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16. Abstract

The purpose of this project was to create a database for existing, current, and future geotechnical records and data. The project originated from the Geotechnical Design Section at the Louisiana Department of Transportation and Development (LADOTD) and their need to review historical geotechnical data prior to new design decisions. The database could benefit the Department by reducing or eliminating the need and time necessary to conduct new soil borings and test their samples. The database would also serve as a valuable reference resource to the design and other sections.

Initially researchers believed the project would require its own computer server to store the vast amounts of data. Upon further review of existing LADOTD databases and storage capabilities, only an interface was necessary to access different existing databases. Content Manager, an Enterprise Document (Object) Management System, already used within the Department is key to the capture, storage, retrieval, and printing of online documents within the Department.

The project created a Global Information System (GIS) with a user friendly interface and additional links to existing databases within (and outside) the Department to speed access times, compared to hardcopy searches, consolidating vast amounts of information into one online resource. The data will be accessed mainly by Headquarters' Geotechnical Design Section but also by the Louisiana Transportation Research Center (LTRC) and district laboratory offices.

This project has already benefited the design section. Specifically, the GIS Web site application has been implemented to "...enhance the Geotechnical Design Section's ability to select proper boring depths. Additionally, the information attached to the database such as load test data, pile driving logs, and other activity logs will greatly improve the pile resistance prediction. The better pile length prediction may ultimately reduce the cost of foundation construction." (Ching Tsai, LADOTD Geotechnical Design Section).

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Project Review Committee

Each research project will have an advisory committee appointed by the LTRC Director. The Project Review Committee is responsible for assisting the LTRC Administrator or Manager in the development of acceptable research problem statements, requests for proposals, review of research proposals, oversight of approved research projects, and implementation of findings.

LTRC appreciates the dedication of the following Project Review Committee Members in guiding this research study to fruition.

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Development of a Geotechnical Information Database

by

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June 2009

ABSTRACT

The purpose of this project was to create a database for existing and future geotechnical records and data. The project originated from the Geotechnical Design Section at the Louisiana Department of Transportation and Development (LADOTD) and their need to review historical geotechnical data prior to new design decisions. The database could benefit the Department by reducing or eliminating the need and time necessary to conduct new soil borings and test their samples. The database would also serve as a valuable reference resource to the design and other sections.

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ACKNOWLEDGMENTS

IMPLEMENTATION STATEMENT

The Web site will allow the Louisiana Department of Transportation and Development to locate existing boring logs and geotechnical data from a variety of sources. The Web site provides a GIS interface to present the data and allows the data to be accessed more easily reducing time and searching effort. Users can combine information with other relevant information, such as soil survey maps, geological maps, quadrangle maps, etc., so that appropriate decisions can be made with minimal time spent searching for data by hand.

To meet the needs of the Pavement and Geotechnical Section, the Web site will have many implementable features. Specific applications of the database and methods of implementation will be to use the Web site to enhance the Geotechnical Design Section's ability to select proper boring depths and to reduce the time to locate historic boring log information.

Additionally, the information attached to the database, such as load test data, pile driving logs, and other activity logs, will greatly improve the pile resistance prediction and may ultimately reduce the cost of foundation construction.

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INTRODUCTION

Knowledge of existing soil conditions prior to road and bridge construction can reduce construction cost, time, and headaches. LADOTD drill crews and District Laboratories collect soil boring, Subgrade Soil Survey (SSS), and other valuable geotechnical information prior to highway design and construction. The data includes field data (site location and sample station), groundwater data, and changes in soil type (color with depth). Laboratory results and soil classifications of the samples are also included in records.

The field data and laboratory results, collected far in advance of project construction, are often slow to reach the project designers because of the data's volume, presentation, and storage methods. The boring logs and SSS-sheet take many hours to compile, analyze, and hand draw the data into figures. The hardcopy presentation method was developed prior to the invention of the personal computer and has been kept in effect for decades. Unfortunately, after completion of the project, these hardcopies have been filed away, sometimes never to see the light of day again. The logs and surveys serve many purposes and it is not suggested to eliminate them. The data storage method needs to be updated to allow for easy retrieval, which will allow a more practical and accurate estimate of the site conditions, cost savings by eliminating some unknown soil conditions, better quality control, and ultimately a better road design.

This project was designed to create a user interface to link the district laboratories, the Materials Testing (MATT) system, and headquarters regarding geotechnical data. However, once started, the fate of the MATT system became unclear with the planned implementation of Site/Materials Manager.

In late 2006, LTRC and HQ personnel were able to view a presentation by the Kentucky Transportation Cabinet (KYTC), which showed the capability and opportunities of their geotechnical data management system. Their work was inspiring and spurred the long overdue need for this type of Global Information System (GIS) regarding geotechnical data in Louisiana. The LADOTD project was modified to provide a comprehensive solution regarding geotechnical data, and address the need for an easily operated user interface to access and view departmental records in a timelier manner.

After the KYTC presentation, several meetings were held within LADOTD where researchers determined that many databases, records, and resources already existed within LADOTD. LTRC researchers, therefore, focused efforts on coordination and connection of these systems into a GIS web-based interface to meet the Geotechnical Design Section's needs. LTRC's efforts would allow access to Content Manager; Site Manager/Materials Manager; Geotechnical Integrator (GINT), a Geotechnical Database; and other databases as the need arises.

OBJECTIVE

The objective of this project was to create a virtual geotechnical database by connecting and networking existing databases and datasets, which already exist within (and outside) LADOTD, so that LADOTD Headquarters' Geotechnical Design Section has the necessary tools and resources available to make the best design decisions.

The development of a GIS is the main task necessary to accomplish the objective of this project. Developing a geotechnical GIS web application will allow access to boring logs, cone penetration test (CPT) records, and other geotechnical information, including the Bridge Scour data and other information collected by Headquarters, the districts, and outside consultants. The objective is to create a tool, which will speed reporting time and consolidate LADOTD's geotechnical information into one location.

Another objective is to create a GIS with a simple interface designed to use existing online tools within the Department. The GIS Web site will be a reference resource to improve estimations, save time and money, and ideally improve geotechnical designs. The Web site becomes the property of the Geotechnical Design Section for current use and future (growing) needs of the section.

SCOPE

The scope of the project focused on the creation of an entirely new tool for the Geotechnical Design Section. Specifically, it was to create GIS and Web site applications to link and allow access to existing databases and resources within the Department.

The scope was limited to creating quick and logical access to existing boring logs already scanned in digital format. Older boring logs existing in hard copies were not included in this study and would need to be included as a separate project.

Additional geotechnical information, such as pile driving records, load test reports, etc., were not included in this report and would need separate, later projects to research and add these modules.

METHODOLOGY

The initial task of the project involved researching the current methods of processing and storing boring logs and geotechnical data within LADOTD. The existing hierarchy, software, formats, and storage location of the data was investigated to determine current systems and status. The investigation included meetings with the LADOTD District Lab Engineers, Project Review Committee (PRC) members, Headquarters' Geotechnical Design Section, the Materials Laboratory, Information Technology (GIS, Content Manager, etc), Pavement Management, and others.

Since the boring logs and subgrade soil survey information were the primary focus of this project's scope, the next task focused on obtaining access to available geotechnical information. The Department has collected soil information for many years for the design and construction of roads and bridges. Most of the Department's historical information exists in paper and microfiche format within the project files. The Materials Laboratory (Section 22), responsible for coordinating and conducting soil borings, recently (1998) began scanning hard copy boring logs to preserve the stamp and signature approval. These documents were saved as PDF files and then maintained at the Materials Laboratory. This upgrade to digital format was an improvement, but the digital documents remained isolated at the Materials Laboratory. This project focused on and incorporated these scanned boring logs and cone penetration test (CPT) locations into Content Manager.

The next task was to establish a logical link between the existing boring logs and existing databases in LADOTD, which would permit the display of these boring logs as points or a line on the GIS Map. This search led us to the Tracking of Project Systems (TOPS) database in the LADOTD Mainframe. This database contained the log mile/control section data, which would enable the boring logs to be displayed in the form of a line on the GIS Map. The boring logs are in turn linked to the TOPS projects using either the Project Number or the Construction Number.

Some of the projects had Global Positioning System (GPS) latitude and longitude data stored in the Structures Master (STRM) database. These points were linked using the Project Number, hence some boring logs are displayed as a line (control section) and some are

displayed as (GPS) points on the GIS Map, based on the availability of the data. Similar logical links were established for other data including the Bridge Scour data and the STRM database in the LADOTD Mainframe using the Bridge Number. Once these logical links were established to retrieve the GPS coordinates or the log mile/control section data, the next task involved the construction of the interface and connection to these databases.

With recent advancements in technology (speed, connectivity, and storage capacity), the need has reached reality regarding the capability of making vast amounts of historical data accessible through a user-friendly interface. The Information Technology (IT) section of the Department was key in explaining existing networking capabilities, the unique computer systems, and databases within LADOTD. A customized approach would be necessary to solve the problem. The LTRC programmer works closely with the IT section to methodically create a solution.

Software Structure and Design

During the investigation, a vast amount of valuable information was found to exist within the LADOTD network; however, a consolidated outlet for this information did not exist. Rather than create a new massive database, a Global Information System (GIS) allows many of the existing databases to continue to populate themselves and be managed by their respective sections. A GIS interface serves as a unified entry point for the geotechnical staff to access these multiple reference sources.

The GIS and web applications for this project were developed using the ArcGIS server software. It was initially developed in version 9.2 and later migrated to version 9.3. All the data we required was stored and maintained on the servers at LADOTD. Some of the data was already accessed from the ArcGIS server and displayed on the GIS maps, whereas some of the data was stored on other relational databases such as DB2 and MS Access. Researchers connected to these relational databases via the ArcGIS server in order to display the data in the form of points/lines on a GIS map. Often, the data was spread across two or more tables. In such cases, the tables from these databases were joined together to get the GPS coordinates required to display the data as a feature/symbol on the map.

The results of this project are compiled as software programming, which is designed to be interconnected with other existing department structures and databases in the future.

Content Manager

The LADOTD IT Section defines Content Manager as "an Enterprise Document (Object) Management System." It allows users to capture, store, retrieve, and print documents online. Content Manager provides extensive data integrity and security. The client software can be installed on a variety of computers if the computer meets the minimum requirements. Content Manager has a web client that allows users to search for documents. Objects can be placed into the system through scanning or importing. The system uses a DB2 database to manage the documents by providing indexing capabilities and recording the location of the document at all times. DB2 manages the security of the entire system by using User Ids, Passwords, and an Access Control List.

Content Manager is the Department's method for storing old and new documents generated by different sections. Content Manager can store, separate, and retrieve information based on detailed input from the user and will serve as a valuable resource to the Department for years to come. Headquarters and the district laboratories can import documents (boring logs, soil surveys, etc.) to Content Manager for all sections to view. These documents will therefore be preserved and accessible for years.

Soil Boring Logs

The soil boring log documents that were stored locally on the Materials Lab servers were imported into Content Manager at LADOTD for easy retrieval. Importing these documents into Content Manager allowed the boring log locations to be accessed and displayed on a digital map within the GIS Web site. Approximately 4,000 files were digitally received from the Materials Laboratory. The files contained 1,698 borings, of which around 942 have either the log-mile details or the latitude and longitude details and are displayed on the Geotechnical GIS Web site. The remainder of the 4,000 files was a variety of supporting and non-geotechnical documents.

To further differentiate the type of borings in the GIS, of the 942 borings, around 745 borings are displayed as control section lines, and 529 borings at bridges are displayed as a point feature on the map. The difference in display type indicated the availability and/or reason of location information associated within the data. For example, if a boring was known to have occurred along a control section without specific latitude and longitude information, the

boring is displayed as a line rather than incorrectly placing a point on the control section. In contrast, if the boring log had specific GPS coordinates, they were used and the data plotted as a point. In addition, some 332 borings out of these 942 are displayed as both control sections and points. Older boring logs located in paper or other formats (e.g., microfiche) were not included as part of this study, though may be found and imported as a separate study. Around 700 Cone Penetration Test (CPT) locations were included and displayed on the GIS map. Out of which 645 are from LADOTD. A separate study conducted by LSU will analyze the CPT data (LTRC 06-6GT).

To enable easy storage and retrieval, all scanned boring log documents at the Materials Lab were imported into Content Manager at LADOTD. Along with the documents, certain information, such as the project number, construction number, project name, district, parishes, and LA route, were also stored in Content Manager as identifiers. This not only helps in searching and accessing the documents easily but also in tying this data with other databases. Because some of the data links are dynamic, users can access the most recent data available in the database.

System Architecture

To display the boring log locations on the map using the GIS capabilities, existing databases maintained at LADOTD (including GPS coordinates, log-mile, and/or control section data for projects) were identified. One of these databases was the TOPS database on the LADOTD mainframe. This database stores all project details including the log-mile and control section data, which is used to display the project in the form of a control section (line) on the map. Similarly, the bridge layer was created using the STRM database on the LADOTD mainframe. The Bridge Scour layer was created by accessing the Bridge Scour database from the Hydraulics Section at LADOTD. Similarly, the Content Manager data is linked to the GIS web application, which facilitates easy viewing and printing of the scanned boring log documents. The CPT data files with GPS data were received from Louisiana State University (LSU) and are stored on the GIS server. All of this data are connected to the GIS Application using the ArcGIS Spatial Data Server (SDE), which links several databases and retrieves the data dynamically. The web application then connects to the SDE to communicate the data to the end users. The following figure explains the connectivity of the databases and the flow of the data back and forth from the ArcGIS user interface and the backend databases.

10
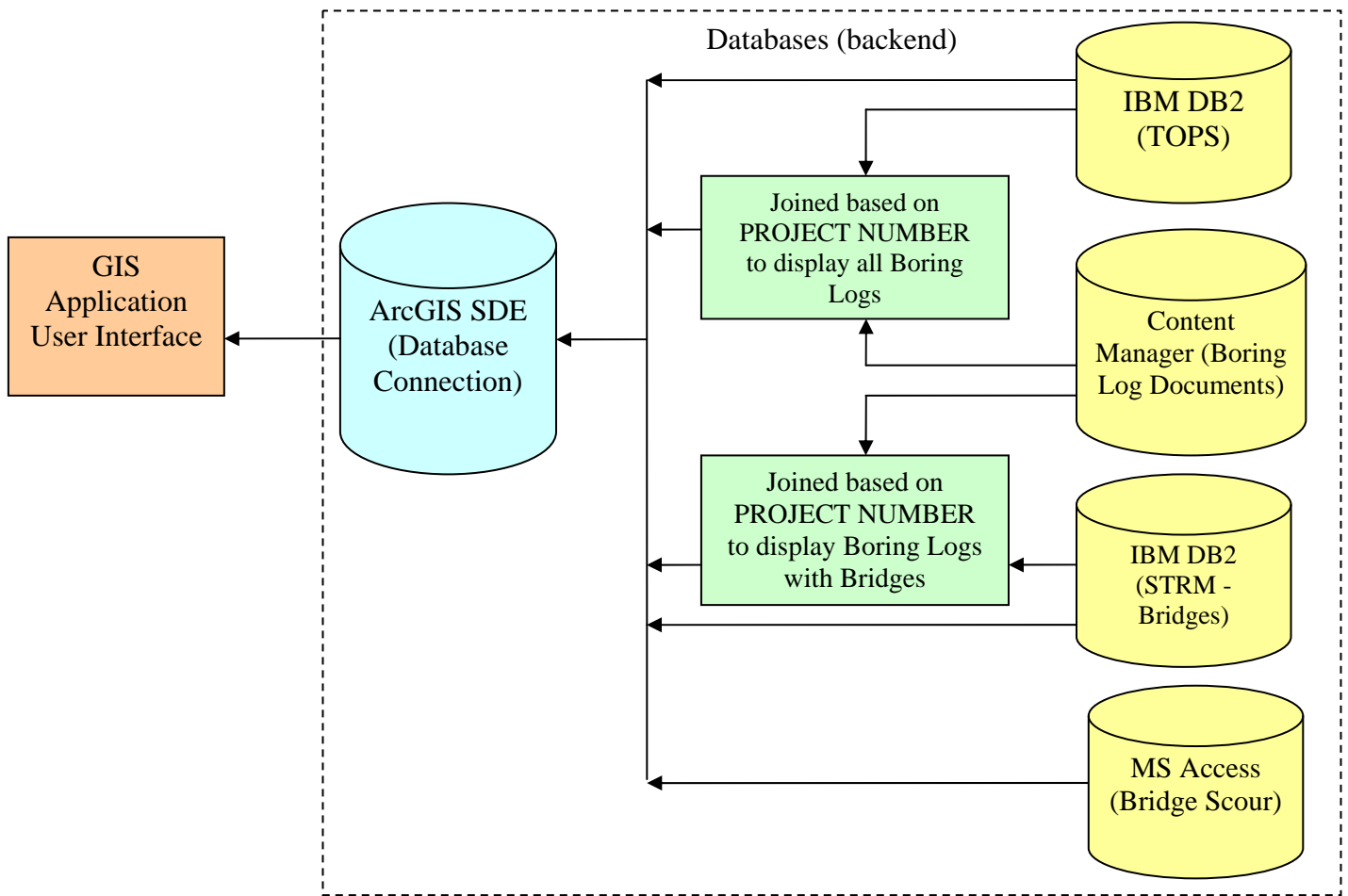
Figure 1
System architecture—database connectivity for boring logs, bridges, and bridge scour

User Interface

Once the Boring Log database was setup within Content Manager, the next task was to develop the GIS user interface, which could display the boring log locations. To meet the Pavement and Geotechnical Design Section's needs, a set of map layers were developed which includes the soil survey information, soil surface geology data, bridge locations, etc.

Two Web sites were developed within the software; both were developed using Microsoft Visual Studio 2005, .Net Framework Version 2.0. The code was written using VB.NET language. Both Web sites allow the users to view the scanned boring log document stored in

Content Manager. One Web site is an ArcGIS based web mapping site and the other is a non-GIS search Web site, which provides the user enough flexibility to search the boring logs either by mapping the selected boring logs on the map or by manually entering the search criteria, such as the project number, district number, or other such related details.

The **non-GIS search Web site** allows the user to search the boring logs based on the following search criteria:

1. Project Number
2. Project Name
3. Construction Number
4. Federal Aid Project Number
5. Project Engineer
6. Organization
7. Parish Number
8. Route Number
9. Field Book
10. Retainer Contract Number
11. Task Order Number

When searching the boring logs, they can be mapped to the GIS Web site directly, which highlights the boring log selected to be mapped. The boring log document can be viewed from this Web site directly. The link to access the Web site will be posted on the LADOTD Intranet Web site.

The **GIS application** provides a set of interactive map layers and tools. They provide details based on the extent of zoom. The link to access the GIS Web site will be posted on the LADOTD Web site.

Following is the list of layers with details in the GIS map of the application:

1. Basemap

   This displays the basic map of Louisiana and the following data:
   o Interstates
   o US Highways
   o State Highways
   o Rail Roads
   o Roads
   o Parishes
   o Water ways
   o Parks
   o Places
   o Louisiana (state name)

2. All TOPS Projects
   o This displays the TOPS Projects data existing in the TOPS DB2 database on the LADOTD Mainframe in the form of Control Sections, grouped based on the Project Status field.
   o The various project status types are "Inactive," "Complete," "Under Construction," "Finished," and "Proposed."
   o All projects can be accessed by using the "Hyperlink" functionality associated with the control section.
   o Projects with boring logs have a link to access the documents in Content Manager.
   o This Web page also provides a link to access the Visiweb.

3. TOPS Projects Under Construction
   o This displays the TOPS Projects data existing in the TOPS DB2 database on the LADOTD mainframe in the form of Control Sections having the Project status "Active/Under Construction" or "Finished/Awaiting Start Date."

4. LADOTD CPT Data
   - CPT data originated by LADOTD and digitally located by LSU is displayed.
   - The CPT points displayed on the map are hyperlinked to the documents.
   - The documents can be accessed by using the Hyperlink button and the appropriate text visualization. Locate "LADOTD CPT Data" in the dropdown list associated with the hyperlink button and click on the required feature on the map.

5. Soils Testing Engineers, Inc. (STE) Data
   - CPT data from a Geotechnical Consultant, STE, are displayed.
   - CPT STE data are displayed in the form of points.
   - The CPT points displayed on the map are hyperlinked to the test documents.
   - The documents can be accessed by using the Hyperlink button and the appropriate text visualization. Locate "STE CPT Data" in the dropdown list associated with the hyperlink button and click on the required feature on the map.

6. Boring Logs in Content Manager
   - This displays all the boring logs uploaded into Content Manager.
   - The boring log documents can be accessed by using the "Hyperlink" functionality associated with the control section.
   - This Web page also provides a link to access the Visiweb, a Web site which shows a video of Louisiana roads.

7. Boring Logs with Bridges
   - This displays all the boring logs uploaded into Content Manager that are associated with bridges in the state.

8. Average Traffic Data (ADT)

9. Surface Geology (Survey, Louisiana Geological, 1984)

10. Soil Survey Information (U.S. Department of Agriculture, Natural Resources Conservation Service)
   o This layer displays information for each parish separately.

11. All Bridges
   o All bridges within the LADOTD system are displayed on and off system bridges.

12. Bridge Scour Data
   o Bridge scour data from the LADOTD Bridge Scour Database are displayed in this layer.
   o The photos, contour maps, and soil boring information for the bridge scour data can be accessed by using the "Hyperlink" functionality associated with the bridge scour feature on the map.
   o Following links are accessible:
      i. Bridge Photo
      ii. Contour Maps
      iii. Soil Borings Image

Deployment

The applications were deployed on the H13000ms006 Server (ArcGIS version 9.2) at LADOTD. Later they were migrated to the H13000ms010 Server (ArcGIS version 9.3). The applications are now accessible via the LADOTD Intranet GIS page.

1) Data Retrieval: The software will be able to download a specific boring log document or bridge scour document from the Content Manager system.
2) Data Storage: The Materials Laboratory has the access required to store boring log documents residing on their section computers into Content Manager. The software will allow new and amended files into the system, allowing information to stay current and up-to-date without the need to re-enter data.
3) Accessibility: The software will be accessible by LADOTD employees on the LADOTD Intranet.

4) Security: The software has security controls and is located within the internal LADOTD Intranet. The integrity of the database is secured by utilizing the ArcGIS database connection to transfer data.

Maintenance

The applications need to be maintained and migrated to new versions of the software from time to time. Recently the applications were migrated to ArcGIS server version 9.3.

User Manual

To instruct the users of the Web site, this report contains a copy of the user manual for the Web site's two applications. In addition, the user manual can be found on-line to assist users in their needs.

DISCUSSION OF RESULTS

The results of this project can be found at the LADOTD GIS Web page located on the LADOTD Intranet Web site. The user manual, attached as an appendix, can assist in navigating the Web site and GIS applications.

CONCLUSIONS

This project developed a GIS based mapping application and Web site that will allow the Geotechnical Design Section and others access to boring logs and other geotechnical documents via the Intranet. The GIS interface can access many different sources and types of data within and outside the Department. The quick access to valuable data, including the mapping applications and GIS technology, will speed and aid in the analysis of data. Content Manager serves as the storage warehouse for geotechnical data, and is a valuable tool that helped make this project possible. The project has created a reference resource that will aid in the evaluation of specific geotechnical site data, which will allow for more accurate and cost effective design decisions.

This project has created a Web site and GIS application that accesses and encompasses data related to the boring logs, bridges, bridge scour, and CPT data. CPT locations received from LADOTD and others are also displayed. The data from the LTRC report 06-6GT will be linked to this project's GIS Web site.

Since its initiation and during its development, the application has been demonstrated several times. Initially the project was developed using ArcIMS, which was then migrated to the new ArcGIS 9.2 version. After being developed into the new version, another demonstration of the project was given to the PRC committee on July 16, 2007. Other demonstrations were given on June 12, 2008; September 12, 2008; and January 9, 2009. The Web site can be found on the LADOTD Intranet Web site. This application is ready to serve the Geotechnical Design Section and others in the Department.

RECOMMENDATIONS

Web site and Server Maintenance

Application maintenance and periodic updating of software and hardware are essential to ensure the smooth functioning and optimized performance of the application. This will require combined efforts and ongoing support of both LTRC and the GIS Team at LADOTD.

Personnel and Access

It is recommended that a Geotechnical Design Section employee be designated to maintain (scan and upload) the in-house geotechnical documents to Content Manager so that records are kept timely and accurate in digital format. District staff should also contribute their local documents to Content Manager for access via the Intranet.

The Web site is currently based on the LADOTD Intranet. One goal of the project is to eventually open the Web site to the public. Additional efforts regarding firewalls, user security, and level access will need to be implemented for this to occur. This should be proposed as part of a secondary project to incorporate additional geotechnical modules (pile records, microfiche historical data, etc.) and others based on the Geotechnical Design Section's recommendations.

Site/Materials Manager

The connections to Site/Materials Manager are unknown at this time. Additional connections and modules will likely be needed and realized as the Site/Materials Manager implementation occurs. These connections will likely offer additional expansion/linked opportunities to the GIS user interface regarding geotechnical applications.

Future Modules

With advancements in technology, engineers expect and need quick responsive and interactive data. This project is the start of digitally storing geotechnical data within the Department for easy retrieval, rather than being lost in the hardcopy archives. Current and future data should be recorded and stored digitally, so as data grows, it can be accessed via Content Manager, Site/Materials manager, this GIS Web site, etc.

Enhancements to the Web site and application should be incorporated in phases so that the Geotechnical Information Database becomes an even more valuable resource. This project could expand into future studies by including data from other various sources to provide more information and details to designers. Moving forward, the actions taken now regarding document handling (scanning, saving, digital format, etc.) will benefit future modules and allow an easier transition and incorporation into a simple user interface like the GIS application.

ACRONYMS, ABBREVIATIONS, AND SYMBOLS

ADT Average Daily Traffic
CPT Cone Penetration Test
GINT Geotechnical Integrator (Commercial Software)
GIS Global Information System
GPS Global Positioning System
HQ Headquarters
IT Information Technology
KYTC Kentucky Transportation Cabinet
LADOTD Louisiana Department of Transportation and Development
LSU Louisiana State University
LTRC Louisiana Transportation Research Center
MATT Materials Testing
PRC Project Review Committee
SSS Subgrade Soil Survey
STE Soils Testing Engineers, Inc.
STRM Structures Master
TOPS Tracking of Project Systems

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APPENDIX A: GEOTECHNICAL GIS WEB SITE USER MANUAL

Louisiana Transportation Research Center

Geotechnical GIS Web site

User Manual

9/20/2007

Geotechnical GIS Web site User Manual

Contents

Web sites

There are two Web sites; one is a **GIS based web mapping Web site** and the other a **non-GIS search Web site,** which provides the user enough flexibility to search the boring logs either on the map or by manually entering the search criteria, such as the project number, district number, or other such related details.

Both Web sites allow the users to view the boring log document scanned and stored in Content Manager.

Non-GIS Search Web site

The link to the non-GIS based Web site is on the LADOTD Intranet Web site.

This Web site lets the user search the boring logs based on the following search criteria:

1. Project Number
2. Project Name
3. Construction Number
4. Federal Aid Project Number
5. Project Engineer
6. Organization
7. Parish Number
8. Route Number
9. Field Book
10. Retainer Contract Number
11. Task Order Number

On searching the boring logs, they can be mapped to the GIS Web site directly by highlighting and clicking the selected boring log to be mapped. The boring log document can be viewed from this Web site directly.

The following figure displays the sample Web page of boring logs searched:

Boring Log highlighted on the GIS Web site

Non GIS Web site for searching Boring Logs
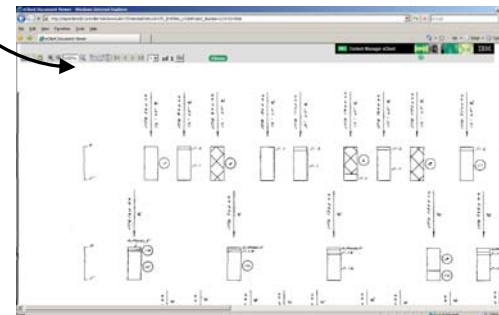
Boring Log document

GIS Web site

The link to the GIS Web site is on the LADOTD Intranet Web site.

Map Contents

To meet the Pavement and Geotechnical Design Section's needs, a set of maps was developed, which includes the following layers of information:

Layers

1. Basemap

This displays the basic map of Louisiana and the following data:

- o Interstates
- o U.S. Highways
- o State Highways
- o Rail Roads
- o Roads
- o Parishes
- o Water ways
- o Parks
- o Places
- o Louisiana (state name)

2. All TOPS Projects
   o This displays the TOPS Projects data existing in the TOPS DB2 database on the LADOTD mainframe in the form of Control Sections, grouped based on the Project Status field.
   o The various project status types are "Inactive," "Complete," "Under Construction," "Finished," and "Proposed."
   o All projects can be accessed by using the "Hyperlink" functionality associated with the control section.
   o Projects with boring logs have a link to access the documents in Content Manager.
   o This Web page also provides a link to access the Visiweb.

3. TOPS Projects Under Construction
   o This displays the TOPS Projects data existing in the TOPS DB2 database on the LADOTD mainframe in the form of Control. Sections having the project status as "Active/Under Construction" or "Finished/Awaiting Start Date."

4. Boring Logs in Content Manager
   o This displays all the boring logs uploaded into Content Manager.
   o The boring log document can be accessed by using the "Hyperlink" button and the appropriate text visualization. "View Boring Logs" in the dropdown list associated with the hyperlink button besides it and clicking on the required control section.
   o On clicking the "View Boring Log" link, if there is a single boring log found for that control section, then the document link in Content Manager is directly opened.
   o If there are multiple boring logs found for the control section selected, a Web page pops up that lists the boring logs with the links to the boring log documents in Content Manager for each boring log.
   o This Web page also provides a link to access the Visiweb.

5. Boring Logs with Bridges
   o This displays all the boring logs uploaded into Content Manager that are associated with bridges.

6. Average Traffic Data (ADT)

7. Surface Geology (Survey, Louisiana Geological, 1984)

8. Soil Survey Information (U.S. Department of Agriculture, Natural Resources Conservation Service)
   o This layer displays information for each parish separately.

9. LADOTD CPT Data
   o CPT data (LADOTD) are displayed on the map and are hyperlinked to test documents.
   o The documents can be accessed by using the hyperlink button and the appropriate text visualization. Locate "LADOTD CPT Data" in the dropdown list associated with the hyperlink button and click on the required feature on the map.

10. Soils Testing Engineers, Inc. (STE) Data
    o CPT data from Geotechnical Consultant STE are displayed in the form of points on the map and are hyperlinked to tests documents.
    o The documents can be accessed by using the hyperlink button and the appropriate text visualization. Locate "STE CPT Data" in the dropdown list associated with the hyperlink button and click on the required feature on the map.

11. All Bridges
    o All bridges are displayed in on and off categories.

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12. Bridge Scour Data
    o Bridge Scour data are displayed from the Bridge Scour Database at LADOTD.
    o The photos, contour maps, and soil borings for the Bridge Scour Database can be accessed by using the hyperlink button and the appropriate text visualization. Locate "Bridge Scour" in the dropdown list associated with the hyperlink button and click on the required feature on the map.
    o On clicking the "Bridge Scour" link, a Web page appears with the links to the:
        i. Bridge Photo
        ii. Contour Maps
        iii. Soil Borings Image

Getting Started

Most of the following information is available in the **Help** link on the top right side of the toolbar on the Web page.

The **Web Mapping Application** enables users to explore a map and find useful information.

How it Works

The Web Mapping Application page has three main parts:

- Along the top, a **menu** toolbar exists with Help and other Web site links for interacting with the map.
- Map
- Console, on the left side of the page, allows interaction with the map and provides information about the map.
    - **Tasks** enable you to find and interact with data. Available tasks may include, depending on the application:
        - Find or search for features
        - Find address
    - Results
    - Map Contents
    - Overview
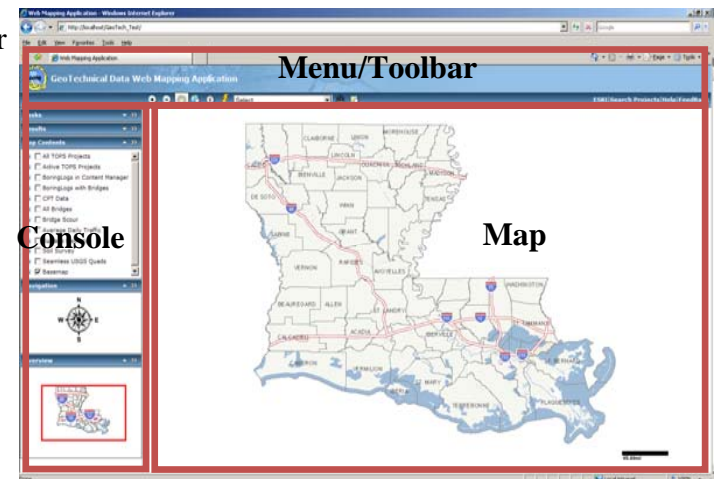
Working with the Console

You can hide and then show the Console as needed. Click the gray arrow ⊩ just to the left of the map to hide the Console. Click the arrow (which now points to the right) again to show the Console.

You can resize the area used by the Console by clicking and dragging the divider between the Console and the Map. This allows more room to view either area.

Expand and collapse sections as needed by clicking the down arrow to expand a Console section:

Click the up arrow in the title of a section to collapse it to its title bar:

The content of the section is hidden but not deleted. Expand the section to see the content again.

Console sections can be adjusted and resized in height. To resize a section height, move the cursor to the bottom of the task section, until the up-down arrow appears. Click and hold the left mouse button, and drag the section up or down to resize.

Show or Hide the Title Image

Hiding the title/banner image allows more room for the map and other Web site elements. To hide or show the banner image, click the Show link at the upper right corner of the page. This Show link is to the right of any links that may appear in the page.

Working with Moveable Elements

Some elements, such as the Measure window and the Magnifier window, may be moved around the page, collapsed, and closed. You can arrange these elements to suit your own work.

To move elements, click and hold with the left mouse button on the title bar of the element. As you hover over the element's title bar, the cursor changes to a four-way arrow, indicating you can move it by clicking and dragging.

Drag the element to the desired position and then release the mouse button.

If an element is accidentally moved outside the visible window, move it back by using the browser's scrollbars to scroll the window until the element is visible and then drag it back to the main area of the window.

To collapse the element, click the up arrow in its upper right corner. The element window collapses to its title bar. To restore it to normal view, click its down-arrow.

Close a moveable window by clicking the close button in its upper right corner. Most such windows may be re-opened from the appropriate location. For example, the Measure and Magnifier windows may be re-opened from the Toolbar.

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Resizing Moveable Elements

Some element windows, such as Magnifier, can be resized to show more or less area. To resize, move the mouse over the right or bottom edge of the element window until the cursor changes to a double arrow. Hold the mouse down and drag the window edge to resize it and then release.

Search for Features

The Web mapping application may allow you to search and find features of interest to you. The available search tools will depend on how your application is configured.

Search, Find, and Query Tasks

The Web site will enable you to search one or more layers for text that you enter, find an address, or search for places using a Web database. The administrator of the Web site determines the types of searches available.

For example, the query may ask you to enter a value for the name of a city. A more complex query may ask for two or more values and search using these values. For example, a query may ask for a city name and country name. The query might use the values you enter to look for a city with the name and that is in the country you entered.

1. The search or find task can be displayed from the Tasks list in the Console. Click the down-arrow to expand the Tasks list. Click on the task item to open it.

2. The search or find task opens in a new element window within the mapping application. Some examples of possible tasks are shown below. This element window may be moved, collapsed, and closed.

Find Control Section ▲ « ⊗	Find Parish By Number ▲ « ⊗
Search for: 450-03	**Search for:** 61
Find	Find
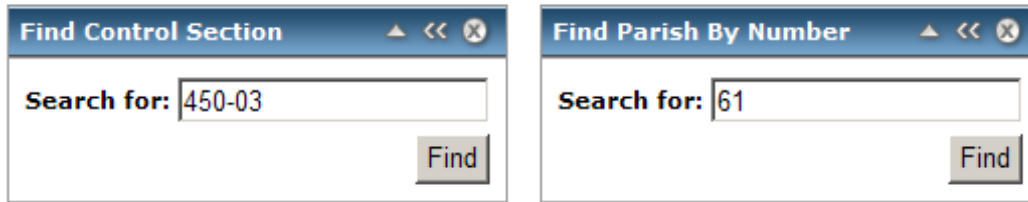
3. Enter text you want to search for in the input box of the task window. The task may require entering all of the value, or part of the value. The task text should give a hint about what you need to enter to find features.
4. Click **Find** to start the search.
5. The Results section expands in the Console to display results of the search (if it does not expand automatically, click the down-arrow in the Results section to display it). The information searched for displays in the results box.
6. If features are found, a plus button ⊞ appears next to the results item. Click the plus button to expand and explore the results. The example below shows one possible result of a search using Find.

Results ▲ «

- 450-03 (1)
  - ☑ CSRoutes
    - ☐ 450-03

OBJECTID	1893
CS_CODE	450-03
Shape	ESRI.ArcGIS.ADF.ArcGISServer.PolylineN
SHAPE..SdeLength ()	35979.9775514259
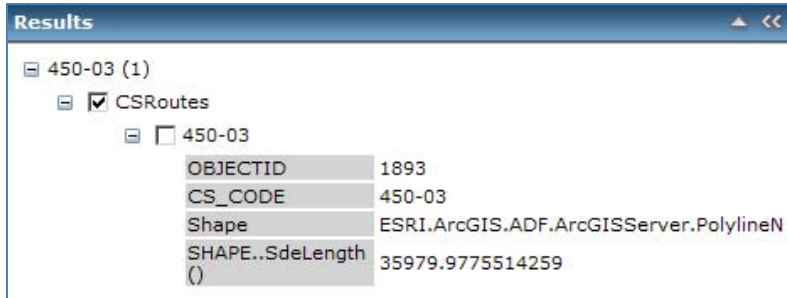
7. The results display one or more layers where features are found. Click the plus button next to a layer to display features found.

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Using the Toolbar

The toolbar allows you to interact with the map by clicking on the map with a tool. For example, if you click in the toolbar on the Zoom In tool, then click on the map, the map will zoom in around where you click.

To Use a Tool

Note that some tools do an action immediately. These include the Full-extent tool and the Magnifier tool.
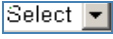
- In the toolbar, click on the tool you want to use.
- Move the cursor over the map. The cursor may change to indicate the tool you are using.
- Click on the map with the left mouse button. Note that some tools work by depressing the mouse and dragging the cursor to draw a rectangle, line, or polygon then releasing the mouse button.
- The results depend on the tool. The map appearance may change, such as zooming in or out. The results may also appear in the Console's Results section, such as with the Identify tool.

Tools

Tools in the Web site depend on the purpose and use of the application. Some or all of these may be available:

Name	Icon	Description
Zoom in		**Click and drag a rectangle**: Click and hold the left mouse button down on the map at one corner of the rectangle to zoom in to. Drag the mouse to the other corner of the rectangle, and release the mouse button. The map will zoom in to the area of the rectangle.
Zoom out		**Click and drag a rectangle**: the map will zoom out so that the current map area will fit into the rectangle drawn. The smaller the rectangle you draw, the more the map will zoom out.
Pan (recenter)		**Click and drag the map**: Click and hold the left mouse button on the map, and drag the map. The map will be recentered with the location dragged at the location you dropped it.
Full extent		**Full extent**: Immediately zooms map out to the area of all features and layers. The active tool does not change.
Identify		**Click to identify**: Click with the left mouse button on the map. A small icon is added to the map and the Location is added to the section in the Console.
Measure		**Measure distance or area**: See Measuring for usage.
Magnifier		**Magnify a section of the map**: See Magnifier for usage.
Hyperlink		**Click to view**: Click left mouse button on the feature to view information page/document linked to that feature.
Hyperlink Dropdown list		**Select:** Select the various hyperlink options to view **before** clicking on the hyperlink button next to it.

Using the Hyperlink Tool

The hyperlink tool allows you to interact with map features by clicking on the map to access details in a new Web page or document. The dropdown list Select ▼ beside the hyperlink button ⚡ lists all the options that the user can view.
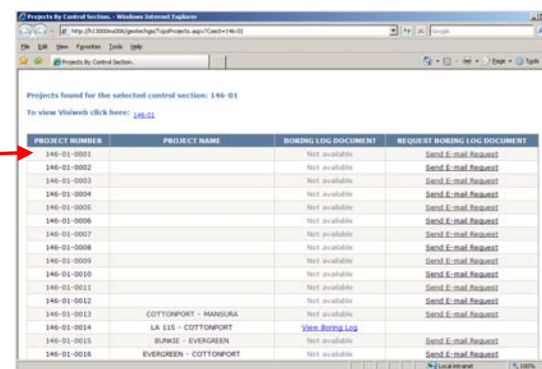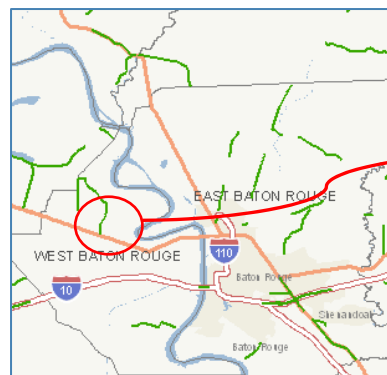
For example, if you select the option "View Boring Logs" listed in the dropdown list and click on the hyperlink button on the toolbar, the cursor can be used to click on the Boring Log map feature. The Web page or document linked to that feature will then popup and display the contents of the selected feature. In this case, it would be the Boring Log feature selected.

The next steps explain how to best utilize the hyperlink tool:

1. Click the drop down list to expand the options list. Click on the option item you need to view.
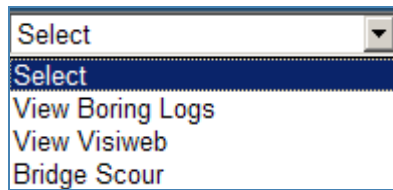
2. Click on the hyperlink button ⚡ on the toolbar to use it.
3. Select the required feature on the map.
4. Web page/document linked to the feature will popup.

# Using the Overview and Magnifier

Overview

The Overview window displays a small map with a larger extent than the current map. The current map's extent is shown in this window with a red rectangle.
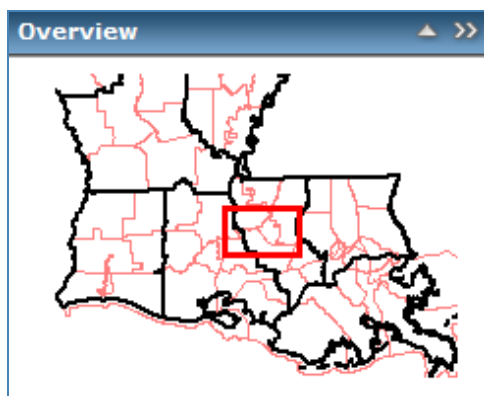

- Display the Overview window by clicking its down-arrow in the Console.
- The map can be re-centered by moving the red extent rectangle. Click and drag on the red rectangle to re-center the map.
- As you zoom the map in or out, the Overview map's extent changes, so it shows an area somewhat larger than the main map.
- The Overview map may look different from the main map. Layers may be visible at different map scales (zoom levels). In addition, if the Web site uses multiple map services, only one will display in the Overview map.

Magnifier

The Magnifier window allows a close-up view of a small portion of the main map.
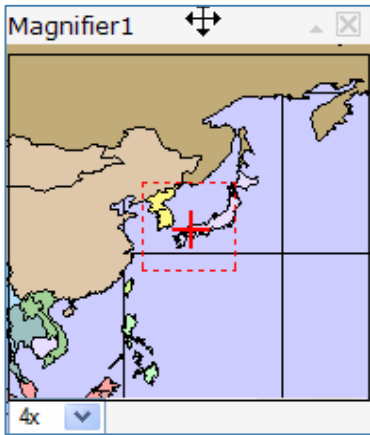
Magnifier moving to new location
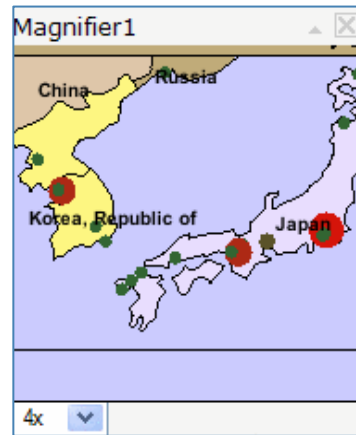
Magnifier displaying zoomed view

- To display the Magnifier window, click the Magnifier icon on the Toolbar.
- The Magnifier window can be moved, collapsed, or closed as desired.
- To magnify an area of the map, move the Magnifier window over the area by dragging on its title bar. A small red rectangle shows the area that will be magnified. Once you drop the Magnifier on a location, a zoomed-in view of the area will display within the Magnifier window.
- The amount of magnification can be changed with the drop-down list in the lower left of the Magnifier window. If the Web site uses multiple map services, only one of them will display in the Magnifier window. The map service can be set by the administrator.

Measure Distance and Area

You can use the Measure tool to measure distances and areas. To use one of these tools, open the Measure dialog and then use the appropriate tools below:

- To open the Measure dialog
- To measure a line
- To measure a polygon
- To find X,Y coordinates

To Open the Measure Dialog

1. In the Toolbar, click the **Measure** icon. If the Measure icon is not visible, then the Measure tool is not available for this application.

2. This opens the Measure element dialog.
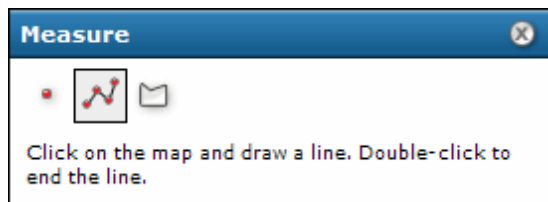
   See the instructions that explain how to measure a line or area. You can also use the point option to find the X, Y coordinates of a location on the map.

3. After measuring, you can close the Measure dialog by clicking on its Close icon in the upper right or by clicking any other tool in the Tools element (Zoom in, Zoom out, Pan, etc.)

To Measure a Line

1. In the Measure dialog, click the Line icon . The Line icon is outlined to show it is the active type.
2. Move the cursor to the first point of the line you want to measure, and click the left mouse button. As you move the mouse from this location, you will see the line stretching to the current position. The measure dialog will also begin to display distance.
3. Move the cursor to the second point of the line. If you only want to measure one straight-line segment, double-click at this location. Otherwise, click once with the left mouse button.
4. If measuring a line with multiple segments (polyline), continue clicking at vertices to add segments. The length of the previous segment is shown in the **Segment** display in the Measure dialog. The **Total Length** displays the sum of segments added so far.
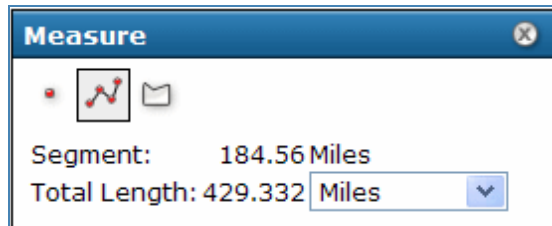
5. At any point during the measuring, you can change the units for measuring distance by using the drop-down list in the measure dialog. You can also change units after completing the measurement.
6. At the last vertex, double-click to end the line. The **Total Length** displays the length of the line, including all segments if multiple ones were drawn. You can change the unit's drop-down list to see the same line expressed with different units.
7. To draw a new line, simply click on the map to start the new line. This erases the previous line.
8. To erase the line from the map, click any of the measure type icons in the Measure dialog. If you click any other tool in the Tools element, this will close the Measure dialog, and any line or polygon will also be erased.

To Measure Area

1. In the Measure dialog, click the Polygon icon ⌂ . The Polygon icon is outlined to show it is the active type, and the dialog changes to show information on measuring polygons.
2. Set the units for measuring distance. For polygons, the measured area displays in the Area Units, and the perimeter displays in the Distance Units.
3. Click the left mouse button at the first point in the polygon. As you move the mouse from this location, you will see the line stretching to the current position.
4. Click the second point of the polygon. The first segment draws, and the polygon now stretches to the current position from the last point as well as to the initial point. When you click the third point, the measure dialog displays the perimeter and area of the polygon based on the vertices added. The total is updated as you add more vertices.
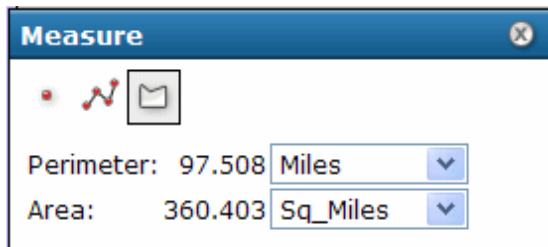

5. Continue adding points (vertices) of the polygon. New vertices add segments connecting to the previous vertex.
6. At the last vertex in the polygon, double-click the mouse. You do not need to click at the original point again. Read the Area and Perimeter from the Measure dialog. You can change the Distance Units to see the same polygon expressed with different units.
7. To draw a new polygon, simply click on the map to start the new polygon. This erases the previous polygon.
8. To erase the polygon from the map, click any of the measure type icons in the Measure dialog. If you click any other tool in the Tools element, this will close the Measure dialog, and any line or polygon will also be erased.

To Find X, Y Coordinates

The Measure dialog also allows finding the X, Y coordinates at a point where you click on the map.

1. In the Measure dialog, click on the point symbol .

2. Click on the map. The coordinates at the location you clicked will be displayed in the Measure dialog.
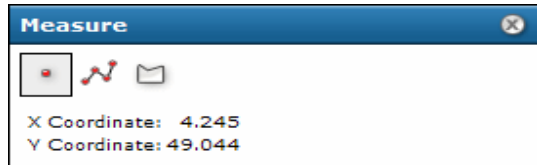
The units and projection (spatial reference) of the coordinates will be based on the map used in the web application.