capability to measure pipe diameters, but existing records frequently contain this information.• GPR and EMI arrays are increasingly used for utility investigations, which augment the capability to detect X-Y-Z locations, but the 3D imageries are disconnected and not integrated with other data sources. <p>There is a need to develop and test metrics to assess the utility investigation quality levels in ways that make sense to project design teams. As TxDOT continues its move to digital delivery, future operations need to ensure that utility investigation deliverables are of the highest quality, contain data that designers actually need, and have the metrics to assess the effectiveness of these technologies. Improvements shall lead to a better stakeholder understanding to communicate the quality levels commonly used by the SUE industry (D, C, B, and A), the basis for assessing utility investigation deliverable quality, and would be able to tie quality levels to quantifiable performance metrics such as positional accuracy, error, and completeness, which are common in engineering and surveying when collecting field data for a project.</p>
Technical Objectives:	<p>The objectives of this project are:</p> <ul style="list-style-type: none">• Conduct a literature review and summarize state-of-the practice and key findings.• Develop data fusion algorithms that use GPR data, time domain EMI (TDEMI) data, and possibly one more type of geophysical data to produce X-Y-Z maps of existing utility facilities; improving upon and training those algorithms' depictions of location, depth and possibly material, condition, and size of buried utilities.• Test the AI models using data collected at locations where utility facility X-Y-Z locations, type, and condition can be verified with test holes using, but not limited to, a GPR array system other TDEMI system or geophysical equipment.• Identify a statistically significant sample of TxDOT projects around the state in which utility investigations have been completed at different quality levels (A, B, C, and D) and schedule a data collection campaign using test holes to compare utility investigation deliverables against ground truth observations.• Test quantitative metrics (e.g., positional accuracy and completeness) to tie the quality levels to project delivery expectations using factors such as data needed for utility conflict management (UCM); definition of project design elements; risk assessments by project delivery phase and utility type, schedules and costs; and damage prevention and safety during construction.• Develop and test guidance and training materials for conducting utility investigations using traditional and advanced geophysical techniques, providing a clear link between project delivery expectations, utility investigation scopes, data collection activities, and accuracy and completeness of deliverables. <p>The expected technology readiness level (TRL) for this project is 8.</p>

Anticipated Deliverables:	<ol style="list-style-type: none"> 1. Technical memorandum for each task completed. 2. Monthly progress reports. 3. Project Summary Report 4. Research report documenting the findings of this research, including: <ul style="list-style-type: none"> • AI models and procedures for interpretation of geophysical data sets for improved location, depth, and material type of buried utilities. • Performance metrics to tie utility investigation quality levels to project delivery expectations. • Guidance and training materials on how to conduct effective utility investigations at TxDOT. • Value of Research (VoR) that includes both qualitative and economic benefits.
Proposal Requirements:	<ol style="list-style-type: none"> 1. RFP#1 Q&A Deadline: 12:00 p.m. Central Time, Tuesday, February 20, 2024. 2. Proposal Deadline: 12:00 p.m. Central Time, Thursday, March 21, 2024. 3. Use the current “ProjAgre” and “PA Forms” templates located at the RTI Forms webpage. 4. Proposals will be considered non-responsive and will not be accepted for technical evaluation if they are not received by the deadline or do not meet the requirements stated in RTI's University Handbook. 5. Proposals should be submitted by the University Liaison in PDF format; (1) PDF file per proposal. File name should include project name and university abbreviation. 6. This project will be tracked during the life of the project using the Technology Readiness Level (TRL) scale. 7. The 2021 Texas Legislative Session requires that universities be in compliance with Senate Bill 475 by submitting a completed and signed TxDOT Security Questionnaire (TSQ) to RTIMAIN@txdot.gov. Universities that have not submitted a completed and signed TSQ one week after award will be considered non-compliant and unable to participate in the Program.