# GeoGIS

Phase II

Prepared for the

Alabama Department of Transportation

by

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16. Abstract

A new web-based geotechnical Geographic Information System (GeoGIS) was developed and tested for the Alabama Department of Transportation (ALDOT) during Phase II of this research project. This web-based system stores geotechnical information about transportation projects, such as subsurface data, construction drawings, and design information. Typically this information is in a report or drawing format, but raw data can also be accommodated in the GeoGIS. The goal of this project is to provide a system to easily access and store all of the geotechnical and subsurface structural information from across the State of Alabama. Accesses through a secure web interface allows for keyword searches and interactive map selection. Phase II of this project migrated the desktop version of the GeoGIS, developed during Phase I, to the web. This migration required a complete redesign of the architecture. To the client, or GeoGIS user, the changes are minimal other than logging-in and accessing the site through the web. To the administrator, a more complex, secure, and robust system allows for users, projects, and data to be added and deleted from the GeoGIS. Currently the web-based GeoGIS is populated with the original GIS layers and project data collected during Phase I. It is anticipated that in future phases of this work additional geotechnical data will be added to the system and site improvements will be made.

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# Executive Summary

A new web-based geotechnical Geographic Information System (GeoGIS) was developed and tested for the Alabama Department of Transportation (ALDOT) during Phase II of this research project. This web-based system stores geotechnical information about transportation projects, such as subsurface data, construction drawings, and design information. Typically this information is in a report or drawing format, but raw data can also be accommodated in the GeoGIS. The goal of this project is to provide a system to easily access and store all of the geotechnical and subsurface structural information from across the State of Alabama. Accesses through a secure web interface allows for keyword searches and interactive map selection, which provides a user-friendly interface. Phase II of this project migrated the desktop version of the GeoGIS, developed during Phase I, to the web.

During Phase I, geotechnical data from projects and bridges from across the State of Alabama were collected and categorized. From this data and the needs of ALDOT, a GIS was designed with four layers: project, bridge, foundation, and soil boring, which were linked to attribute database tables. The layers were also linked to HTML pages to access preconstruction and construction information for the projects and bridges. Although the GeoGIS system was successful, the pilot study was performed on a desktop computer, which limited the availability of the information.

Phase II of this research project migrated the GeoGIS to the web, which required a complete redesign of the architecture. To the GeoGIS user, the changes are minimal other than logging-in and accessing the site through the web. To the administrator, a more complex, secure, and robust system allows for users, projects, and data to be added or deleted from the GeoGIS. Currently the web-based GeoGIS is populated with the original GIS layers and project data from Phase I.

Recommendations developed during this phase focus on improvements to the GeoGIS web site as well as increasing the amount of data within the GeoGIS. Although not necessary at this time, tighter integration with existing ALDOT systems such as CPMS and Hummingbird would be beneficial. Ongoing or future project data should be added to the GeoGIS by geotechnical consultants and approved by ALDOT engineers, while past project data should be added by data entry personnel and also approved by ALDOT engineers.

# Section 1.0 – Introduction

The Alabama Department of Transportation (ALDOT) and other state highway agencies from across the country have amassed significant quantities of information related to geotechnical engineering within their respective states. Geotechnical information includes, but is not limited to, subsurface investigation data, laboratory testing, construction drawings, design information, and construction data. (Lefchik and Beach, 2006). This information can be very valuable to future projects and therefore proper stewardship over the data is an important component of the engineering process. Geotechnical information can come from a number of sources including bureaus from within the Department and from outside consultants. The majority of geotechnical information is collected during the early stages of a project, but some information is collected during construction and even during the life of a project for monitoring purposes. This information may be submitted to the central office or to the districts. Historically this information has been submitted on paper in the form of reports, plans, or test results. Currently, the paper format is being replaced with electronic versions.

Because of the complex nature of project documentation, maximizing the benefit of past geotechnical data is virtually impossible. It was determined that a geotechnical document management system was needed to electronically upload, store, and access geotechnical and subsurface structural data for transportation projects in the state. This research project is Phase II of a development project to create a geotechnical data management system based on a Geographic Information Systems (GIS) to meet ALDOT requirements.

Phase I of the Geotechnical Geographic Information System (GeoGIS) project focused on developing and implementing a prototype GeoGIS on a desktop computer. Phase II of the project focused on migrating the GeoGIS from a desktop-based system to a web-based system. This web-based GeoGIS allows authorized users access to geotechnical documents and a GIS map from any computer that has an internet connection. This greatly increases the availability of the GeoGIS by creating a means for field engineers and authorized consultants access to information and data.

# Section 2.0 – Literature Review and Background

## Literature Review

Most researchers who have tackled the issue of storing and visually representing geotechnical data, especially on the web, have chosen to try to create a standard method of identifying data, referred to as GeoML or GeotechML. The acronym "ML" stands for Markup Language, which is a standard computer science approach of describing individual pieces of data in a way that web browsers can recognize and search engines can index (Toll and Cubitt, 2003; Turishchev, 2002; Sen and Duffy, 2004).

Instead of capturing individual data elements and tagging the elements with Markup Language flags, this project created a centralized database that will store geotechnical documents, document data, and associated locations of projects. This differs from what has been reported in the literature because the GeoGIS is designed to meet the specific needs of ALDOT. Rather than creating an online database of geotechnical data elements, this project manages construction project documents related to geotechnical information. The GeoGIS allows for quick loading, searching, and displaying of geotechnical documents and document data.

A small number of web-based geo-database systems exists, such as GeoFrance and the Korean Institute of Construction Technology (KICT) database. The GeoFrance database system requires massive standardization of data, but the benefits of standardization are appreciable (Chang and Park, 2004). One benefit is online mapping which can accommodate the spatial complexity of geotechnical data and can maximize the sharing of data (Chang and Park, 2004). The KICT Geodatabase and associated web-based GIS includes data analysis tools, which are difficult to code in a system based on markup language technology.

Another benefit of using a Geodatabase instead of markup language is the ease of adding new analysis functions and integrating tools into the system as a whole (Chung 2007). A larger variety of analysis techniques are available as a result of the speed of calculations in a web-based GIS. In addition, standard analysis tools within a GIS are available and easy to use (Cintron 2007).

**GeoGIS Phase I**

The desktop GeoGIS application that was developed in Phase I of the project is a tool for storing both graphic and attribute geotechnical data. This system allows users to access data spatially. During Phase I, it was determined that a GIS could provide both a framework to store geotechnical data and also a means to retrieve the data. GISs have an advantage over other database systems in that a GIS allows spatial display, querying, and selection of database information. Spatial access of data can be as simple as selecting a point of interest from a digital map. The GeoGIS was designed to be expandable to include virtually all of the geotechnical and subsurface structural information from across the state. The overarching goal of the project was to develop a user-friendly system capable of handling all subsurface data from past, present, and future transportation projects.

Project information from across the state was collected, scanned, and used to develop and test the desktop GeoGIS. Data was collected for eight projects in seven counties and included 18 bridges. Each project was identified by a project number and each bridge was identified by a bridge identification number (BIN). Several projects had more than one bridge.

From the site-specific data for the eight projects collected during Phase I, four distinct sets of geotechnical data were identified: projects, bridges, foundations and soil borings. Each of these geotechnical data sets has three components: 1) location, 2) attributes, and 3) scanned information. It was determined that these four datasets could be represented as line and point features on a GIS map. The graphic entities were then associated to keyed-in attribute data that were related to scanned information.

To display data spatially, a frame of reference is required. In a GIS, a basemap is used as the frame of reference. The basemap for the Phase I work consisted of Alabama counties, roads, railways, and water bodies as shown in Figure 1. Over this basemap the new line and point layers of projects, bridges, foundations, and soil borings were located.

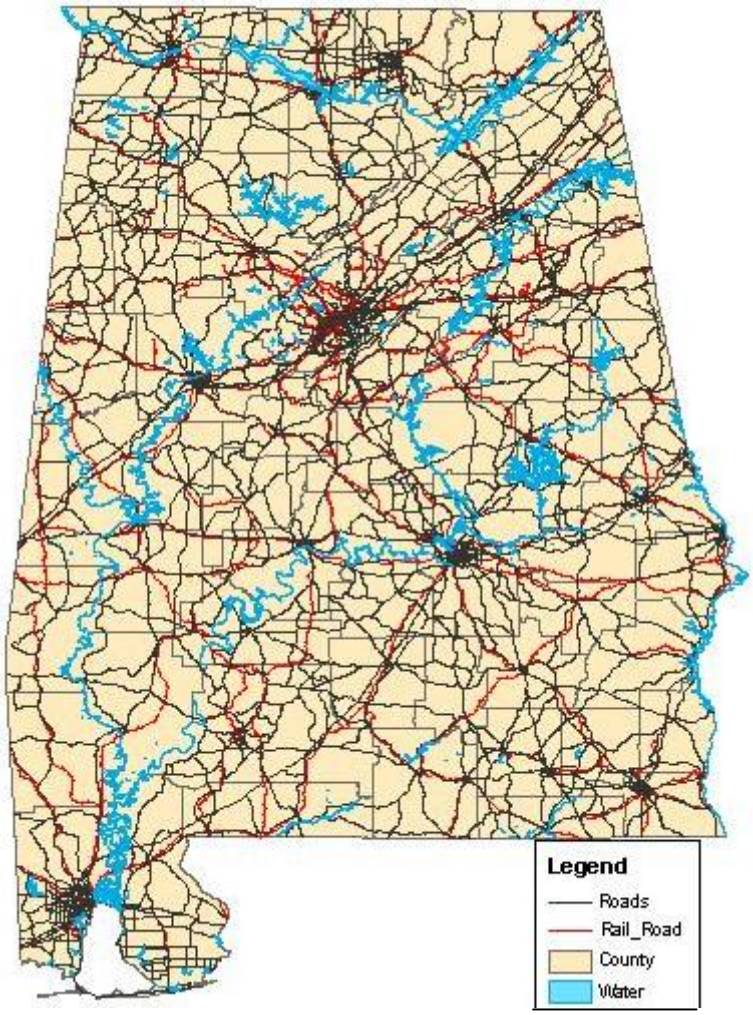


**Figure 1 – Phase I Basemap Showing Counties, Roads, Railways, and Water Bodies**

Most data for transportation projects comes from specific locations. Presenting that data on a map allows information from multiple projects to be combined based solely on proximity. In addition to proximity, attribute data can associate projects.

Attribute data is information that is keyed into the GIS database to describe a graphical entity on a GIS layer. Each layer in a GIS has a table that stores attribute data. Attribute tables have names and fields that store specific data about a line or point on a map. Each of the four layers in the desktop GeoGIS developed in Phase I had an attribute table containing relevant fields. Prior to the migration to the web-based system in Phase II, each table in the desktop GeoGIS had an 'image' field that stored a link to a web page (for project and bridge tables) or an image file (for foundation and soil boring tables). These fields linked the graphic features to the scanned documents.

Archived reports on site investigations, bridge construction details, and subsurface information such as foundation and soil boring data were collected for the eight projects in Phase I. To easily access site-specific information, these reports were classified into two categories: preconstruction and construction. Preconstruction reports describe data that were generated during reconnaissance and site investigation for a project. Construction reports describe data that were generated during and after construction such as as-built sheets. Preconstruction data is typically related to a project while construction data is typically related to a bridge. This information can be accessed through the project, bridge, foundation, or soil boring features on the GIS map. All single page drawing sheets, records, and reports were scanned and stored in a TIF or JPG format. Multiple page reports that were scanned as TIF or JPG format were stored in PDF format so that an entire report could be accessed at one time.

Due to the success of Phase I, a second Phase of this project was initiated to migrate the desktop GeoGIS to a web-based version.

## Section 3.0 – Web-Based GeoGIS

The purpose of the GeoGIS project was to develop a system that would facilitate the retrieval of geotechnical data. This was accomplished through the development of the desktop system in Phase I that allowed a user to perform spatial- and attribute-based queries to select a desired project. Phase II of the GeoGIS research focused on the migration of the GeoGIS from a desktop to the web to allow authorized personnel online access to the GeoGIS.

An authorized GeoGIS user will access the web-based system through the login page. GeoGIS users or clients can have different privileges based on the type of user. All users can view maps and documents while some users can upload and approve documents while other users can create and manage users. The four GeoGIS user types and privileges are shown in Table 1.

**Table 1 - User Types and Associated Privileges**

| User Type | Privileges |
|---|---|
| General User | Search, View Map, View Documents |
| Consultant | Above Privileges and Upload Documents |
| ALDOT Engineer | Above Privileges and Approve Documents |
| Administration | Above Privileges, User Account Addition/Modification, Add New Projects |

The web-based GeoGIS homepage has several functions that are appropriate to a user's needs. These functions include a map, searching for key words, document uploading, document approval, a connection to the Hummingbird database, and an administration page. GeoGIS is a secure website and requires a username and password for use. After entering a valid username and password, the GeoGIS homepage will be displayed. Figure 2 shows the GeoGIS homepage for a general user; the Administration button is removed for all users except the administrator.

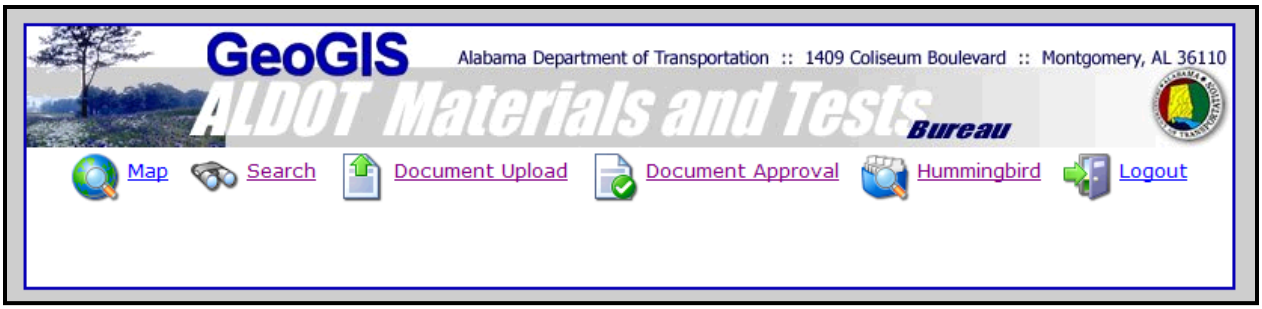


**Figure 2 - GeoGIS Homepage**

Figure 3 shows a flow chart of feature connectivity within the GeoGIS. Starting in the upper left of Figure 3, an authorized GeoGIS user will navigate to the login page and enter a valid user name and password. Once logged in, the GeoGIS homepage will appear with seven buttons: Map, Search, Doc Upload, Doc Approval, Admin, Logout, and Hummingbird, as shown across the top of Figure 3.

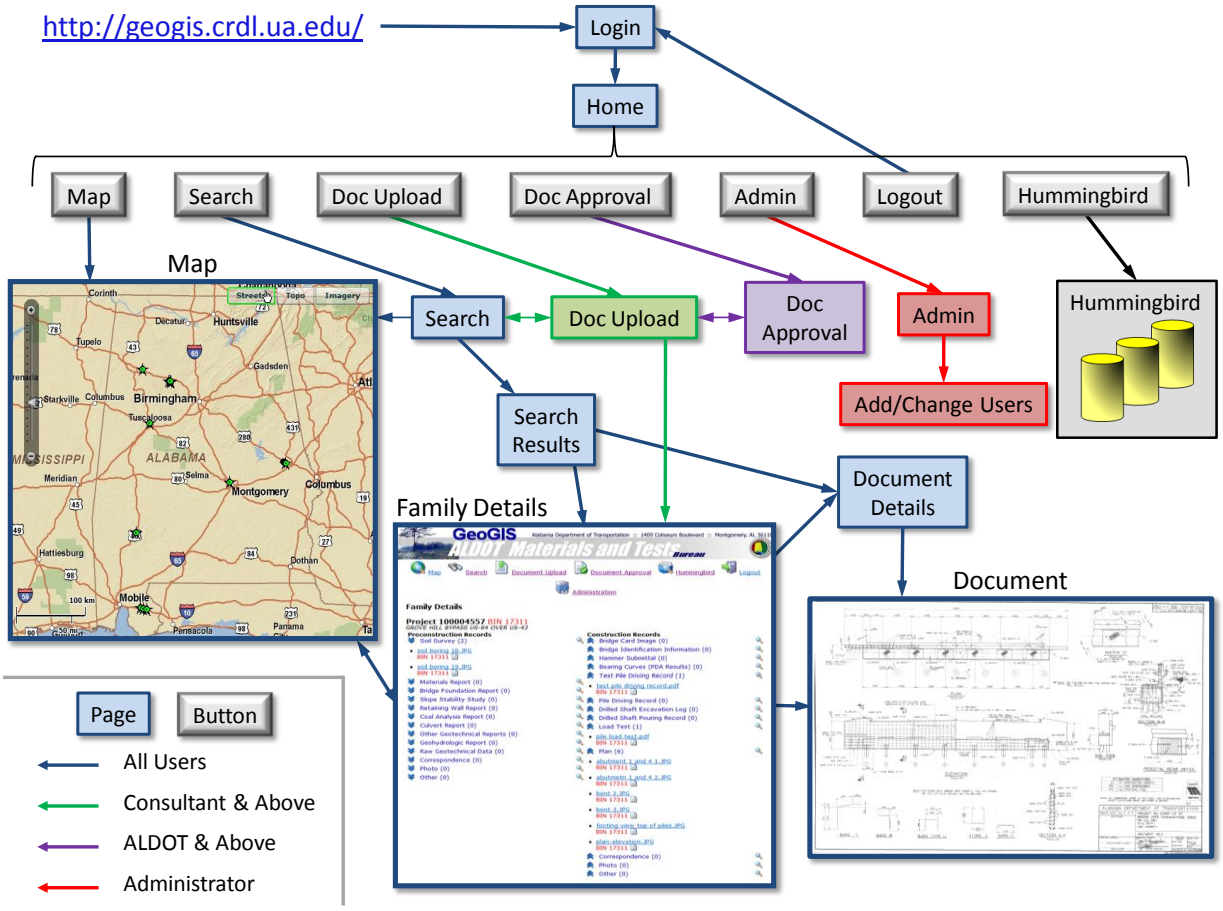


**Figure 3 - Feature Connectivity Within the GeoGIS Web Application**

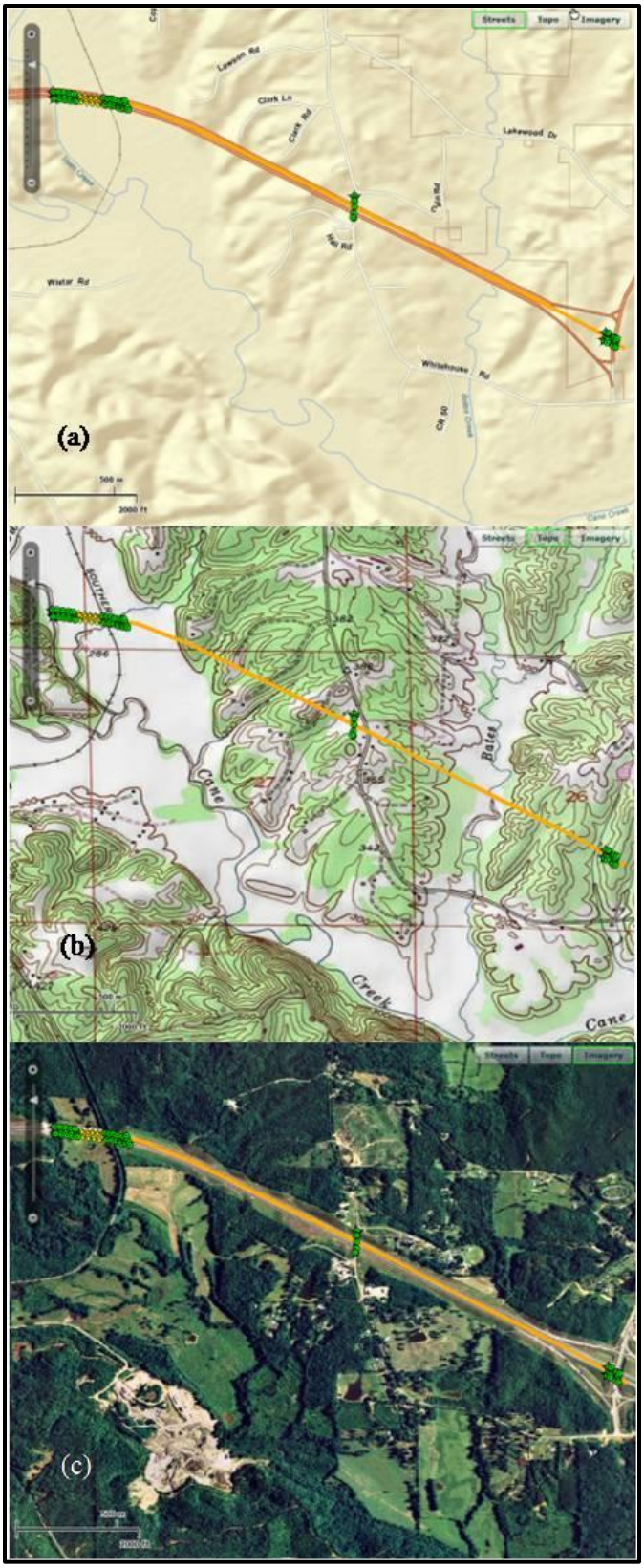


**Figure 4 - Streets, Topo, & Imagery Views in GeoGIS**

Each of these buttons allows a user access to different GeoGIS functionality. Arrow color in Figure 3 indicates which user type can access specific GeoGIS functionality.

Starting at the left of the function buttons, clicking the map function displays a map of the state or a portion of the state. As shown in Figure 4, there are three basemaps that can be displayed: (a) Street, (b) Topo, or (c) Imagery. Street view shows a map containing streets, street names, water bodies, etc.; the Topo view shows USGS topographic maps; and the Imagery view shows aerial photography.

As shown in Figure 4, the map also displays the four GeoGIS layers: projects, bridges, soil borings, and foundations. The map is equipped with zoom and pan functionality and all project layers are visible and can be selected to access the associated geotechnical documents.

Referring to Figure 3, a user can move between the map and Family Details page as shown at the bottom center of Figure 3. Selecting a line or point on the map related to a project will open the associated Family Details page as shown in Figure 5.

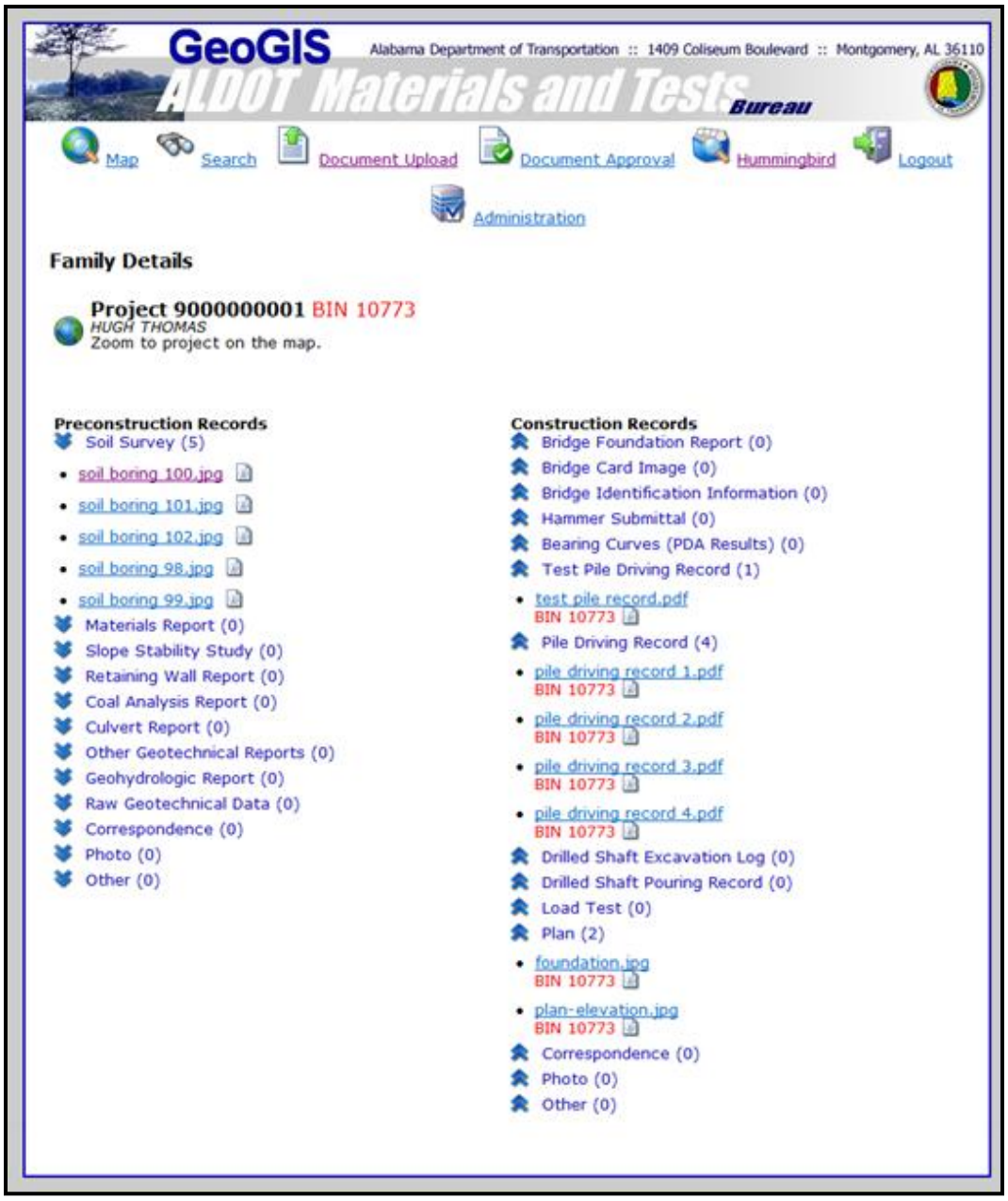


**Figure 5 - GeoGIS Family Details Page**

All documents that have been uploaded and approved for a project can be found on this page. From the Family Details page, any document for a project can be viewed or downloaded. To zoom directly to a project location on the map, a GeoGIS user can click the globe icon next to the project number on the Family Details page. This automatically zooms to the project on the map, even if the user does not know where the project is located.

A useful functionality of the GeoGIS is the thumbnail popup for files. When a user hovers over any filename, a thumbnail image of the fill pops up. This is a very efficient function to quickly scan documents for the desired data. An example of a thumbnail pop-up is shown in Figure 6.

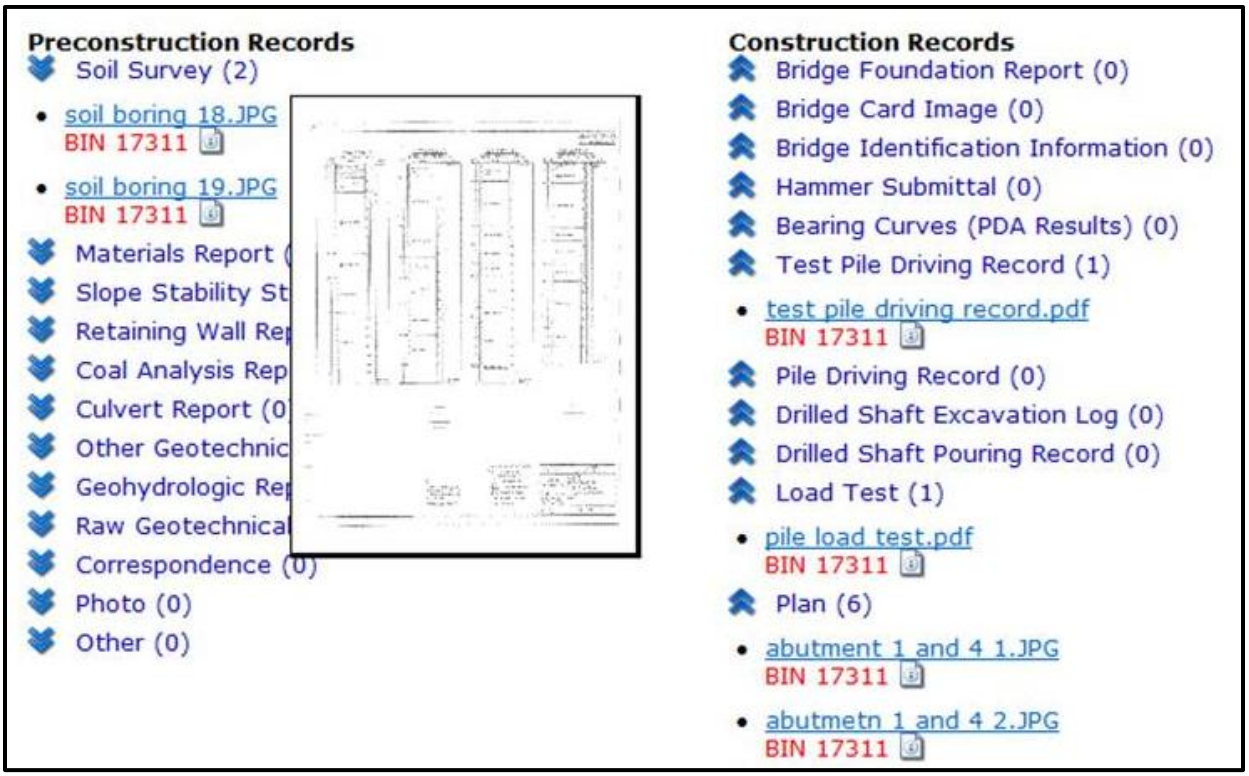


**Figure 6 - Family Details with Thumbnail View**

After every document on the Family Details page is an information icon which, when clicked, takes the user to the document details page. The types of documents that are currently stored in the GeoGIS are in JPG (scanned image) or PDF (document) format. Selecting a file name from either the Family Details page or the Document Details page displays the document on the screen. Figure 7 shows a typical document in GeoGIS.

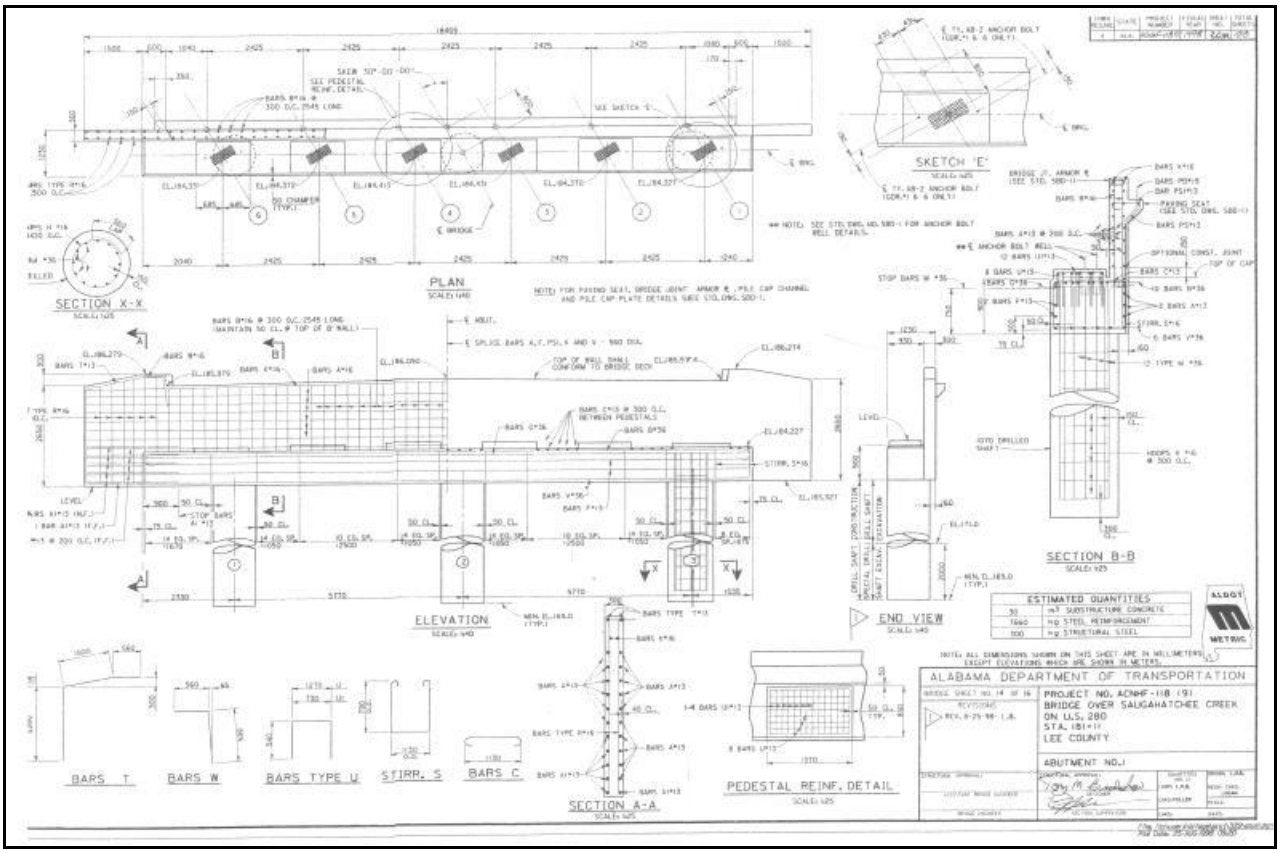


**Figure 7 - Typical Geotechnical Document Uploaded in GeoGIS**

The Family Details page can also be accessed through the search and search results page as shown in Figure 3. The search page contains a search bar that allows key word searches. Words or numbers can be entered and the database will be searched for documents by: name, project description, project reference ID, and type. The search results are displayed in a list with thumbnail views of the documents, along with the name of the document, and the BIN. This allows for quick and easy selection of documents.

The Document Upload button on the GeoGIS homepage is for the document upload process. As seen on Figure 3, this button takes an authorized user to the document upload page. The document upload process begins by choosing a project with a valid project ID number, selecting the document type, selecting the document itself, and entering the Bridge Identification Number (BIN), if applicable. It should be noted that the project must have a line and/or points in the GIS before documents can be uploaded. The connection between the GIS and the Family Details page is made through one of two common data fields. The shapefiles for a project has two

attribute fields that contain the project reference ID or the family ID, which is the data the system uses to relate graphical entities on the map to the Family Details page.

As with the desktop version of the GeoGIS developed in Phase I, the web-based version allows documents to fall under one of two categories: preconstruction or construction documents. Types of preconstruction documents are soil surveys, geohydrologic reports, material reports, etc. Construction documents are bridge foundation reports, hammer submittals, drilled shaft pouring records, etc. Documents must be scanned or in digital format before the documents can be uploaded into the GeoGIS.

The Document Approval page, shown in Figure 3, allows authorized users to approve or deny documents that have been uploaded into the system. If a document is approved, the document will become searchable and viewable in the system. If a document is denied, the document will be removed from the GeoGIS database.

The Administration page can be accessed by a GeoGIS user with administration privileges. An administrator can create, delete, and modify users, passwords, and user types in the system. A user can be one of four types: general user, consultant, ALDOT engineer, or administrator. The general user can view the map, view documents, use the search tool, and access the Hummingbird login page. The consultant can perform these tasks plus upload documents. The ALDOT engineer can perform the actions available to the general user and consultant, plus approve documents. Finally, the administrator can use all of the GeoGIS functions plus create/edit users, passwords, and user types.

ALDOT's Hummingbird database, shown on the right side of Figure 3, contains all types of ALDOT documents, including geotechnical documents. There is a link to the Hummingbird database from the GeoGIS homepage that allows ALDOT employees the ability to alternate between the two systems. The Hummingbird system requires a user name and password that is separate from the GeoGIS user name and password.

For detailed instructions regarding uploading and approving documents, creating users, and using the map, refer to the User's Guide in the Appendix of this report, which also contains a step-by-step process for adding new projects, which requires the use of SQL Server and ArcGIS.

## Section 4.0 – Web-Based GeoGIS Architecture

To migrate the GeoGIS from the desktop to the web, a completely new architecture was needed. The first phase of this research concentrated on using GIS functionality to search and select stored data, and then used hyperlinks to connect the GIS to that data. The new GeoGIS website has a completely different architecture. This architecture, shown in Figure 8, is the structure behind the web pages, maps, and documents.

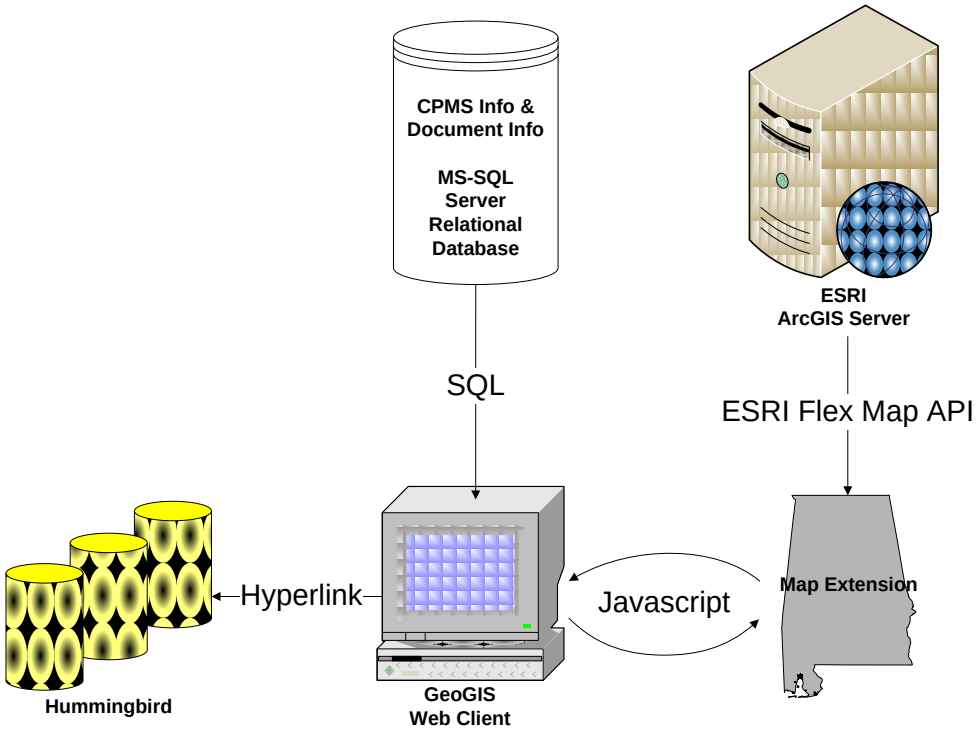


**Figure 8 - GeoGIS Architecture Flow Chart**

The GeoGIS architecture consists of a relational database, web client for document viewing and management, a map which is an extension of the web client, and an instance of ESRI's ArcGIS Server for handling map related tasks. Each of these cohabiting pieces play a key role in the execution of the features available in the GeoGIS web client.

The relational database is the data powerhouse for GeoGIS. It is housed within the Microsoft SQL Server 2008 environment running on a host server (the computer that runs the web site

client as well as the GIS program). This database stores the attribute information about projects, associated document information, information regarding web client users, and recent user activity. The web client directly interfaces with this database to display information requested by the user. This database communicates with the GIS using the project ref ID.

The GeoGIS web client is the main front-end accessed by all users and is the central hub to all the components of the architecture. The web client was described in detail in the previous section, Section 3.0 – Web-based GeoGIS Client. The web client holds a connection to the database and the map extension. By referencing projects from the database, the web client can access the map extension, via Javascript, telling the map extension to display the selected project on the map.

The Flash map extension of the client is written with Adobe's Flex Builder. The Flash Map uses the ESRI Flex API for interfacing with ArcGIS server (another ESRI application), allowing very rich, dynamic web applications to be created. This map communicates with the ArcGIS instance, allowing the map to "pull down" the necessary information to display the projects on the map.

ESRI ArcGIS Server resides on a host machine and serves up the location data and map tiles needed for the map extension to display projects. ESRI is a partnering GIS company which offers a very nice interface that provides a rich user experience for projects involving maps.

# Section 5.0 – Conclusions and Future Work

Phase II of this research successfully used GIS and web programming to convert a desktop geotechnical database system for managing geotechnical and subsurface structural information to a web-based system. The web-based GeoGIS developed during this research phase efficiently stores and retrieves data associated with projects and bridges in the state of Alabama. A comprehensive user guide is in the Appendix of this report.

While the web-based GeoGIS is operational and successful, there are several items that could be addressed in a subsequent phase of this research. For example, the procedures to upload and approve documents are straight forward, but the procedure to create a new project requires the use of SQL Server, the database management program. The bulleted list below describes aspect of the current GeoGIS that could be addressed in future phases of this work.

- Document Upload page: Create a way to upload multiple documents simultaneously, whether the documents are of the same type or not. This would increase the efficiency of the upload process.

- Document Upload page: When selecting a document type from the document type list, the document type should remain as the default setting. This will allow many documents of the same type to be uploaded in series.

- Document Approval page: Additional information for each pending document should be listed and include: the project number, the BIN, and the file name. Currently there is minimal information listed for each document. The most descriptive and informative information currently displayed is the document type, the user who uploaded the document, and the time at which the document was uploaded. This makes it difficult to determine the difference between pending documents.

- Create a new GeoGIS Project page: When uploading a document into the GeoGIS, the project number must be known. There is currently no simple method to determine which projects are available in the GeoGIS. This project page would list all the projects that are

available in the GeoGIS. The project page would also have links from each project to the Family Details page, the Document Upload page, or to the location on the map.

The next suggestions for future work in a subsequent phase of this research pertain to the process of adding projects to the GeoGIS map and database.

- Add a "Records Management" page for adding in new projects. Currently the architecture is set up in such a way that the addition of records to the GeoGIS project database is manual. This is a time-consuming process and requires a user to know SQL.

- Automate adding map features. Currently, there is no way for the map data to be updated except through manually drawing points or creating events on the map. Automating this process through GIS tools would greatly increase the usability of the map and significantly reduce the turnaround time from project additions.

- Connect Hummingbird and GeoGIS. Documents that are currently in Hummingbird could be transferred or referenced in GeoGIS. A line of communication could be opened so that when the Hummingbird database receives new documents, the GeoGIS could have direct access to those documents as well.

  A way to visualize these connective changes is to look at the architecture diagram with additional arrows (red), shown in Figure 9. Black arrows in the diagram represent systems that communicate with each other in the process of using and updating GeoGIS data. Red arrows represent the addition of new lines of communication between systems that are not currently connected.

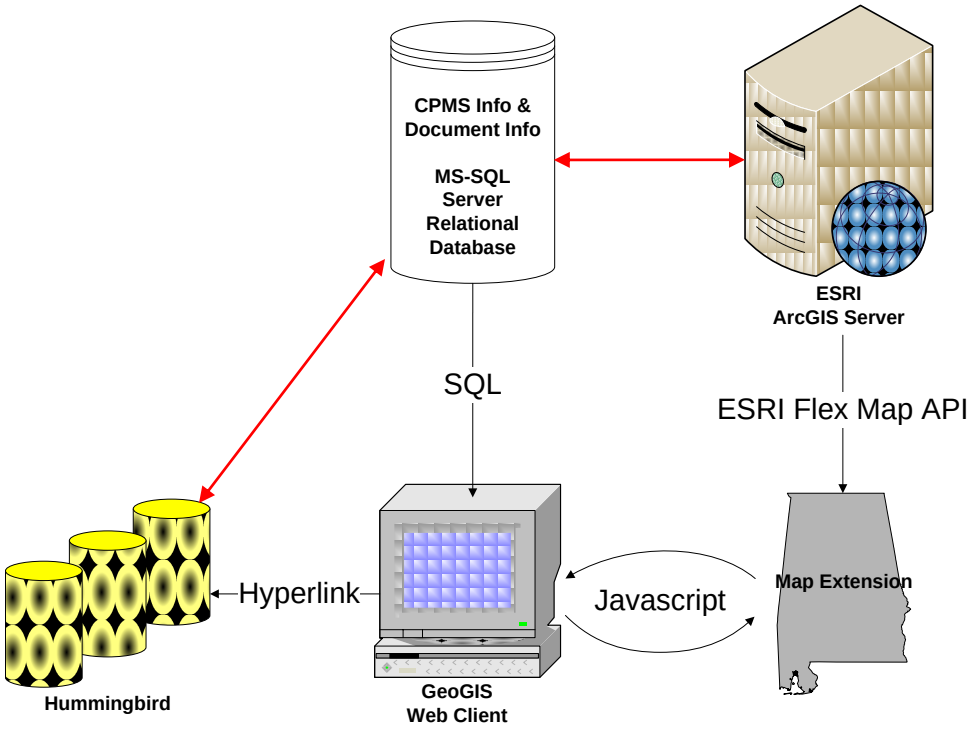


**Figure 9 - GeoGIS Architecture with New Communication Lines Added**

- Map filters in the Flash Map. With an increase in GeoGIS projects and an increase in viewable map content, there is a need to filter the data on the map. Query functionality for the map would allow a user to pick certain types of projects to view, or certain pieces of projects, or even projects in a specific county or city.

- Digital forms should be used for data entry. Implement teachable optical character recognition (OCR) software to extract searchable text from scanned documents. Consultants working with ALDOT could also be encouraged to submit searchable documents rather than "dumb" scanned documents. Documents that are searchable will allow for more robust data retrieval.

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# Appendix

# GeoGIS Users Guide

## Introduction

This guide will describe the process of using the GeoGIS site, beginning with the privileges given to the general user, followed by consultant privileges, ALDOT engineer privileges, and finally administrative privileges. Each section of this Users Guide will explain the tasks that can be performed by each user type. This guide will also explain how to add and edit projects in the GeoGIS using SQL Server and ArcGIS.

## GeoGIS User Types

GeoGIS is a structured system that allows users of different classifications to perform different operations depending on their user type. There are four user types: general user, consultant, ALDOT engineer, and administrator. These are listed in order of increasing privileges. Each classification has privileges that allow users to perform certain tasks. Each higher classification can perform all the tasks of the lower classifications. The general user can view the map, view and retrieve documents and document details, and search for data. These are the only tasks the general user can perform. The purpose of the consultant user is to allow outside consulting firms the ability to upload documents to a temporary storage space where the data awaits approval. The consultant can also view the map, documents, and search the system. The purpose of the ALDOT engineer user is to approve documents. An ALDOT engineer can also upload documents and perform the other tasks related to the lower level users. The administrator can create or change user names, passwords, and privilege levels for GeoGIS users. The administrator can also add new projects to the map, as well as perform any action that can be performed by the lower level users.

## General User Type

The GeoGIS website requires a valid login ID and password. Only a user with administrator status can create a login ID and password. Contact the administrator for a login ID and password.

This section will discuss the privileges associated with the general user. A general GeoGIS user is restricted to a “view only” status and therefore cannot edit, add, or delete any information in the system.

## Login Page

The GeoGIS website is located on a secure server. At the time of this Users Guide, the GeoGIS is located at the link below. Navigate to this address using a web browser to bring up the GeoGIS Login Page.

http://geogis.crdl.ua.edu/

Figure A1 below shows the Login Page. Before logging in, the buttons across the top of the page will not function.

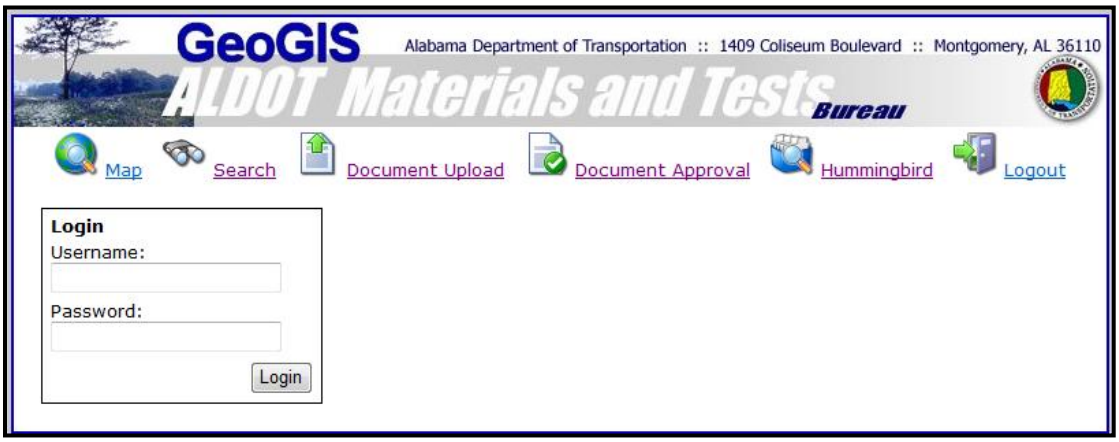



**Figure A1 - GeoGIS Login Page**

As mentioned previously, a valid login ID and password must be created for each user of the GeoGIS. After a valid user name and password is entered, the user can click the Login button and the GeoGIS homepage will appear.

## GeoGIS Homepage

The GeoGIS homepage is shown in Figure A2. This page is the starting point for a GeoGIS user. The page has several buttons including Map, Search, Document Upload, Document Approval, Hummingbird, and Logout. From this page, a user can select any function, but the user can only perform the functions that are within the privileges of the user type.

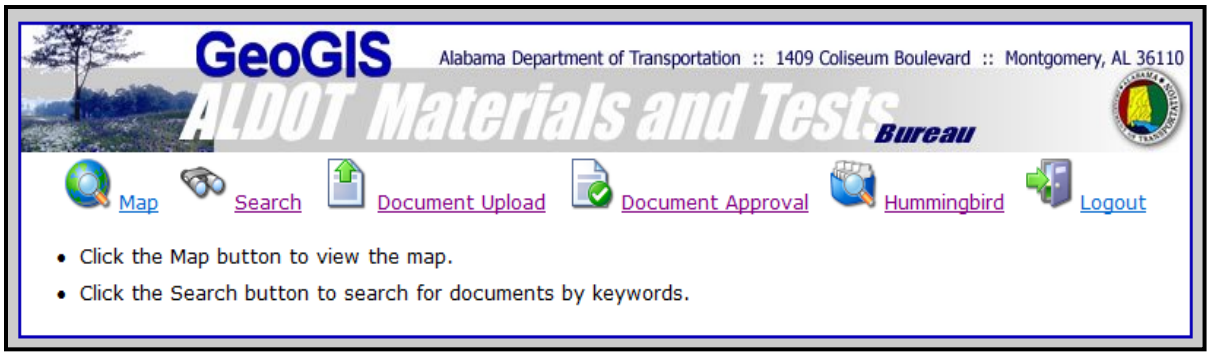



**Figure A2 - GeoGIS Homepage**

## GeoGIS Map

Clicking the Map button will open a new window containing the GeoGIS map. The ALDOT projects that are in the GIS shapefile will appear on the map. Figure A3 shows the street map for Alabama; the green circles with stars are the locations of projects currently in the GeoGIS.

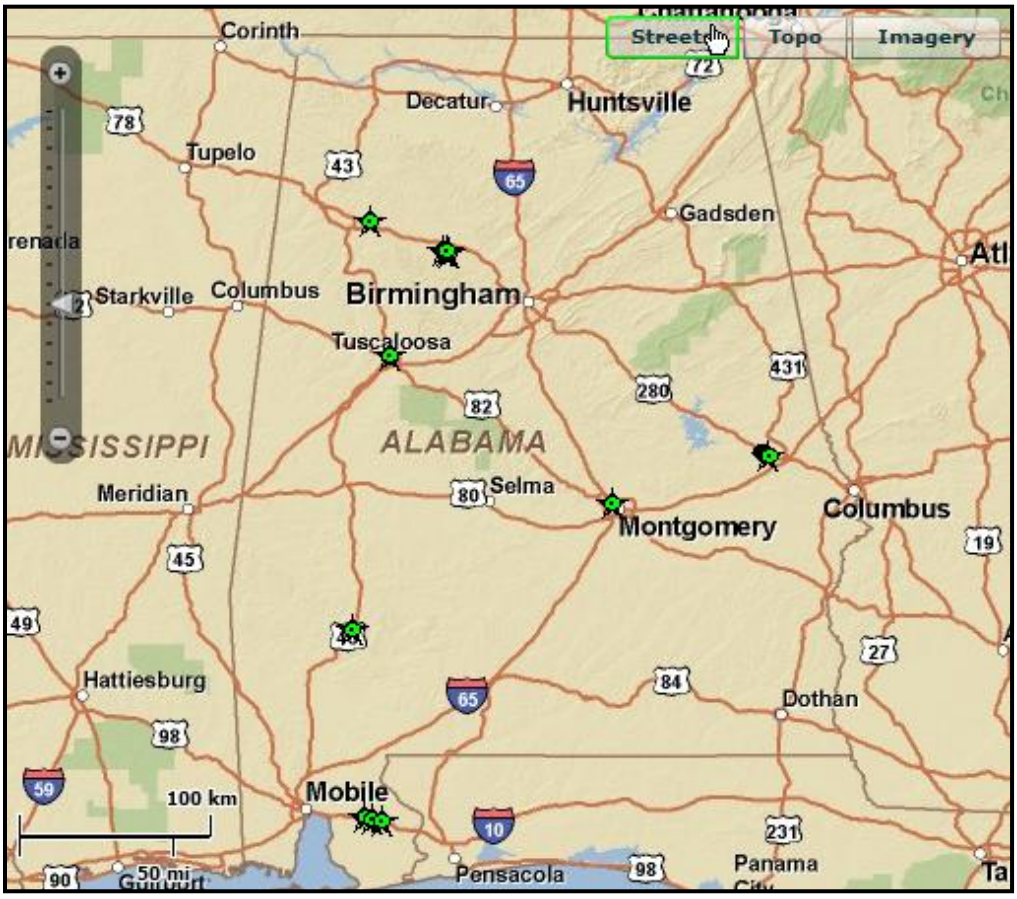



**Figure A3 - GeoGIS Map Displaying Streets in Alabama**

To move around the map, a user can simply click, hold, and move the map to pan. Clicking a point on the map will "grab" that point and move the map with the cursor. This will let a user easily locate an area of interest. To the upper left of the map is a grey vertical bar that looks like a ruler, this is the zoom feature. The small sliding arrow that points at the ruler represents the scale of the map being displaying (i.e. when the arrow is low on the ruler, the scale is small and the map shows a larger area, when the arrow is high on the ruler, the scale is large and the map shows a smaller area). To zoom in incrementally, the user can click the ⊕ button at the top of the ruler or slide the arrow upwards. To zoom out, the user can click the ⊖ button at the bottom of the ruler or slide the arrow downwards.

The quickest way of zooming in and out of the map is by using the mouse wheel. Moving the mouse wheel forward will zoom to the cursor. Moving the mouse wheel back will zoom the map out. The mouse wheel allows quick and accurate zooming, and reduces the need to pan the map. Figure A4 below is a zoomed view of the street map.

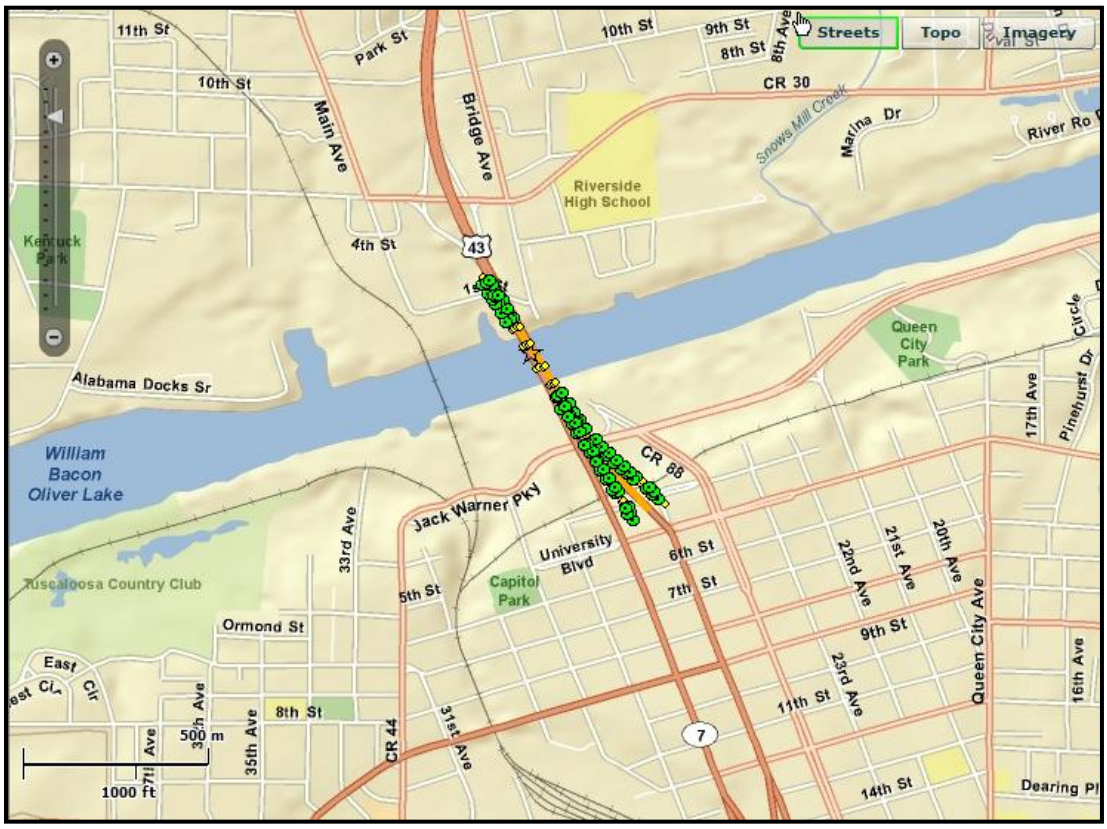



**Figure A4 - Zoomed in View of the Street Map**

There are three different basemap views available in the GeoGIS: Streets, Topo, and Imagery which are shown in Figure A5. Figure A5(a) shows the street view map layer containing roads, road names, water bodies, and shaded relief. Figure A5(b) shows the Topo option that is USGS topographic maps, which include roads, water bodies, elevation contours, townships, etc. The Imagery layer shown in Figure A5(c) shows a detailed aerial view. All map view options will display the GeoGIS project layers as seen in Figure A5.

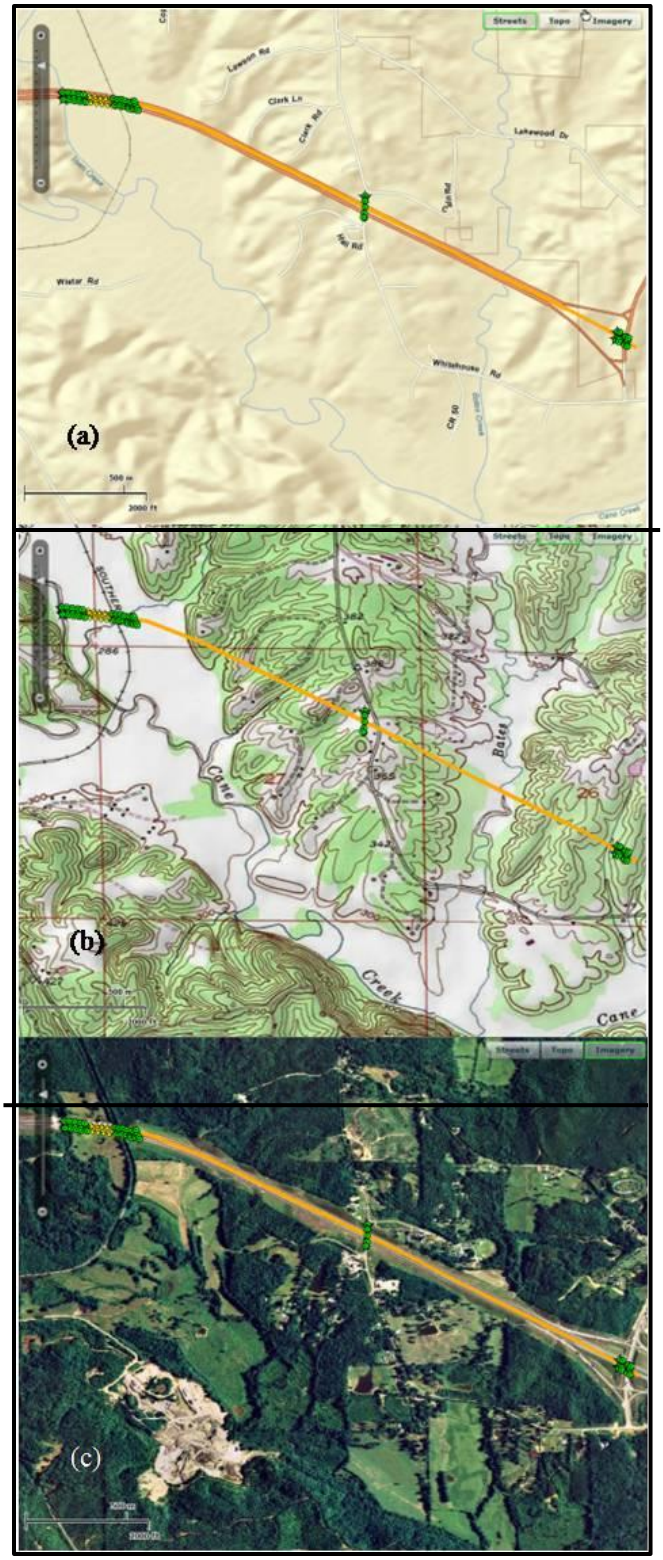



**Figure A5 - Streets, Topo, & Imagery Views in GeoGIS**

Geotechnical projects that are included in the GeoGIS have four potential features: a project line, bridge points, foundation points, and soil boring points. A project line is represented as a thick orange line showing the linear extent of a project as shown in Figure A5. This line represents the stretch of road that the project encompasses. A bridge location is represented as a black outline of a star. Each star represents a point on a bridge and is used to identify a single bridge. There may be several bridges within one project. Green circles represent the location of foundations which can be driven or drilled and typically support a bridge. Smaller yellow dots are the soil boring locations. These dots represent the point where a soil boring was drilled.

Figure A6 shows a zoomed in view of a pair of bridges associated with one project. Each set of features for a project represents the location of project data. However, the purpose of the GeoGIS is to provide a spatially explicit method for organizing geotechnical documents. To access documents, a user can simply click any of the GeoGIS features on the map for a particular project. The map will become the inactive window, and a window containing the Family Details page will appear.

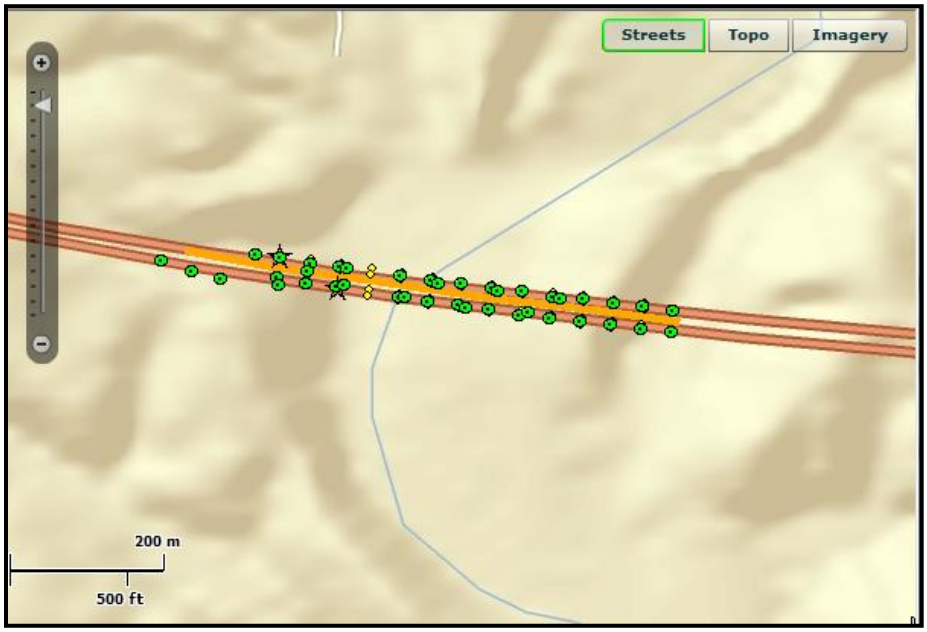



**Figure A6 - Shapefiles for a Single ALDOT Project**

**Family Details Page**

The Family Details page, shown in Figure A7, is the main page to access project information and related documents. The page consists of the project number, available Bridge Identification Numbers (BIN), a brief description of the project location from the CPMS database, and the list of documents. The Family Details page contains two general types of documents: Pre-construction documents (left side) and Construction documents (right side). The documents in each document type are displayed in alphabetical order. Figure A7 displays the Family Details page for an example project. The project ID and a short description of the project location are listed underneath the "Family Details" title. To the right of the project number are BIN(s) for the project in red. The globe icon in front of the project number is a button to jump to the map and zoom to a project extents.

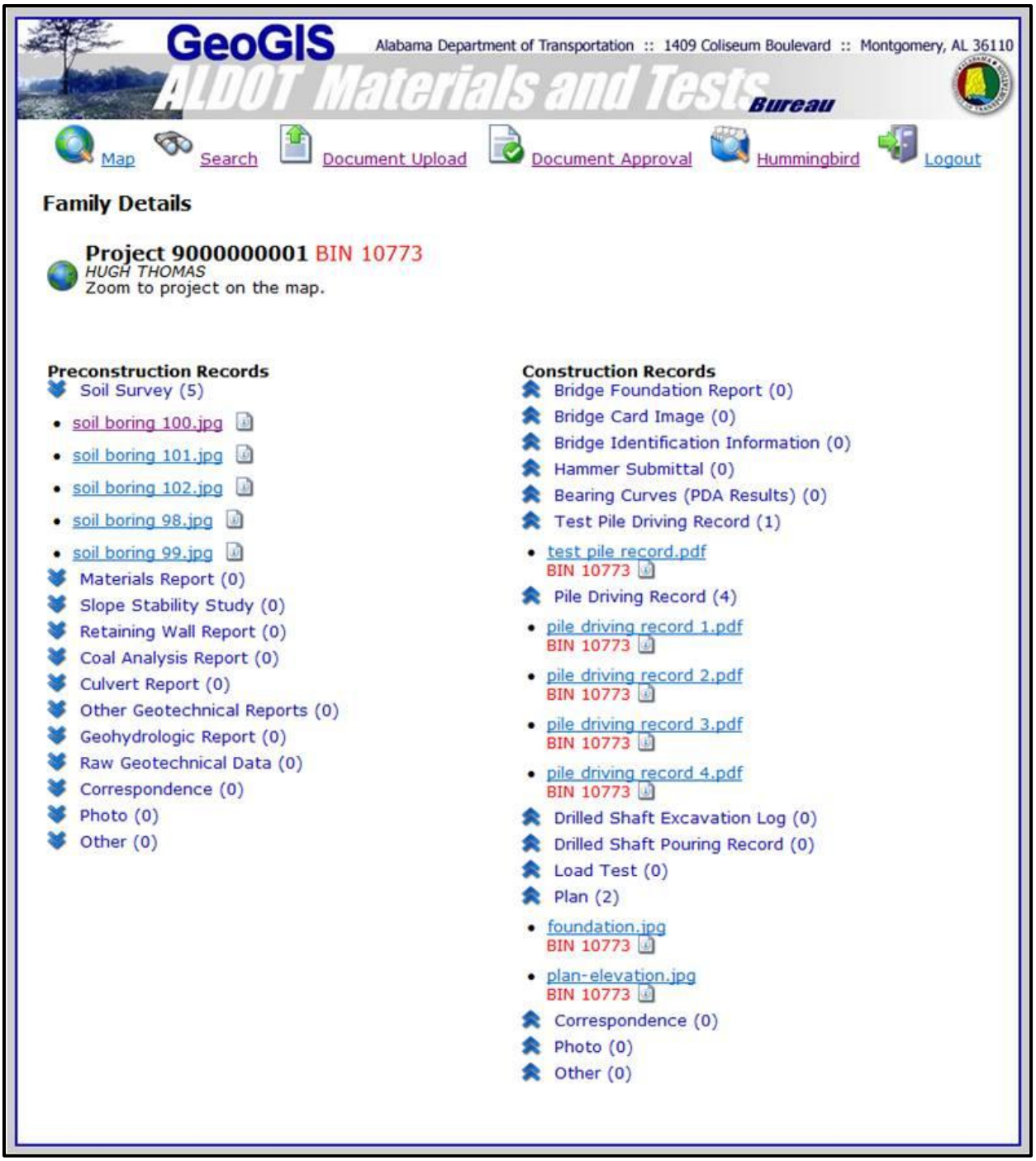



**Figure A7 - GeoGIS Family Details Page for a Project**

There are ten documents associated with the example project in Figure A7. The documents are shown in blue, underlined, and listed under specific document types. It can be seen in Figure A7 that some document types do not have any documents listed under the type. The Family Details page shows a user exactly which documents and documents types are available.

Many projects in the GeoGIS will contain a bridge and have a BIN. This number helps the user identify which bridges are associated with a project. If a document is specific to a certain BIN, that BIN is also placed in red underneath the document name as seen in Figure A7.

There are several options for a user to use to view a document. Hovering over a specific document on the Family Details page will bring up a thumbnail, as shown in Figure A8 below. The thumbnail view in the GeoGIS is a powerful tool to quickly scan through project documents. The ability to thumb through digital documents without opening each document is a common request from document management system users. The GeoGIS was specifically designed to contain this valuable functionality.

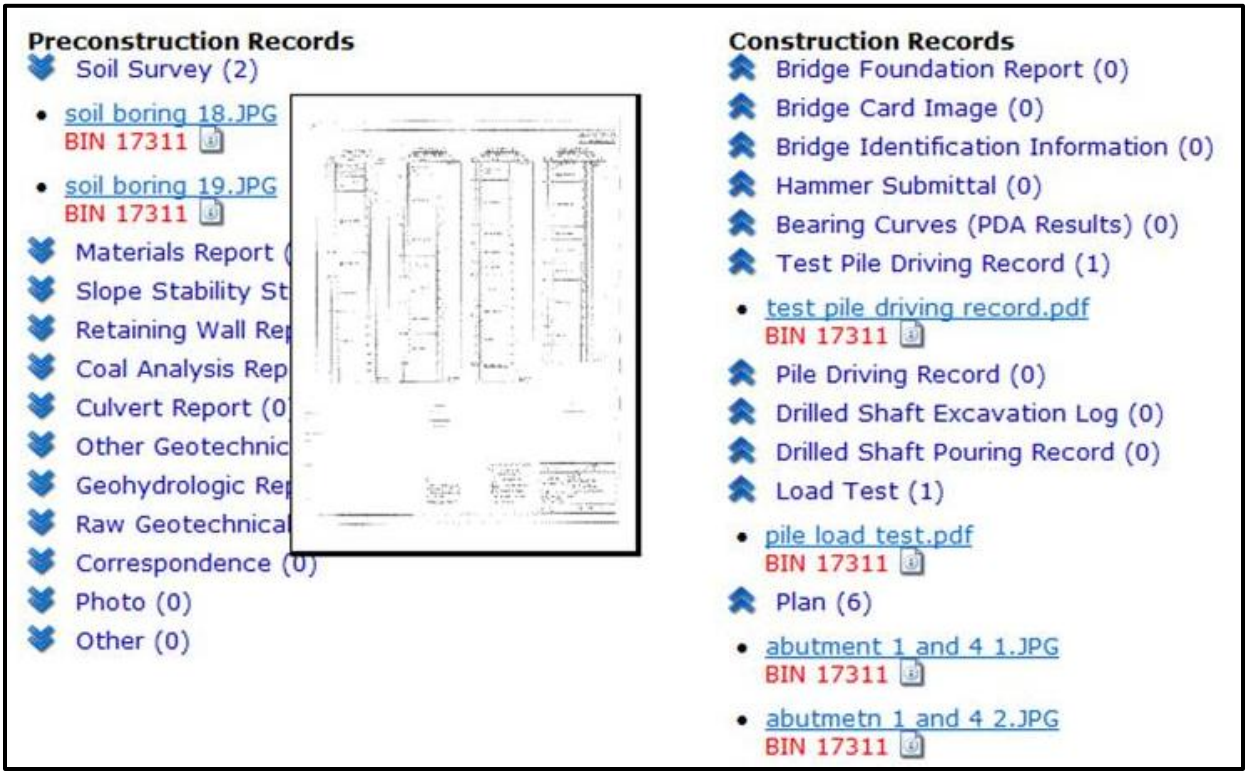



**Figure A8 - Document Thumbnail View on Family Details Page**

Clicking on a document thumbnail or document name will open up a dialog box that allows the user to download or open a selected document. Figure A9 shows the dialog box that opens when document thumbnail or name is selected.

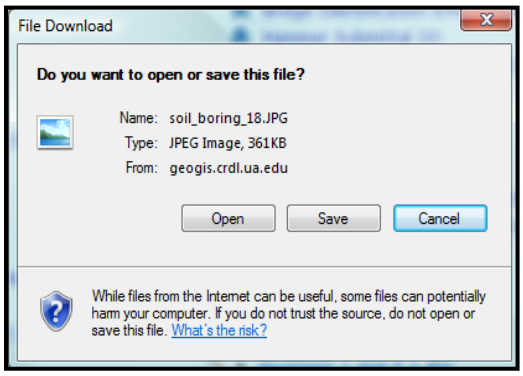



**Figure A9 - File Download Dialog Box for a Soil Boring Document**

The selected document in Figure A9 is a soil boring sheet, which is normally in a JPG file format. There are also PDF file formats used in GeoGIS; to download and view PDF files, Adobe Acrobat is required (Acrobat is available for free from Adobe).

Another way to view a document from the Family Details page is by clicking the information symbol that is displayed below each document. This will direct the user to the Document Details page, which is discussed in the following section.

### Document Details Page

The document details page lists database information about a document and displays a larger thumbnail of the documents on the left side of the screen. If a document contains more than one page, only the first will appear in the thumbnail. Figure A10 shows the Document Details page for a soil boring sheet. A document can be downloaded by clicking the name of the document at the right of the Document Details page.

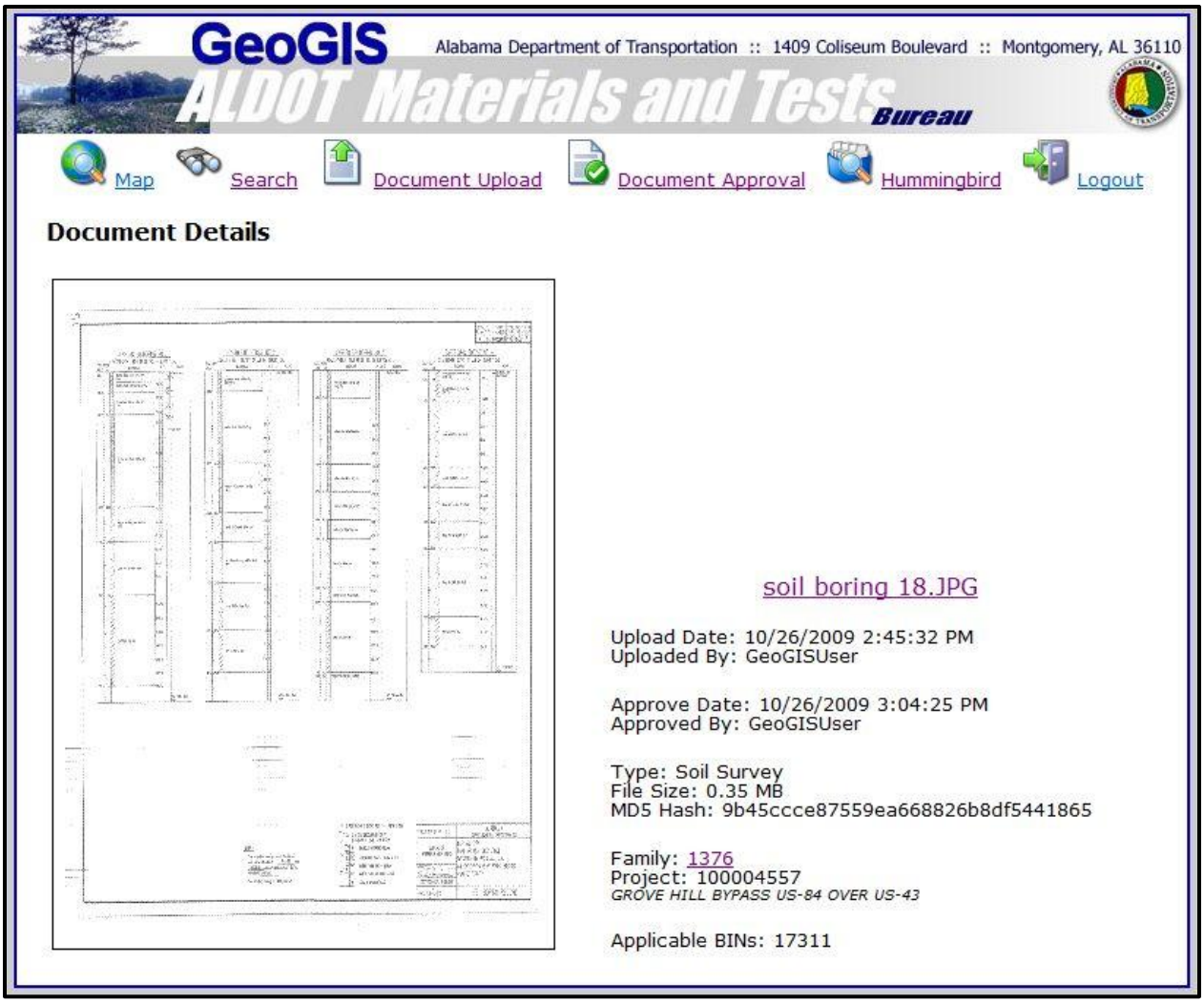



**Figure A10 - GeoGIS Document Details Page**

The document details allows a user to see information such as upload and approval dates, the users that uploaded and approved the document, the type and size of the document, the family and project details, and the applicable BIN.

### Search Page

The search page is designed to allow a user to search the GeoGIS database based on a project ID number, a BIN, a document name, or any keyword associated with a document or project. Figure A11 shows the GeoGIS search page.


**Figure A11 - GeoGIS Search Page**

If a user wants to find all documents that are associated with I-65 North, for example, the user enters “I-65 North” into the text box on the Search page (shown in Figure A11), and clicks the “Search” button. The results of this search are displayed on the Document Search results page shown in Figure A12.

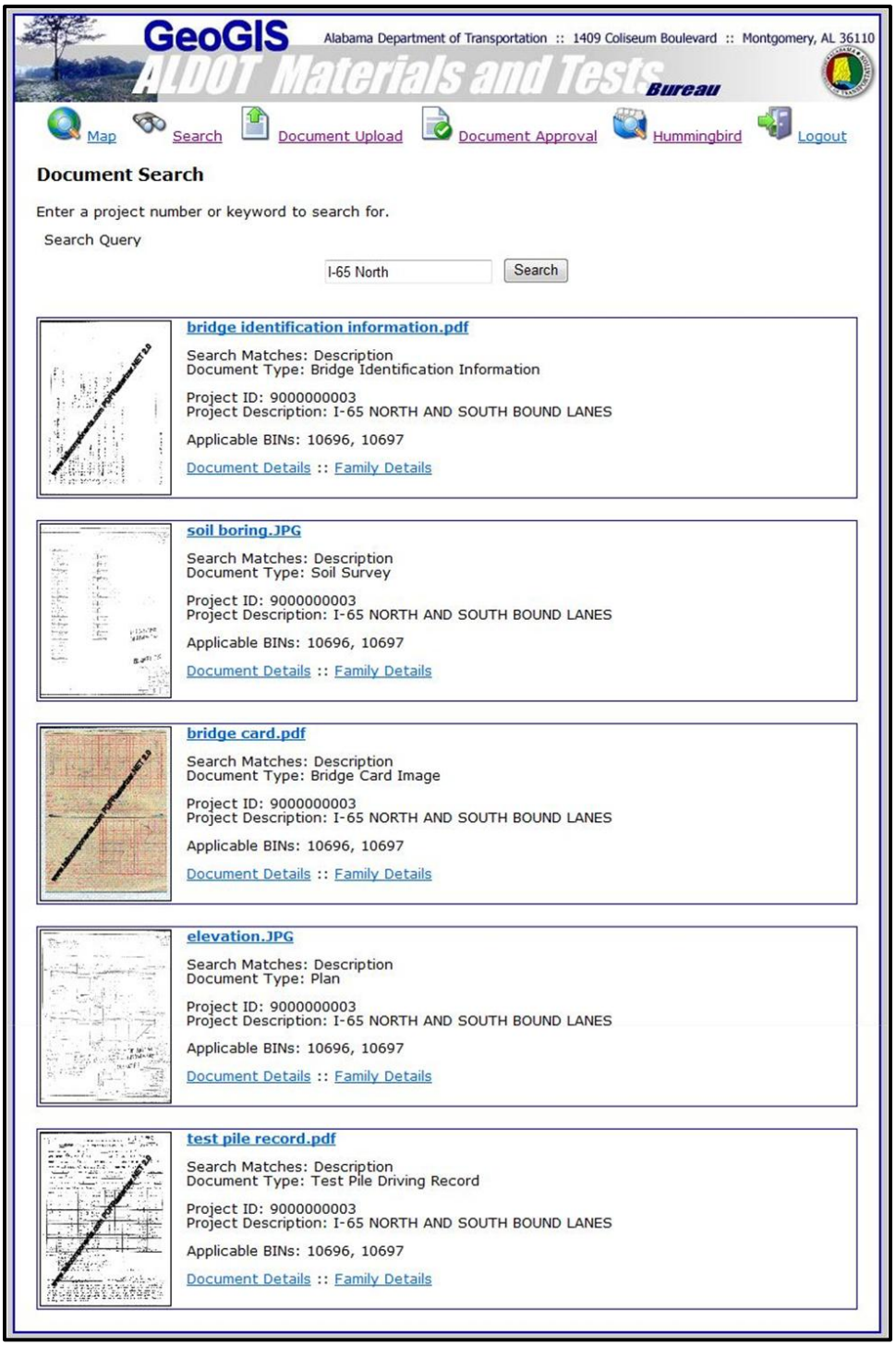



**Figure A12 - GeoGIS Search Results**

The result of the search is a list of documents that met the search criteria. The list contains a thumbnail view of each document, a hyperlink to the document through the document name (which can be used to download the document), the database field the search matched (in this

example the search had a "Description" match for each document), the document type, the project ID, project description, applicable BIN(s), and links to the Document Details and the Family Details pages. Five documents appeared as a result of this example search, meaning there are five documents that contain the text "I-65 North" in the database. If a user had typed in a project ID or BIN, all documents associated with that number would have been displayed, and the match type would have read "PJ_REF_ID" (project ID number) or "BIN", respectively.

### Hummingbird

ALDOT maintains a document management system called Hummingbird that contains both current and historic documents. The Hummingbird document management system is for all types of transportation and project documents, while the GeoGIS is specifically designed for geotechnical documents for projects at specific locations. The GeoGIS uses a proprietary document database that is different than Hummingbird. To allow efficient movement between the two systems, a link to the Hummingbird system is in the GeoGIS. The link can be seen in Figure A13.

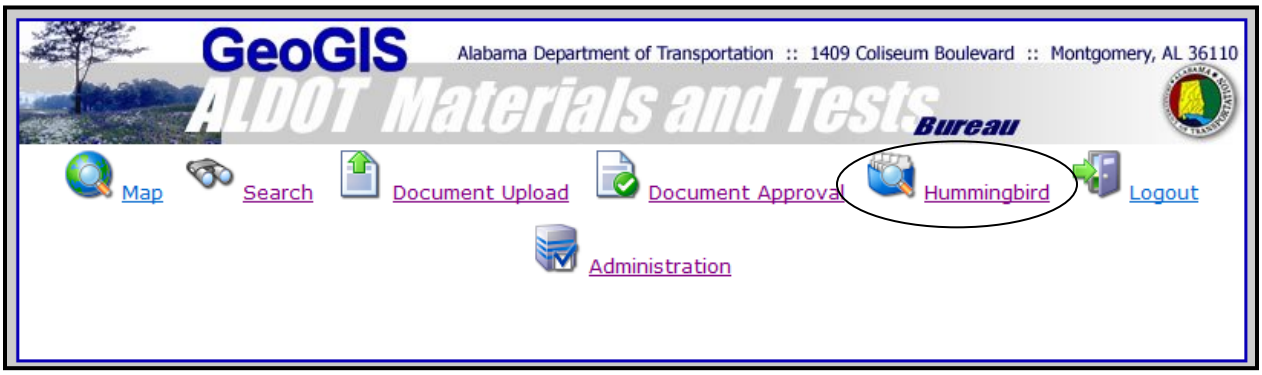



**Figure A13 - GeoGIS Homepage Showing Hummingbird Link**

In order to access the Hummingbird system, a user must obtain a separate username and password specifically for Hummingbird. Clicking the Hummingbird link will open an internet browser and connect to the website http://www.aldotweb.dot.state.al.us. A login box will appear requesting a valid username and password for Hummingbird. Once logged in, a user can browse through the documents that are in the Hummingbird system.

## Consultant User Type

The consultant user type was created to allow a user to upload documents, but not approve documents. The consultant user type may include geotechnical firms, contractors, and other agencies that may own or create documents that are important to ALDOT. This user type can provide more efficient upload, since the consultant can upload the document as soon as the document is created, rather than sending the document to ALDOT for upload. The documents uploaded by this user type will still require approval from an ALDOT engineer user with higher GeoGIS privileges. It should be noted that in addition to document upload, a consultant has all the privileges of a general user.

### Document Upload Page

The Document Upload page is designed to facilitate quick and accurate uploads of geotechnical information by consultants. Figure A14 shows the Document Upload page before any information has been entered. To upload documents for a project, the project must exist in the GeoGIS. Only a GeoGIS administrator can create a new project in the GeoGIS. Once created, the project is available for document uploads. Creating a new project is explained in the Administrator User Type section of this Users Guide.


**Figure A14 - GeoGIS Document Upload Page Prior to Selecting Project**

To upload documents to a specific project, enter the project number into the text box, and click the "Select Project" button shown in Figure A14. When a valid project number is entered, the user will see the Document Upload page shown in Figure A15.

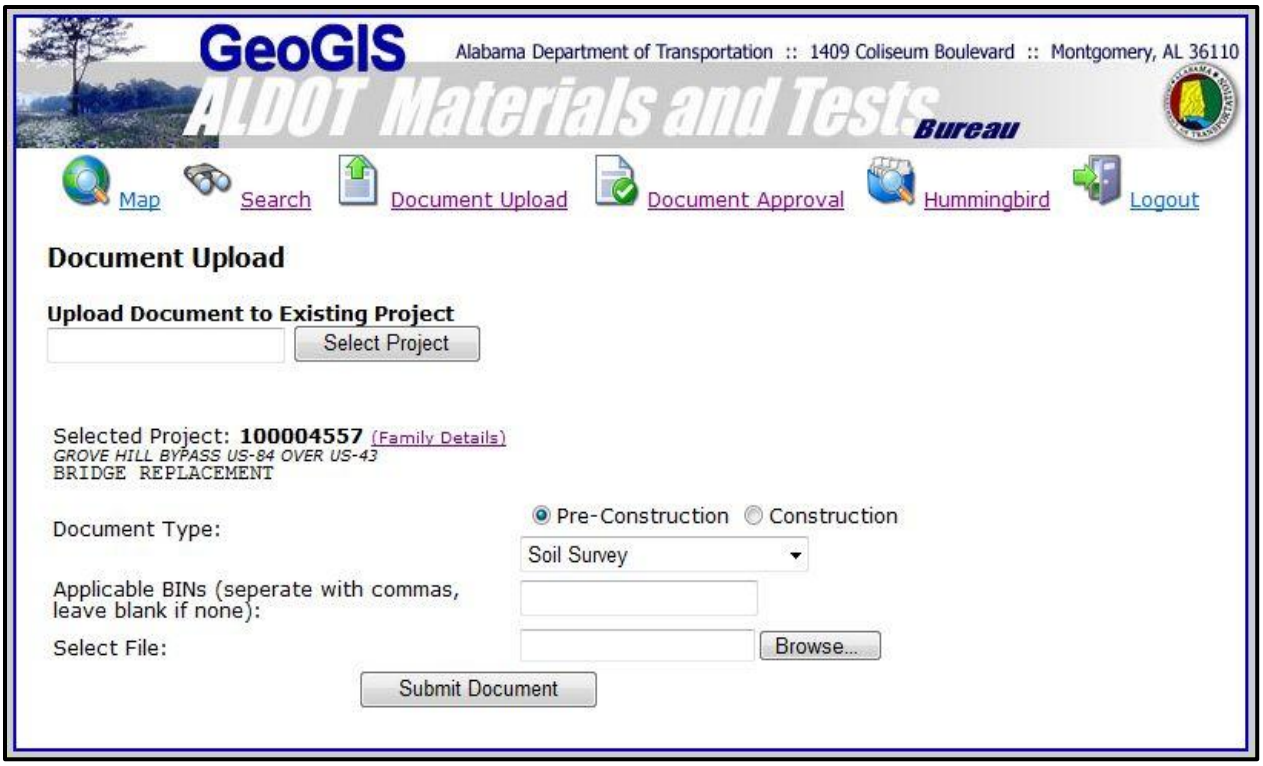



**Figure A15 - GeoGIS Document Upload Page after Selecting Project**

Several document types can be entered into the GeoGIS. Table A1 shows the Preconstruction and Construction document types in the GeoGIS.

**Table A1 - Preconstruction and Construction Document Types**

| Preconstruction | Construction |
|---|---|
| Soil Survey | Bridge Card Image |
| Materials Report | Bridge Identification |
| Bridge Foundation Report | Hammer Submittal |
| Slope Stability Study | Bearing Curves (PDA Results) |
| Retaining Wall Report | Test Pile Driving Record |
| Coal Analysis Report | Pile Driving Record |
| Culvert Report | Drilled Shaft Excavation Log |
| Other Geotechnical Reports | Drilled Shaft Pouring Record |
| Geohydrologic Report | Load Test |
| Raw Geotechnical Data | Plan |
| Correspondence | Correspondence |
| Photo | Photo |
| Other | Other |

To specify which document type is being entered into the GeoGIS, select either the Preconstruction or Construction radio buttons, and then select an option from the drop down menu. Figure A16 illustrates the document type selection procedure, where Figure A16(a) is for Preconstruction documents and Figure A16(b) is for Construction documents.

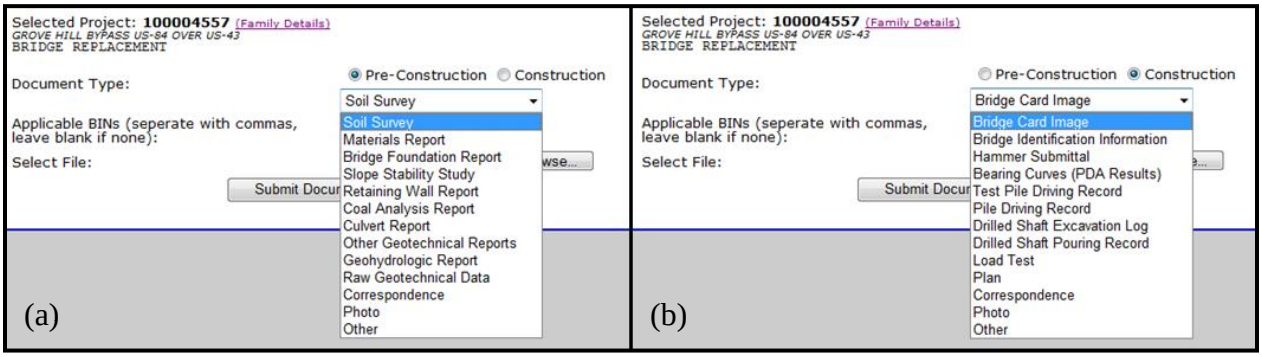



**Figure A16 - Preconstruction and Construction Document Selection**

Many projects in the GeoGIS will contain a bridge and have a BIN. This helps user identify which bridges are associated with a project. After the document type is selected, the BIN should be entered. If the BIN is not known, or there is not a BIN associated with the project, then the Applicable BIN box should be left blank. Click the "Browse" button to open a standard Windows documents list. Browse to the desired document and click "OK". Documents should be named descriptively to increase the metadata about a document. The path to the document will show in the box to the left of the "Browse" button. Click the "Submit Document" button at the bottom of the page to upload and submit the document for GeoGIS approval.

Figure A17 shows the Document Upload page after a document has been successfully uploaded. Notice the green text: "File Uploaded Successfully!"


**Figure A17 - Document Upload Page after Uploading Documents**

The Document Upload page has a link to the Family Details page to the right of the project ID number. As discussed previously, the uploaded documents can be viewed on the Family Details page; however, documents cannot be viewed until they have been approved by an ALDOT engineer. The Document Approval page is only available to an ALDOT engineer user type or the site administrator.

## ALDOT Engineer User Type

The ALDOT engineer user type is designed for ALDOT personnel to approve documents if the documents are valid for specific projects within the GeoGIS. The ALDOT Engineer has all the privileges of a consultant and general GeoGIS user and can also approve documents. The next section describes the Document Approval page.

### Document Approval Page

An uploaded document cannot be used in the GeoGIS until the document has been approved. Figure A18 shows the Document Approval page with one document pending approval.

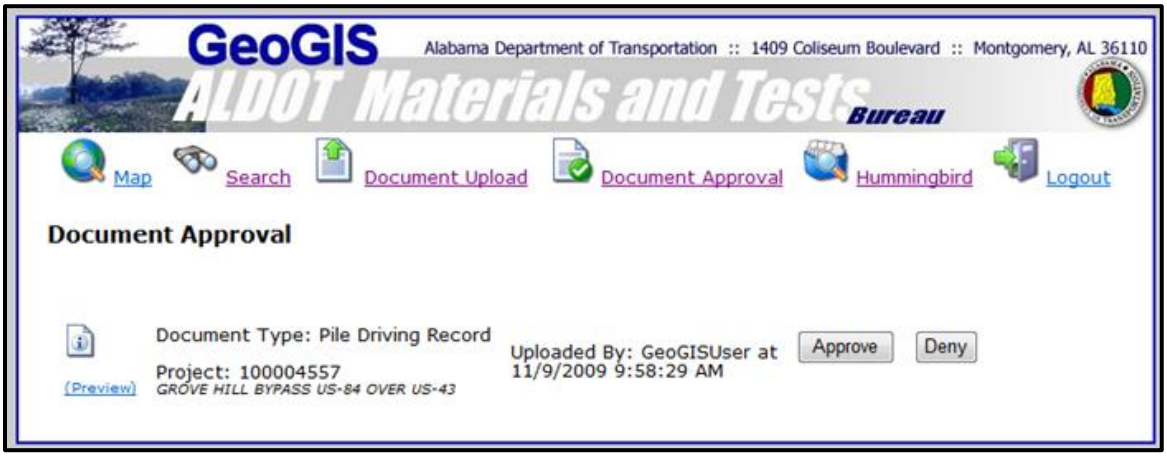



**Figure A18 - Document Approval Page with One Document Pending**

All pending documents are listed on the document approval page and show the document type, the associated project and description, the user that uploaded the document, the date/time the document was uploaded, and a link to preview the document. The ALDOT engineer or administrator can choose to approve or deny the document by either clicking the "Approve" button or the "Deny" button. After a document is approved or denied and the page is refreshed, the document will no longer appear on the Document Approval page.

## Administrator User Type

An administrator user has all the privileges available to an ALDOT Engineer, consultant, or a general GeoGIS user, plus many additional privileges. The main privilege of the administrator is the ability to create and modify user names, passwords, and user types. A GeoGIS user must contact the administrator to create a user name and password. The administrator can also assign users to certain projects, which restricts access to the GeoGIS for that user.

### Administration Page

The Administration page allows an administrator a user friendly page to create users, change existing users, and assign projects to users. Figure A19 shows the Administration page.


**Figure A19 - Administration Page**

The Administration page contains three sections that the Administrator can use to manage users. The first box, at the top of Figure A19, is used to create a new user. The Administrator will enter a user name, password, and user role; the new user must provide a valid email address. Once this information is entered, clicking the "Create User" button will add a new user to the GeoGIS system. The second box is for editing an existing user. The "Username" box is a drop-down box that lists the existing users in the system. The username cannot be edited, only the password, role, and email address of an existing user can be changed. To change a username, a new user must be created. Once changes to a user have been made, click the "Save Changes" button to save the changes. The third box at the bottom of Figure A19 is for assigning a project to a user. This is used to limit consultant privileges to specific projects. By limiting the projects, a consultant can only upload documents to a project the consultant is working on. Choose a user from the drop-down box and enter the project number to assign to the user. Clicking the "Assign Project" button allows a consultant to upload documents to that project. Notice that the existing assigned projects for a user can be viewed at the bottom of the page.

## Adding a Project to GeoGIS

This section describes the procedures to add a new project to the GeoGIS. The basic structure of the system and the programs that are needed for adding a new project are also described.

### Structure of the GeoGIS

To add a new project to the GeoGIS both the database that stores the documents and attribute data, and the GIS map that stores and displays the project location, need to be updated. The database is an SQL database that is accessed through the Microsoft SQL Management Studio. The map is managed through ESRI ArcGIS Desktop and displayed on the web through Flex. Both the SQL Server and ArcGIS map need project records for a new project to be active. Once a project is active, documents can be uploaded to that project.

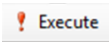
When a document is uploaded or a new user is created using the GeoGIS website, the website communicates with Microsoft SQL Server Management Studio. The SQL Server manages the tables that pertain to both GeoGIS users and the GeoGIS database. The SQL database stores GeoGIS tables including a copy of the CPMS projects table used by GeoGIS, the GeoGIS users and user types tables, and the uploaded and approved documents tables.

Although the SQL database is for attribute data management, the real power of the GeoGIS is the ability to display and search geotechnical data through a map interface. The GeoGIS map is managed, stored, and updated through a suite of GIS products produced by ESRI. It was determined that desktop edits to the maps followed by web-based publishing was the most efficient technique to maintain and update the GeoGIS map interface. Both updating the SQL database and the GIS map are explained in the following sections.

### Adding New GeoGIS Projects to the SQL Database

The SQL database contains a copy of the CPMS_ProjectsLine table. This table currently contains approximately 10,000 records. The CPMS_ProjectsLine table stores both recent and current ALDOT projects; therefore, most projects in the GeoGIS will be in the CPMS_ProjectsLine table. Historic projects may not be in the CPMS_ProjectsLine table and therefore may not be available to the GeoGIS. To check the CPMS_ProjectsLine table for a project reference ID, open the SQL database with a database program and search the CPMS_ProjectsLine table. This can be done with a standard SQL query:

```
SELECT * FROM [GeoGIS].[dbo].[CPMS_ProjectsLine]
WHERE pj_ref_id = "New GeoGIS Project ID";
```

This query tells SQL to "select *this* row and all columns from *this* table where *this* column is equal to *this* value." Once the query is entered, simply click the 

button. If the project record exists in the database, then the project is available to accept GeoGIS documents.

For projects that are not in the CPMS_ProjectsLine table, a new record must be created. Most likely these are historic projects that do not have an official project reference ID. At a minimum, five fields of data for a new project need to be inserted into the CPMS_ProjectsLine table. These are shown in Table A2.

**Table A2 - Required Fields for a New GeoGIS Project**

| Column Name | Column Description | Example |
|---|---|---|
| Pj_ref_id | Project Reference ID (a 10-digit number starting with 9000000…) | 9000000009 |
| Description | Description of project location | Bridge over Raging River |
| Rt_id | Route ID | AL1111 |
| Beg_MP | Beginning mile post | 111.1 |
| End_MP | Ending mil post | 112.0 |

By convention, new GeoGIS projects will be referenced with a pj_ref_id starting at 9000000000 and increasing in consecutive order. In this way, GeoGIS modifications to the CPMS data can be easily identified. The project description shown in Table A2 should be a written description

of the project. The route ID and beginning and ending mile post data will be used to automatically create a line feature on the map at the correct location.

Once the attribute data for a GeoGIS project is determined, a record needs to be inserted into the CPMS_ProjectsLine table. The "INSERT INTO" command will allow an administrator to insert a new record (i.e. project) into the database. Figure A20 shows the "INSERT INTO" command syntax.

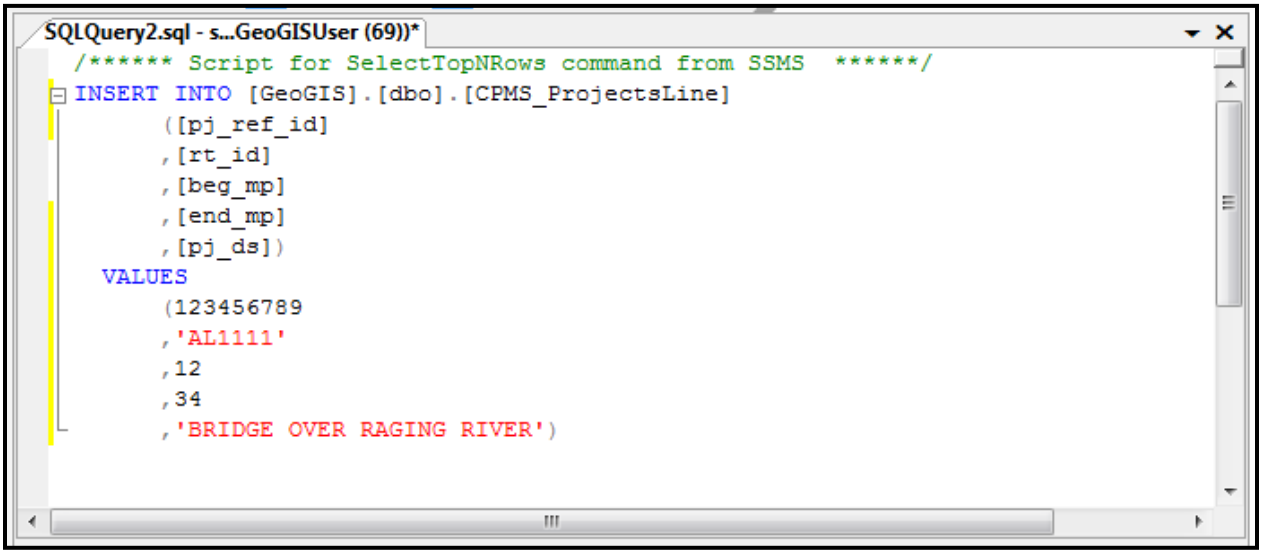



**Figure A20 - Query Syntax for Inserting New Record in SQL**

After the SQL command "INSERT INTO" shown in Figure A20, the user should specify the argument, which is "[GeoGIS].[dbo].[CPMS_ProjectsLine]", the database name and table name. The next several lines in Figure A20 are the column names, in parentheses and brackets and separated by commas. After the column names have been specified, the next line should read "VALUES," followed by the data to be inserted into each column. Be careful to place each column value in proper order before executing the command. If any data is out of place, the location of the subsequent data will be incorrect. Character strings such as route ID and descriptions need to be in single quotes. Click the "Execute" button and the new record will be added to the CPMS_ProjectsLine table.

### Adding a New GeoGIS Project Line to the Map

The previous section described how to add a new project to the GeoGIS SQL database; however, to add the project to the map, the user must add the project to the shapefile using the ArcGIS

Desktop program. Open ArcGIS Desktop and the GeoGIS map containing all of the GeoGIS shapefiles (project, bridge, foundation, and soil boring). In addition to the layers that will be published to the web, the CPMS_ProjectsLine shapefile should also be included in this map. New GeoGIS project lines will be extracted from the CPMS_ProjectsLine shapefile and appended into the GeoGIS Project table.

The CPMS_ProjectsLine table discussed in the last section of the report was used to automatically map project line features. Therefore, if the project existed in the CPMS table then a graphic entity exists in the CPMS shapefile. One the other hand, if a record was entered into the CPMS_ProjectsLine table, then a new line event will need to be mapped. Once the graphic entity exists in the CPMS shapefile, the feature will need to be selected and appended to the GeoGIS Project table for web publishing.

To select a project line from the CPMS shapefile, open the attribute table window and click the "Options" button. From the menu, click the "Select by Attributes" command and the "Select by Attributes" window will appear as shown in Figure A21. From the drop-down list, select the pj_ref_id and double-click the name. This inserts the name into the query box at the bottom of the window. This box contains an expression for a selection query, similar to the query performed in SQL. The command generally states "Select from *this* attribute table where *this* (*these*) column (s) has some relationship to *this* (*these*) value (s)." For this query, the project ID should be equal to a value. The "equals" sign can be inserted by clicking the  button. The value to set the column equal to should be the desired project number. This can either be entered manually, or by clicking the "Get Unique Values" button. This button will display all possible unique values for the chosen column. Scroll to the project number and double-click to insert the value. Once the query is completed, click the "Apply" button. The project is selected and the user can "Zoom to Selected". The user can also click the "Selected" button at the bottom of the attribute table window to toggle between showing all records or just the selected records.

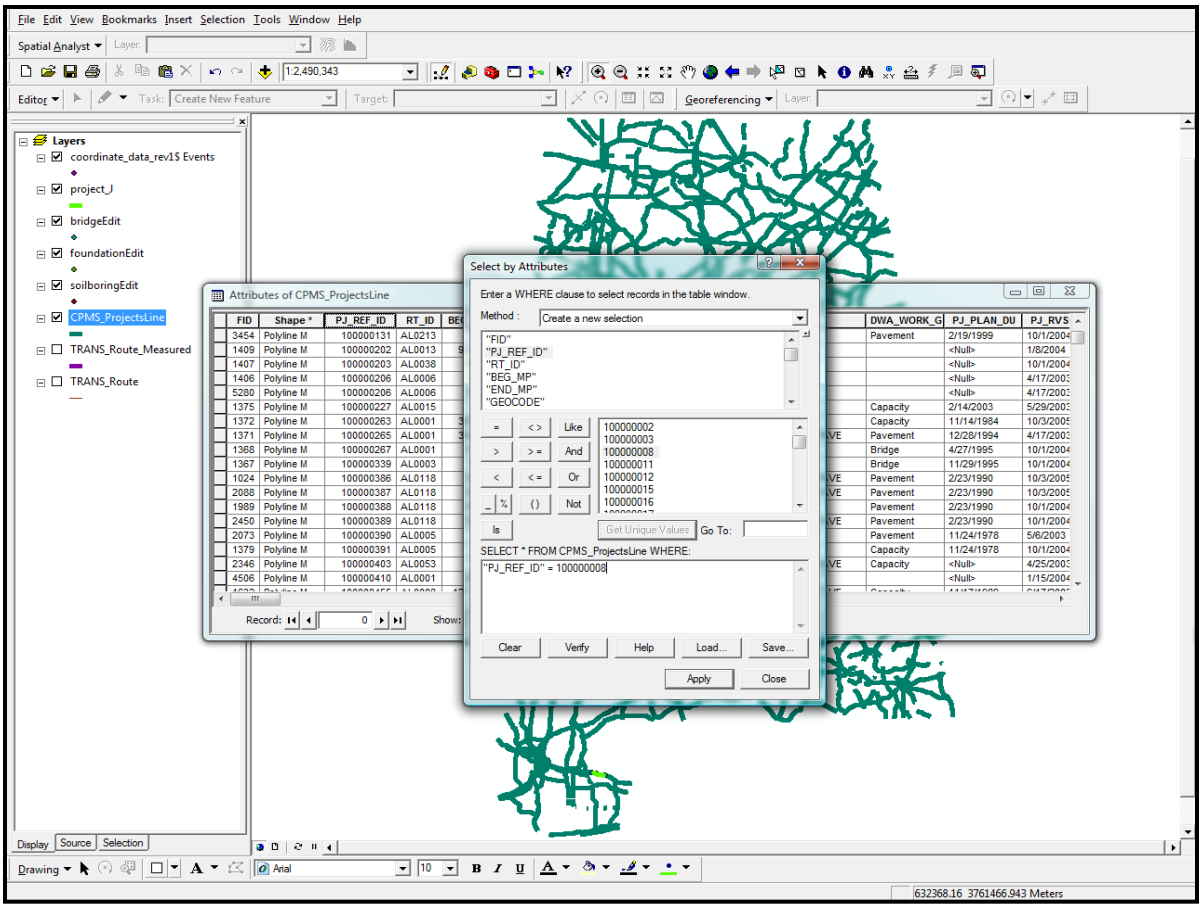



**Figure A21 - Select by Attribute Window in ArcGIS**

Now that the desired projects have been selected, the projects are ready to be appended to the project shapefile that displays in GeoGIS. In the table of contents window, right-click on the CPMS_ProjectsLine layer, click on the Data option, and choose the "Export Data…" command. The "Export Data" dialog box will open. Specify the folder location and a name for temporary shapefile storing the project line of interest, then click OK.

When exporting the line is finished, a dialog box will appear asking if the features should be exported as a layer, click "Yes." The selected feature will be exported into a temporary shapefile and this new shapefile can be appended to the project shapefile that will display in GeoGIS.

To use the "Append" tool, the ArcToolbox must be opened by clicking on the button located on the Standard toolbar at the top of the ArcGIS screen. Once the ArcToolbox is opened, click Data Management, then General, and then "Append" to open the Append dialog box. Figure A22 shows the Append dialog box as is will look when appending a project line.

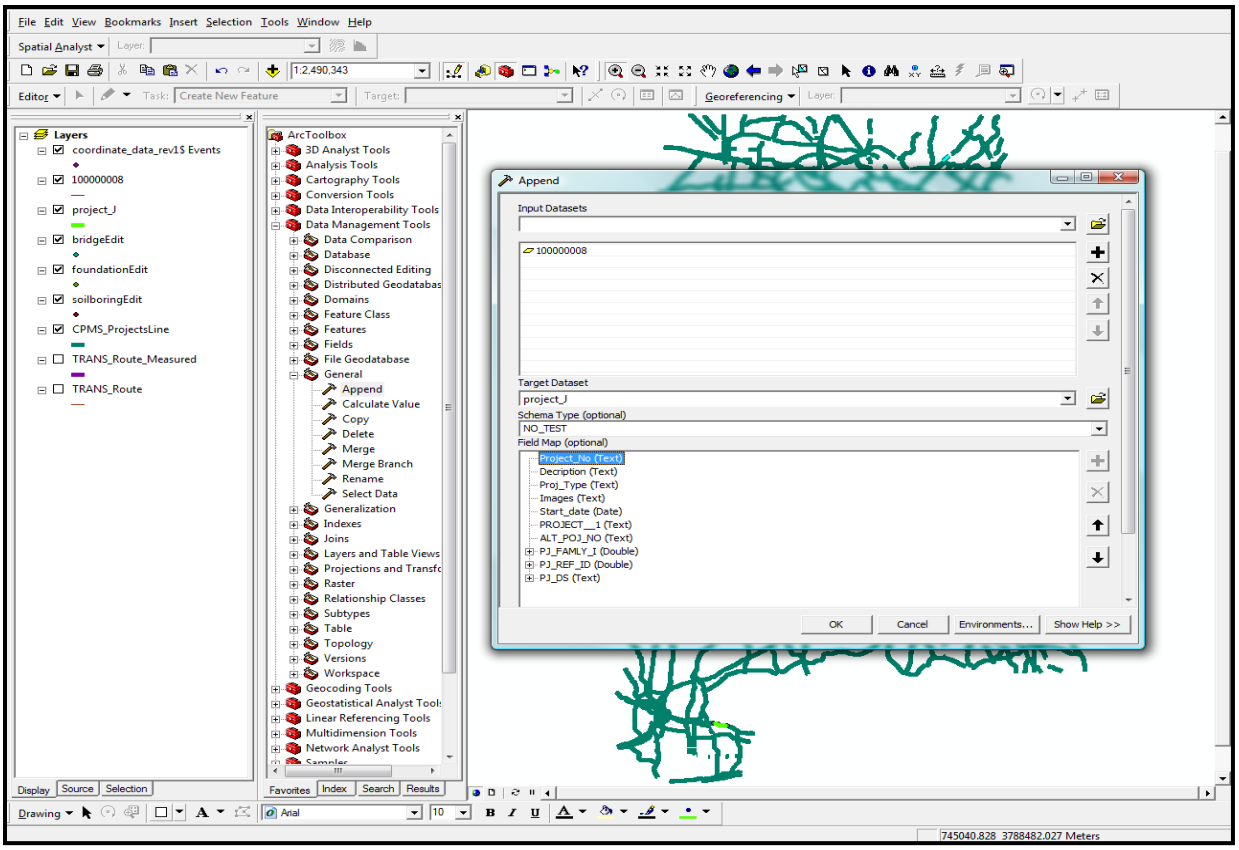



**Figure A22 - Append Dialog Box Showing Entry of Proper Datasets**

The input dataset will be the temporary file that was just created. Notice that the temporary shapefile can be easily chosen from the drop-down box since it was inserted as a layer. If the temporary shapefile does not appear, the user will have to navigate to the folder to find the shapefile. The target dataset will be the GeoGIS project shapefile and under "Schema Type," select "NO TEST" and click OK. This will add the line to the existing GeoGIS Project shapefile.

***Adding a New Line Feature to the CPMS_ProjectsLine Shapefile***

If a brand new project is being added, then the project line will not exist in the CPMS_ ProjectsLine shapefile. In this case, the project shapefile can be edited to allow the feature to be drawn or created through a linear event. To draw on or edit a shapefile, the Editor toolbar must be activated. Right-click in the tool space (the empty area next to the toolbars), and click the "Editor" label to activate the toolbar, a checkmark should appear next to the label. Once the Editor is activated, click the "Editor" button on the left side of the toolbar, and select the "Start Editing" command from the menu that appears. A dialog box appears that contains two boxes: the box on top contains all sources that are referenced by this map, and the box below shows a

list of the shapefiles from each of the sources. Click on the source that contains the GeoGIS Project line shapefile, click OK, and then click "Start Editing". The user is now in Editing mode. On the ArcGIS map, locate the area where the project line will be drawn. Once the area is located and the project line is ready to be drawn, click the sketch tool button to begin drawing. Look at the Editor toolbar to be sure that the project shapefile name is in the "Target:" box. Since the shapefile being edited contains only lines, the drawing tool will automatically draw lines when editing this file. To draw a line, click the location where the line should begin. Then, digitize along the project path. Each click adds a point, and these points are connected by a line; therefore, the more points added, the more accurate the line will be, especially along curved sections. When the last point of the line has been placed, right-click on the map and then click "Finish Sketch" to end the drawing session. If a point is out of place, the point can be moved by double-clicking on the line, and simply dragging the point to a new location. When the edit is completed, click the "Editor" button and "Stop Editing." A dialog will appear asking if the edits should be saved, click "Yes." Figure A23 shows a line that has been drawn using the Editor toolbar.

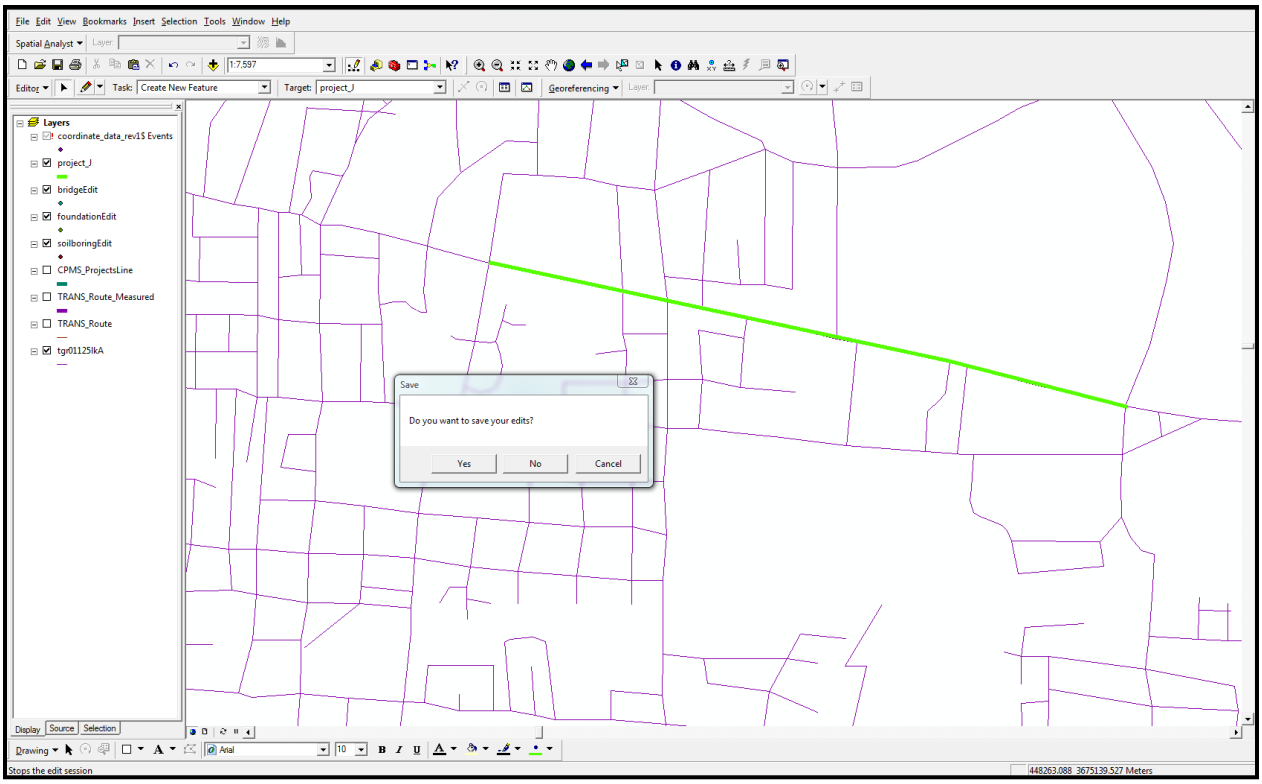



**Figure A23 - New Line Drawn in the GeoGIS Project Shapefile Using Editing Session**

**ArcGIS – Appending Point Shapefiles**

In addition to the project line shapefile, other relevant features may be added to the GeoGIS as well. These features include: bridge location points, foundation points, and soil boring points

Similar to the procedure to add a new project line discussed in the previous section, bridge points can be entered using the same procedure. A shapefile that locates every bridge in Alabama exists at ALDOT. Bridges from the ALDOT Bridge shapefile can be selected and appended to the GeoGIS Bridge shapefile following the same procedure used for appending the project lines. If the bridge cannot be located, then the user can edit the GeoGIS bridge shapefile, using the same edit procedure as discussed in the last section.

For foundation and soil boring points, the locations of these should be recorded in a file by the consulting firm that performed the work. These files should be in Excel format. Preferably, the coordinates for the individual points will be in the file in latitude-longitude format. If this is the case, the creation of the graphical points in ArcGIS is relatively simple.

The Excel file should have columns containing headings that specify which columns represent the latitude and longitude for the points. In ArcGIS, click "Tools" then "Add XY Data". This will open a dialog as shown in Figure A24. At the top of the drop-down box, specify the location of the Excel file and which sheet in the file contains the coordinates. Specify the columns containing the X and Y coordinates of the points. If the columns are titled "Latitude" and "Longitude" or something similar, then those columns will be in the X and Y drop-down boxes. Be sure that the columns specified in these boxes are correct, X should be longitude, and Y should be latitude. The coordinate system used by the map is GCS_North_American_1983 and should appear in the coordinate description box. Finally, clicking OK will generate an event shapefile for the points.

The points will be added into ArcGIS as an "event" shapefile. This is a file that contains only the points that were just added. Since this is not the GeoGIS shapefile, these points need to be appended to the GeoGIS shapefile. Locate the "Append" command in the ArcToolbox under

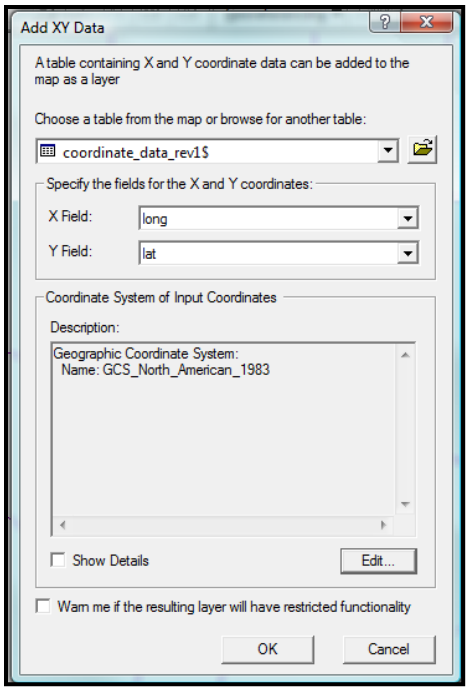



**Figure A24 - Add XY Data Dialog Box**

Data Management, then General, then "Append", and enter the "event" shapefile as the input dataset. The target dataset will be the relevant GeoGIS shapefile. Select "NO_TEST" under "Schema Type" and click OK. Once the append command executes, the points will be a part of the GeoGIS shapefile. If desired, the temporary "event" and export files can be deleted because the features are now located in the GeoGIS shapefiles.

Points can be added manually to the GeoGIS using the Editor toolbar if a file containing the coordinates does not exist. Be sure to select the correct GeoGIS shapefile when beginning an editing session and remember to save the edits. A frame of reference such as roads and rivers is not required when drawing new points, but existing spatial data will help improve accuracy.

Once the points are in the GeoGIS, depending on the way the points were added to the map, they may not contain the necessary attribute data to associate them with a specific project. To ensure points are associated with the necessary data, an Editing session should be started. In the edit session, the attribute table should be opened and the values of the records should be changed. Be sure to enter in all relevant data such as project reference IDs and BINs to match the information for that project.

***Adjusting the Coordinate System***

It is preferable to have a data file with coordinates in latitude-longitude format. However, some consultants may provide coordinates in northing-easting. If this is the case, the addition of points into the GeoGIS requires an additional step. The conversion from northing and easting to latitude and longitude is complex, so programs exist to automate the process. A program called Corpscon6 created by the Army Corps of Engineers can be downloaded and used to convert coordinate data from one system to another. Corpson6 can be downloaded at:

http://crunch.tec.army.mil/software/corpscon/corpscon.html

The Corpscon file to be downloaded is called corpscon_complete.exe. Install the application by following the on-screen instructions. After installing and starting Corpscon, the main Corpscon page will open as shown in Figure A25.

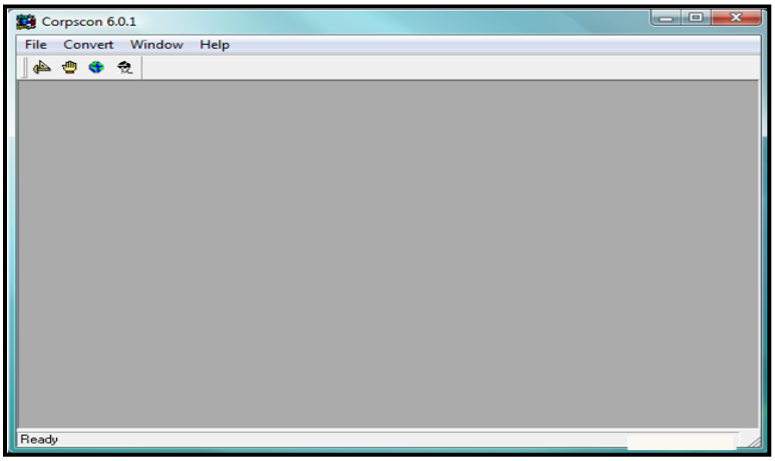



**Figure A25 - Corpscon6 Program Opening Screen**

From this screen, there are several options for converting points to a desired format. Northing and easting coordinates are in State Plane and need to be converted to Geographic format. To set up Corpscon for this conversion, click the "Setup" button in the top-left corner of the screen, beneath the "File" menu button.

Select the "Input/Output" tab, shown in Figure A26, on the Corpscon Setup page. The conversion is from State Plane to Geographic, so those should be selected for the input and output systems, respectively. The datum for each should be 1983 - NAD 83(86), unless there is a different datum specified. Other specifications for the input are: the zone, which in this example

is Alabama West but may also be Alabama East depending on where the project is located; and the units, which should be US Survey Foot, unless otherwise known. Figure A26 shows how the Corpscon Setup page should look.

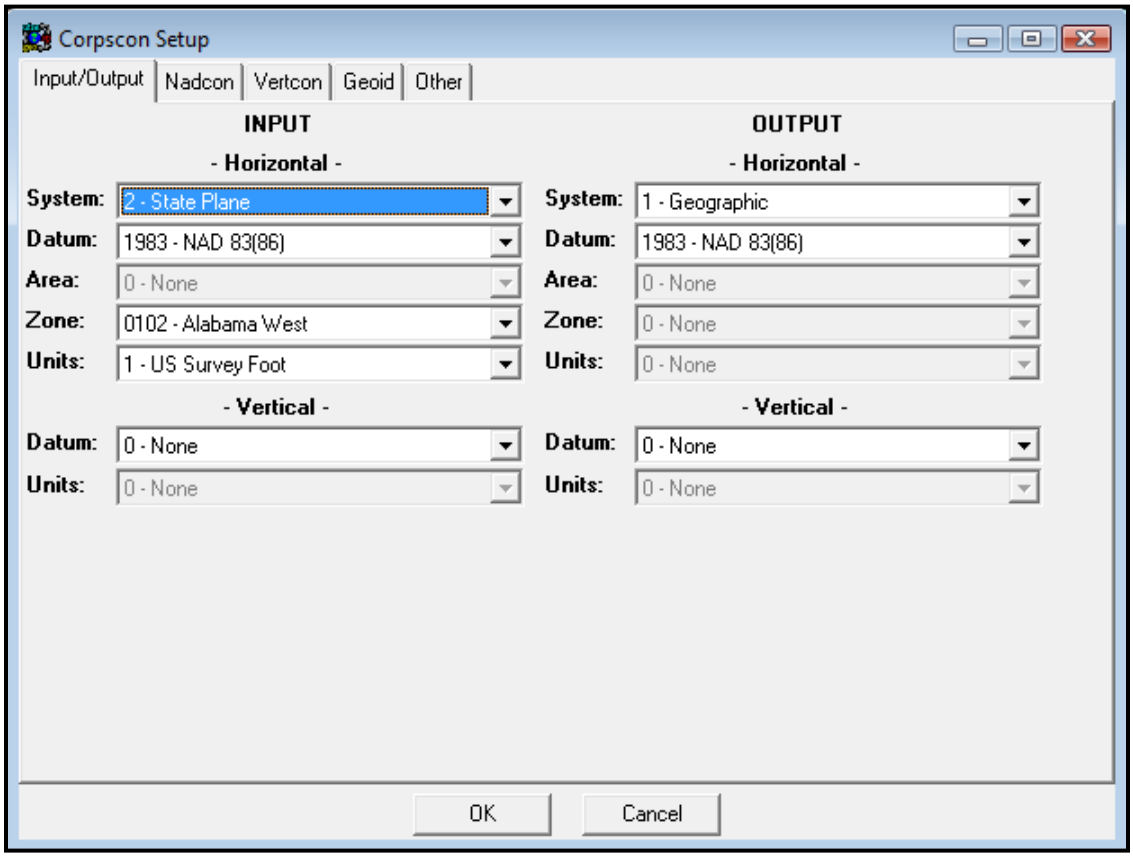



**Figure A26 - Setup Page in Corpscon6**

Once the setup has been completed, the Excel file containing the point coordinates must be converted into a text file because Corpscon cannot read an Excel file. To save an Excel file as text, open the Excel file, click "Save As", and for the file type, select "Text" file, followed by "Save". Close the file once it has been saved in text format. The coordinate file is now ready to be converted.

Click on the "Input File" button  in Corpscon to bring up the User Defined Input File page. This page requires an input text file and an output file. The output file can be the Excel file containing the Northing and Easting coordinates. The output will be in text format, but the output can be opened with Excel. Figure A27 shows how the User Defined Input File page should look when all input and output information is entered.

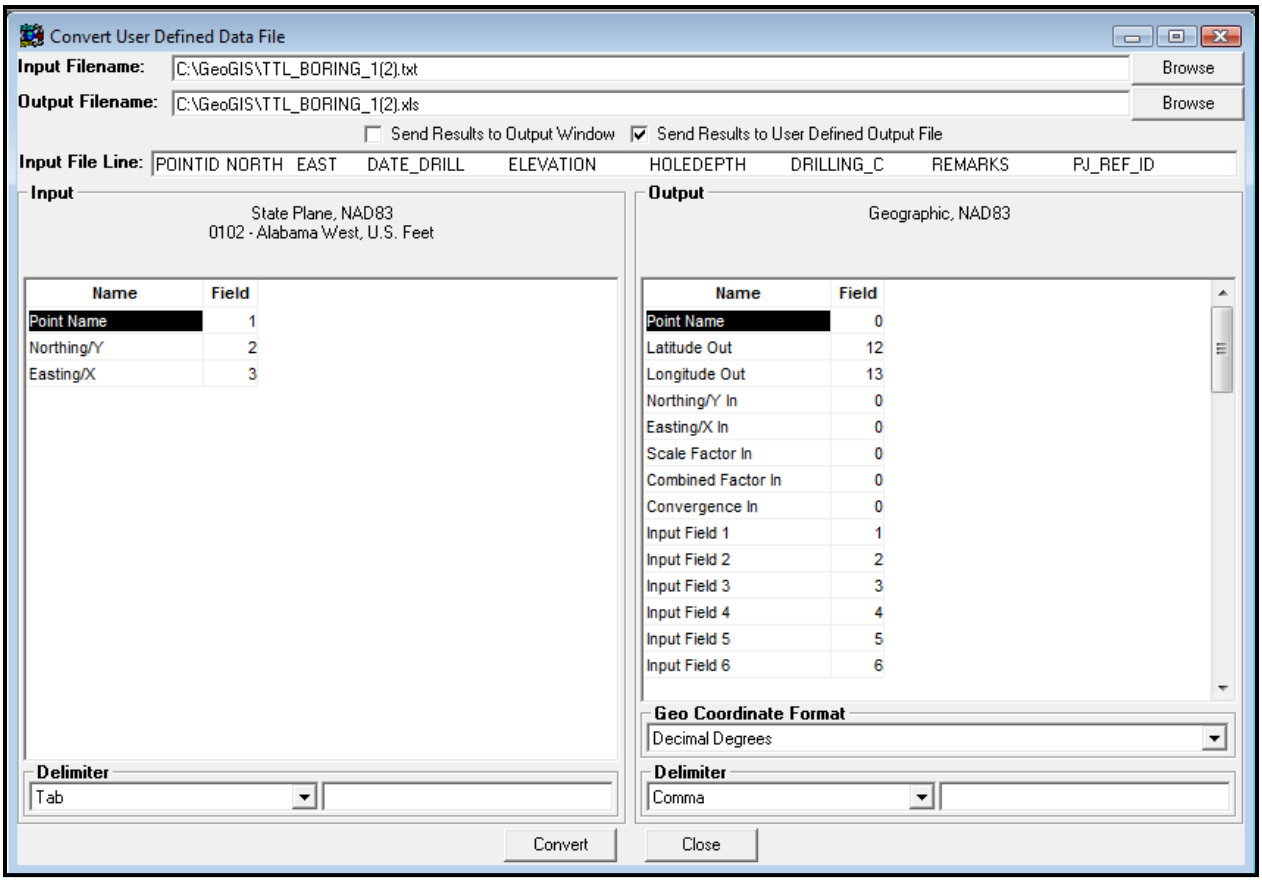



**Figure A27 - User Defined Input File Page in Corpscon6**

The top of the page contains an Input Filename text box and an Output Filename text box. For the Input text box, browse to the text file containing the coordinate information. For the Output text box, enter the Excel file as the output. Just beneath the Output text box, check the "Send Results to User Defined Output File" checkbox.

The Convert User Defined Data File dialog box has two main areas, the left is for the input fields and right is for the output fields. For both the input and output files there are two columns entitled "Name" and a second column entitled "Field." For the input file side (left), the "Name" label represents the column name in the text file, and the "Field" is the numerical value for the column in the text file. The numbers assigned to these columns represent the order of the columns in the file. For example, in Figure A27, the "Point Name," "Northing/Y," and "Easting/X" columns are represented in the input file by the column names "POINTID," "NORTH," and "EAST." These are the first three columns in the file in that order, so the columns are given the values 1, 2, and 3, respectively. If the order or position of the columns are

not known, the names are displayed just above the Input box in a textbox labeled Input File Line. In the example in Figure A27 the box contains the text "POINTID NORTH EAST DATE_DRILL…" This is the order of the columns in the input file.

The right-hand box in Figure A27 is the Output file format with several rows in the box. The format is the same as the left-hand box, there are just more possibilities for the output file. Since the output file is the same Excel file that created the input text file, the output data will be appended to this file, and not replace the original data. The Corpscon6 program allows the user to "carry over" up to 50 user-defined fields. This is useful, because as long as the input file does not contain more than 50 columns, the new latitude-longitude coordinates can simply be added to the original table. In the example in Figure A27, the original Excel file had 11 columns, so the "Input Field 1" through "Input Field 11" will be the numerical values of these columns. The "Latitude Out" and "Longitude Out" columns will be given the subsequent values, in this case, 12 and 13. The rest of the columns should be left at zero unless other output information is desired.

Finally, the coordinate format and the delimiting criteria must be specified. The coordinate format should be Decimal Degrees, "Tab" should be selected as the input delimiter, and "Comma" should be selected as the output delimiter. The point coordinates data can now be converted.

Click the "Convert" button and a message box will appear stating that the output file already exists. It provides three courses of action: Append, Replace, and Cancel. Since all columns were set up to "carry over" to the output file, click "Replace." If everything was entered correctly, a screen will show up that says the conversion is complete.

Navigate to the Excel file, open the file, and click "Yes" when the dialog box appears. The text will be in a single column in the Excel file. To delineate the text, highlight only the first column, click the Data tab at the top of the page, and click the "Text to Columns" button. A window will appear asking how the data should be delineated; click "Next," click the checkbox next to "Comma" and then "Finish." The text will now be separated into columns. The column names for the latitude and longitude columns will be numbers, so change those names to "Latitude" and

"Longitude." Also, the longitude values should be negative so multiply the longitude values by negative one.

The coordinates are now converted from State Plane to Geographic format. This Excel file can now be used to input XY data into ArcGIS following the same procedure as described in the Appending Point Shapefiles section of this Users Guide. Once all the data for each shapefile has been entered into ArcGIS, the shapefiles must be published to the GeoGIS web application.

## Publishing Updated Shapefiles to GeoGIS

The procedures to publish the updated shapefiles to the GeoGIS web application map are presented in Table A3. This table is for the computer administrator that maintains the server. Following the steps in Table A3 will publish the shapefiles to the GeoGIS website, where the shapefiles will appear on the map associated with Family Details page.

**Table A3 - Steps to Publish GeoGIS Web Client and Shapefiles**

| **Publication Process** |
|---|
| The following is the publication process used when publishing out the GeoGIS client to the host server.<br>1.) Publishing the Web Client<br>a. In Flex Builder, export a release build of the Flex Map Extension of the site.<br>i. Rename the html page to Map.aspx. b/c .NET app specifically looks for aspx<br>ii. Copy the .swf and the newly dubbed .aspx file to …\GeoGIS\GeoGISMap, replacing the old copies.<br>b. In Visual Studio, publish the application to a local directory.<br>i. Check the web.config to make sure "GeoGISConnectionString" is correct<br>ii. Check that the "DocumentFolder" and "ThumbnailFolder" directories are correct.<br>iii. Update the "LastUpdated" time. (not required)<br>2.) Publishing new ESRI shapefiles<br>a. Publish if first time (can be done within Arc), then you can copy and replace the existing shape files in the directory used by the .mxd file on the host ArcGIS server instance. |