



# TECHSUMMARY January 2023

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## Geotechnical Asset Management for Louisiana

### INTRODUCTION

The Louisiana Department of Transportation and Development (DOTD) has many elements that compose its transportation system. Roads and bridges are managed to provide proactive maintenance. Similar to the approach of bridge management, pavement management, and dam/levee safety, DOTD should adopt a methodology to evaluate retaining walls, bridge embankments, culverts, and potentially problematic soil slopes to determine repair priorities. Knowing where and how many of these assets exist, as well as their age and condition, will determine maintenance schedules, necessary funding, and potential risks of failure.

A goal of a Geotechnical Asset Management (GAM) plan is to reinforce the Transportation Asset Management Plan (TAMP) and to keep transportation corridors open allowing the flow of commerce. If a geotechnical asset fails and blocks a road or disrupts traffic, the transportation corridor is affected along with economic growth. Funds, labor, and time are required to repair failures in addition to the lost economic dollars, frustration of drivers and businesses encountering construction (and/or detours) during repairs.

Knowledge of an asset's component materials and design life will lead to the asset's overall effectiveness. Documentation of this knowledge will aid in proactive planning and decision-making for maintaining, repairing, or replacing these structures through their design life.

### OBJECTIVE

The research project objectives were to review state and federal efforts regarding geotechnical asset management; determine local compatibility issues and existing Louisiana systems; develop database parameters for storing geotechnical asset information; identify logical steps toward full implementation; recommend strategies for implementation; and document the research effort.

### SCOPE

This project focused on Geotechnical Asset Management (GAM) within DOTD and established the basics and foundation on which to build a GAM system for DOTD. The project researched GAM systems and implementations within other state agencies and on the national level.

### METHODOLOGY

After reviewing existing state and federal efforts regarding geotechnical asset management, DOTD policies and other asset management programs/computer systems were assessed to determine applicability for implementing Louisiana's geotechnical asset database.

National Cooperative Highway Research Program (NCHRP) Report 903, entitled "Development of an Implementation Manual for Geotechnical Asset Management for Transportation Agencies," provided excellent guidance along with other references.

The NCHRP report provides valuable data, insight, and direction for state agencies regarding Geotechnical Asset Management. It recommends, "starting lean," and researchers utilized this logic even prior to receiving the NCHRP report. There are thousands of geotechnical assets across the state, and potentially so much data that could be collected in a database. However, how much effort and energy is required to collect all this information, and what benefit would it provide on the microscopic detail level? Starting lean refers to getting a foothold in the data. Similar logic is that it might take 20% effort to collect 80% of the data, but the last 20% of data will take 80% effort. Starting lean ensures that the process is started and that existing data was utilized to speed the process.



### LTRC Report 664

Read online summary or final report:  
[www.ltrc.lsu.edu/publications.html](http://www.ltrc.lsu.edu/publications.html)

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Retaining Walls were compiled as a pilot dataset, low-hanging fruit first, focusing on interstate and high ADT projects. The database will contain many fields (as available) including location and dimensional elements (height width, GPS location, etc.) and component descriptions (wall type, age, reinforcement type for corrosion rates, etc.). By documenting these geotechnical assets, we can track and proactively plan to address these structures as they near their ultimate design life.

DOTD uses Environmental Systems Research Institute (ESRI Roads and Highways) as the Linear Reference System (LRS) to categorize road sections so that each (road, ramp, directions, etc.) has a unique identifier. This project utilized RouteID and many Enterprise GIS software and protocols already existing within the department. ESRI ArcGIS® ArcMap™ was utilized to the collect and visualize geo-referenced wall locations.

Google Earth and Google Maps with aerial and street view imagery was viewed to scan and locate 2D and 3D perspectives of existing field and road conditions safely and efficiently from the office. The Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP) aerial imagery was also a collection data source.

ArcGIS FieldMaps is a mobile data collection application that is part of the ESRI suite. The application allows fieldworkers the ability collect, edit, and analyze geospatial data and send accurate data directly into centralized GIS databases. The app works even when disconnected from the internet and integrates seamlessly into ArcGIS.

## CONCLUSIONS

This research advanced Geotechnical Asset Management (GAM) within the Louisiana DOTD. Full GAM development and implementation will provide the department a logical method to manage risk, address problematic locations, and effect a rationale to implement appropriate repairs in a timely manner.

The developed GAM GIS database provides geospatial locations, digital storage, digital rating applications and visual interfaces for retaining walls including historical information. Inventory efforts utilized efficient and effective tools of aerial photography, mapping, GIS software, web applications, and mobile applications. DOTD can replicate these efforts for other asset types.

Researchers developed desk and mobile GIS applications for efficient collection of condition and consequence assessment data into the GIS Database. Districts with their local knowledge should use these tools as part of the rating process.

Researchers await DOTD HQ Operation and Maintenance issuance of direction to the districts regarding the next steps of the GAM implementation and segment ratings. HQ manages district workload, staffing, and funding priorities associated with the maintenance and asset management efforts. Awaiting HQ directives slowed implementation by affecting the timeliness of the risk calculations and the full implementation of GAM.

Culverts and slopes are tougher to locate/inventory via aerial photos and would benefit from a mobile application like Field Maps or Headlight. These could allow district personnel to spatially locate the start and end of assets, while in the field, and populate directly to the database. GAM is a proactive way to manage geotechnical assets and future decisions regarding condition, performance, and consequences of risk improving upon the current reactive nature versus deteriorating conditions. GAM can assist DOTD with the logical allocation of limited financial resources to ensure safety and longevity of these assets. With the ever pressing "need to do more with less" and the knowledge drain of retiring workers, further implementation of the GAM system will help preserve the past, so designers can plan for the future.

## RECOMMENDATIONS

Coordination between the DOTD sections is essential regarding the operation and maintenance of geotechnical assets across the state, now and into the future. The following bullets outline some recommendations on how DOTD can incorporate GAM into normal management operations (HQ Maintenance and Operations, Geotechnical, and Bridge Maintenance sections, and district offices).

- Add wall construction details (subcontractor designs/as-builts) to project files earlier (Falcon/FileNet, etc.)
- Continue to inventory assets (410+ wall segments so far)
  - Include additional information on wall Age, ADT of roadway, Project #s
  - Verify with districts for accuracy and missing assets
- Conduct Condition Assessments (HQ-District Forces) with FieldMaps Application
  - Operation and Maintenance Condition (1-5)
  - Safety Consequences (1-5)
  - Mobility/Economic Consequences (1-5)
- Calculate Risk Scores (A to F) to set priorities
- Review Treatment options
- Communicate Results and Manage assets
  - Utilize the GIS database, mobile application, and the GAM guide as part of the GAM implementation within DOTD. A user guide was developed for the FieldMaps application and is attached as an appendix in the final report.
  - Inspection Recommendations (Checklist & Inspection Frequency)
- Conduct recurring inspections/re-rating of wall assets collected in this research
- Include walls, culverts, and slopes in the GAM and ultimately in the TAMP. Other assets like salt domes, boring logs, should be part of the Geotechnical section records for reference
- Grow the asset database through follow-on efforts to collect other datasets (culverts, slopes, etc.)
- Consider the Field Maps and Headlight applications moving forward

