

Research the Application of GeoGIS in Support of
ALDOT Geo-referenced Documents
931-050

Prepared for the

Alabama Department of Transportation

Prepared by

Dr. Randy K. Smith
Center for Transportation Operations, Planning, and Safety
The University of Alabama
Tuscaloosa, Alabama

TECHNICAL REPORT DOCUMENT PAGE

| | | | |
|--|--|--|------------------|
| 1. Report No | 2. Government Accession No. | 3. Recipient Catalog No. | |
| 4. Title and Subtitle Research Project 931-050, Research the Application of GeoGIS in Support of ALDOT Geo-referenced Documents | | 5. Report Date October 2022 | |
| | | 6. Performing Organization Code | |
| 7. Authors | | 8. Performing Organization Report No. | |
| 9. Performing Organization Name and Address Center for Transportation Operations, Planning, and Safety P O Box 870288 University of Alabama Tuscaloosa, AL 35487 | | 10. Work Unit No. | |
| | | 11. Contract or Grant No. Alabama Department of Transportation Research Project No. 931-050 | |
| 12. Sponsoring Agency Name and Address Alabama Department of Transportation 1409 Coliseum Boulevard, Montgomery, AL36130 | | 13. Type of Report and Period Covered | |
| | | 14. Sponsoring Agency Code | |
| 15. Supplementary Notes | | | |
| 16. Abstract Research Project 931-050, Research the Application of GeoGIS in Support of ALDOT Geo-Referenced Documents was a continuation of the GeoGIS project initiated and led by ALDOT Materials and Test. After transitioning GeoGIS to ALDOT in a previous project, Project 931-050 continued to populate documents in GeoGIS, improve user satisfaction with GeoGIS, and research the potential of GeoGIS to support additional document types. | | | |
| 17. Key Words Geographic Information Systems (GIS), Geo-GIS, document management, geotechnical | | 18. Distribution Statement | |
| 19. Security Classification (of this report) Unclassified | 20. Security Class (of this page) Unclassified | 21. No of Pages | 22. Price |

LIST OF TABLES

Table 1. GeoGIS Document Inventorypage 9

LIST OF FIGURES

Figure 1. Portion of A Bridge Cardpage 6
Figure 2. Bridge Card Details with BIN and Project Numberpage 6
Figure 3. Scanned PDF of Older Bridge Card showing BINpage 7

EXECUTIVE SUMMARY

GeoGIS is a web-based geotechnical database management system developed for the Alabama Department of Transportation (ALDOT). The purpose of GeoGIS is to facilitate the efficient storage and retrieval of geotechnical documents. The website utilizes a web-based map to search for documents based on the location of the project to which the document is associated. Project 931-050, Research the Application of GeoGIS in Support of ALDOT Geo-Referenced Documents was a continuation of the GeoGIS project initiated and led by ALDOT Materials and Test. After transitioning GeoGIS to ALDOT in a previous project, Project 931-050 continued to populate documents in GeoGIS, improve user satisfaction with GeoGIS, and research the potential of GeoGIS to support additional document types. Task 1 involved the population of Bridge Cards into GeoGIS and determining the applicability of linking GeoGIS to other ALDOT Bridge repositories. Task 2 was to research further incorporation of geotechnical data documents in DIGGS format into GeoGIS. Task 3 was to research other geo-located document types within ALDOT that might be appropriate for GeoGIS. Task 4 supported the continue scanning of documents, population of documents, user support, and ongoing maintenance of GeoGIS.

Final Report

Research the Application of GeoGIS in Support of ALDOT Geo-referenced Documents 931-050

1. Introduction

GeoGIS is a web-based geographical information system (GIS)¹ containing numerous documents related to geotechnical, material, and environmental projects. The complete functionality of GeoGIS has been summarized in previous reports^{2,3}.

Project 931-050 “Research the Application of GeoGIS in Support of ALDOT Geo-referenced Documents” had an original Period of Performance of April 1, 2021, to March 1, 2022. A no-cost extension was granted until September 30, 2022. This final report will summarize the progress on the specific tasks related to Project 931-050 “Research the Application of GeoGIS in Support of ALDOT Geo-referenced Documents.”

2. Progress on Tasks

Research Project 931-050 had four primary tasks. These are:

- Task 1: Bridge Cards
- Task 2: Research additional DIGGS functionality
- Task 3: Research application to other geo-located document repositories
- Task 4: Ongoing Maintenance, Support, and document population

Significant progress was made on several of the tasks. These are summarized below.

2.1 Bridge Cards

By the end of this project task, 979 Bridge Cards had been entered through the GeoGIS Portal. If needed, the Bridge Cards were scanned into a PDF format, geo-located, and associated with a project in GeoGIS. If a project in GeoGIS did not exist, a project was created using the Project Id on the Bridge Card. Figure 1 Below shows an example Bridge Card. Figure 2 highlights the Bridge

¹ <https://aldotgis.dot.state.al.us/GeoGIS>

² Final Report, Research Project 930-919, GeoGIS 2016 Development and Support

³ Final Report, Research Project 930-982 GeoGIS Transition and Support

Identification Number (BIN) and the Project Number. Figure 3 below illustrates an older bridge card being digitized.

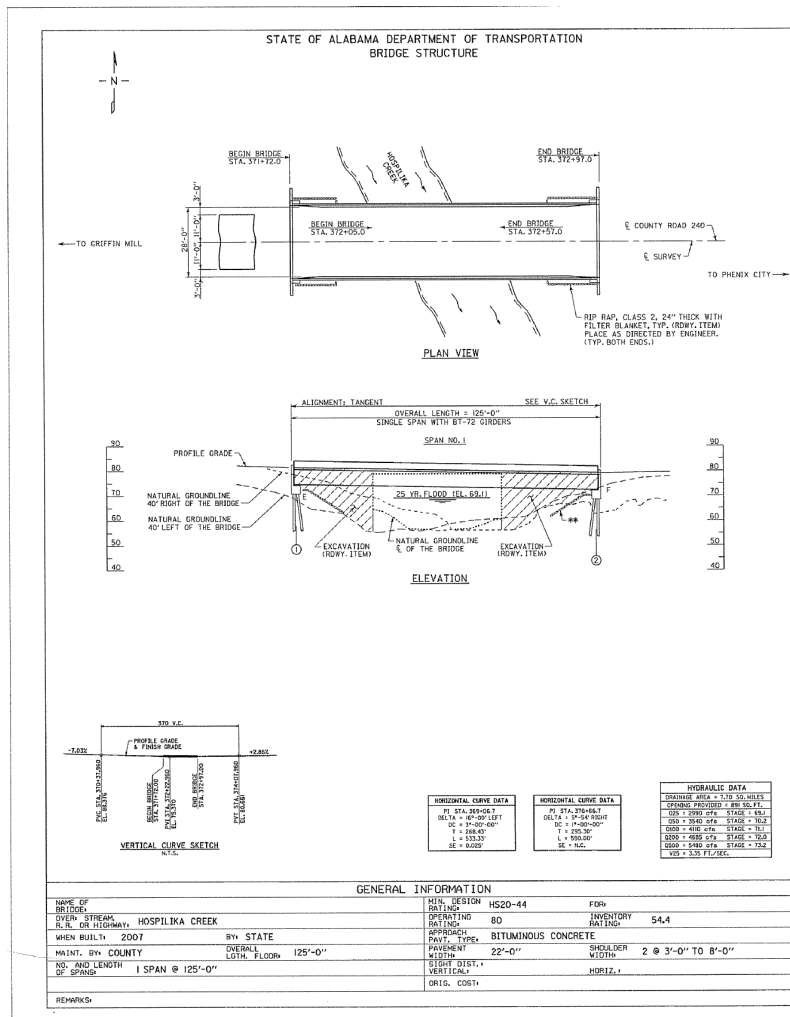


Figure 1. Portion of A Bridge Card

| BRIDGE NUMBER | | COUNTY | FED. RT. | U. S. HWY. | PROJECT NUMBER | TYPE | STRENGTH | | | | ROADWAY | | | | CLEARANCE | | | |
|------------------|-----|----------------------|----------|------------------------------|----------------|----------------|----------|--------------|-----|-------|---------|-----------------|--|--|-----------|--|--|--|
| -H10 | H10 | H15 | H20 | -18 | 18-19 | 20-21 | 22-24 | 24+ | -12 | 12-14 | 14+ | OPEN | | | | | | |
| CO124 | 41 | 18X(00) | LEE | NA | N | BR-8019(600) | PSC | | | | | | | | | | | |
| BIN# 019670 | | PREV. BIN# 001735 | | | | YEAR COMPLETED | | | | | | DATE 08-24-2007 | | | | | | |
| STATE OF ALABAMA | | ADJACENT BIN# 000000 | | DEPARTMENT OF TRANSPORTATION | | PLANS | | CONSTRUCTION | | | | | | | | | | |
| | | | | | | 2005 | | 2007 | | | | | | | | | | |

Figure 2. Bridge Card Details with BIN and Project Number

| BIN: 9860 (-1) CULVERTS | | | | | | | | | | | | | | | | | | | | |
|-------------------------|--------|--|---------|------------|--|----------|-----|-----|---------|----|--------------|----|-----------|----|----|----|----|----|----|------|
| BIN: 9861 (+1) | | | | | | | | | | | | | | | | | | | | |
| 3.80 mi | | | | | | | | | | | | | | | | | | | | |
| BRIDGE NO | COUNTY | FED RT | U S HWY | PROJECT NO | TYPE | STRENGTH | | | ROADWAY | | | | CLEARANCE | | | | | | | |
| 2008 | 38 | Calhoun | | F20-1(BA) | RCC | M10 | M10 | M10 | M40 | 18 | 19 | 20 | 21 | 22 | 24 | 24 | 18 | 12 | 14 | OPEN |
| FORM B1 B | | STATE OF ALABAMA HIGHWAY DEPARTMENT | | | TRUSS - SLAB - BEAM AND GIRDER BRIDGES | | | | | | DATE 7-14-71 | | | | | | | | | |

Figure 3. Scanned PDF of Older Bridge Card showing BIN

GeoGIS provides a Bridge layer in the GIS interface that can be toggled on and off. The points on the layer link to Bridge Cards that have been populated in GeoGIS. If additional documents are linked to the Project Identifier for the Bridge Card, those documents are also available.

Over the later course of this project, there were discussions about linking GeoGIS with the ALDOT Bridge Document Retrieval Program (BDRP). The effort of linking or integrating the two projects exceeded the scope of this project.

2.2 Research additional DIGGS functionality

The DIGGS specification (Data Interchange for Geotechnical and Geo-environmental Specialist) is an XML (eXtensible Markup Language) format for the exchange of geotechnical data⁴. Rather than just storing a PDF of test results, the raw data for a particular test is stored. This data can then be rendered in tables or visualizations. Additionally, DIGGS allows for the data to be exchanged between agencies and software products. GeoGIS accepts DIGGS documents for Atterberg Limits and Cone Penetration tests⁵.

For this task, the team researched additional DIGGS document types that might be of use to ALDOT Materials and Test. In those discussions with ALDOT Materials and Tests, it was determined that another application/file type might be more useful for the geotechnical engineers.

Geotechnical engineers at ALDOT and across many State DOTs and consultants use Bentley's gINT software for geotechnical projects⁶. The gINT software comes in various product tiers with differing capabilities⁷. Regardless, the gINT product produces more than a single file. gINT is a

⁴ <https://www.geoinstitute.org/special-projects/diggs>

⁵ Final Report, Research Project 930-982 GeoGIS Transition and Support

⁶ <https://virtuosity.bentley.com/product/gint/>

⁷ <https://virtuosity.bentley.com/product/gint/>

geodatabase that includes three file types: the gINT project (. gpj), the gINT library (. glb) and the gINT data template (. gdt)⁸. All three files are needed to support the geotechnical reporting of the data contained in the geodatabase. This format makes it difficult to transfer data, share data, or migrate data across projects and agencies,

In researching the technical details required to incorporate the different file types of gINT into GeoGIS, the project encountered two difficulties. First, the geodatabase model of gINT does not mimic the file-based model of GeoGIS. It was determined this could be solved on a project-by-project basis. For a given project, incorporate a single instance of the gINT filetypes into GeoGIS for each project. The second issue involved the accuracy and mechanism used to locate soil borings used by ALDOT in gINT. ALDOT uses two different coordinate systems for recording the location of soil borings. Some of the borings are located with latitude and longitude measured in degrees, minutes, and seconds or in decimal degrees. Other borings are recorded in northing and easting grid coordinates. Northing and Easting have two potential origination points, one for counties on the west side of the state and another for counties on the east side of the state.

In order to incorporate gINT soil boring files (or any file type) into GeoGIS that use easting and northing coordinates must be converted to latitude and longitude using degrees, minutes, and seconds or in decimal degrees. This can be done on a file-by-file basis using a coordinate translator such as CorpsCon⁹.

2.3 Research application to other geo-located document repositories

Task 3 was originally intended to research the application of GeoGIS to other ALDOT geo-located document repositories. The GIS-based interface in GeoGIS is generalizable to any geo-located document type. While preliminary discussions were had during the semi-regular meetings and ad-hoc discussions were held, the team determined that the progress being made by ALDOT's eGIS initiative and eDocs initiative rendered this task mute for GeoGIS with resources more appropriately to the remaining tasks.

⁸ <https://communities.bentley.com/products/geotechnical1/w/wiki/42303/the-gint-files>

⁹ https://beta.ngs.noaa.gov/PC_PROD/pc_prod.shtml#CORPSCON

2.4 Ongoing Maintenance, Support, and document population

Since the beginning of Project 931-050, over 300 new projects have been initiated in GeoGIS with over 750 new documents populated into the system. The project team held semi-regular meetings with representatives from ALDOT Materials and Test, Maintenance, and Environmental where action items were taken, progress reported, and direction was given. Notes of these meetings are included as an addendum to this report.

Currently, GeoGIS supports over 130 ALDOT personnel and over 90 contractors. As of October 2022, the GeoGIS document inventory contains the following:

| GeoGIS Inventory | |
|----------------------|--------|
| Initialized Projects | 3,826 |
| • Geotechnical | 1,708 |
| • Material | 2,042 |
| • Environmental | 742 |
| Approved Documents | 15,755 |
| Unapproved Documents | 388 |
| • Geotechnical | 22 |
| • Material | 342 |
| • Environmental | 741 |
| Bridge Cards | 979 |

Table 1. GeoGIS Document Inventory.

Note that an initialized project may be categorized by more than one project type therefore the number of initialized projects does not need to equal the sum of the project types.