

FINAL REPORT ~ FHWA-OK-14-11

DEVELOPMENT OF A PROTOTYPE GEOTECHNICAL REPORT

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DEVELOPMENT OF A PROTOTYPE GEOTECHNICAL REPORT DATABASE

FINAL REPORT ~ FHWA-OK-14-11
ODOT SP&R ITEM NUMBER 2259

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SI* (MODERN METRIC) CONVERSION FACTORS

| APPROXIMATE CONVERSIONS TO SI UNITS | | | | |
|--|----------------------------|-----------------------------|-----------------------------|-------------------|
| SYMBOL | WHEN YOU KNOW | MULTIPLY BY | TO FIND | SYMBOL |
| LENGTH | | | | |
| in | inches | 25.4 | millimeters | mm |
| ft | feet | 0.305 | meters | m |
| yd | yards | 0.914 | meters | m |
| mi | miles | 1.61 | kilometers | km |
| AREA | | | | |
| in² | square inches | 645.2 | square millimeters | mm ² |
| ft² | square feet | 0.093 | square meters | m ² |
| yd² | square yard | 0.836 | square meters | m ² |
| ac | acres | 0.405 | hectares | ha |
| mi² | square miles | 2.59 | square kilometers | km ² |
| VOLUME | | | | |
| fl oz | fluid ounces | 29.57 | milliliters | mL |
| gal | gallons | 3.785 | liters | L |
| ft³ | cubic feet | 0.028 | cubic meters | m ³ |
| yd³ | cubic yards | 0.765 | cubic meters | m ³ |
| NOTE: volumes greater than 1000 L shall be shown in m ³ | | | | |
| MASS | | | | |
| oz | ounces | 28.35 | grams | g |
| lb | pounds | 0.454 | kilograms | kg |
| T | short tons (2000 lb) | 0.907 | megagrams (or "metric ton") | Mg (or "t") |
| TEMPERATURE (exact degrees) | | | | |
| °F | Fahrenheit | 5 (F-32)/9 or (F-32)/1.8 | Celsius | °C |
| ILLUMINATION | | | | |
| fc | foot-candles | 10.76 | lux | lx |
| fl | foot-Lamberts | 3.426 | candela/m ² | cd/m ² |
| FORCE and PRESSURE or STRESS | | | | |
| lbf | poundforce | 4.45 | newtons | N |
| lbf/in² | poundforce per square inch | 6.89 | kilopascals | kPa |

| APPROXIMATE CONVERSIONS FROM SI UNITS | | | | |
|---------------------------------------|-----------------------------|-------------|----------------------------|---------------------|
| SYMBOL | WHEN YOU KNOW | MULTIPLY BY | TO FIND | SYMBOL |
| LENGTH | | | | |
| mm | millimeters | 0.039 | inches | in |
| m | meters | 3.28 | feet | ft |
| m | meters | 1.09 | yards | yd |
| km | kilometers | 0.621 | miles | mi |
| AREA | | | | |
| mm ² | square millimeters | 0.0016 | square inches | in ² |
| m ² | square meters | 10.764 | square feet | ft ² |
| m ² | square meters | 1.195 | square yards | yd ² |
| ha | hectares | 2.47 | acres | ac |
| km ² | square kilometers | 0.386 | square miles | mi ² |
| VOLUME | | | | |
| mL | milliliters | 0.034 | fluid ounces | fl oz |
| L | liters | 0.264 | gallons | gal |
| m ³ | cubic meters | 35.314 | cubic feet | ft ³ |
| m ³ | cubic meters | 1.307 | cubic yards | yd ³ |
| MASS | | | | |
| g | grams | 0.035 | ounces | oz |
| kg | kilograms | 2.202 | pounds | lb |
| Mg (or "t") | megagrams (or "metric ton") | 1.103 | short tons (2000 lb) | T |
| TEMPERATURE (exact degrees) | | | | |
| °C | Celsius | 1.8C+32 | Fahrenheit | °F |
| ILLUMINATION | | | | |
| lx | lux | 0.0929 | foot-candles | fc |
| cd/m ² | candela/m ² | 0.2919 | foot-Lamberts | fl |
| FORCE and PRESSURE or STRESS | | | | |
| N | newtons | 0.225 | poundforce | lbf |
| kPa | kilopascals | 0.145 | poundforce per square inch | lbf/in ² |

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380.

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1 INTRODUCTION

1.1 PROBLEM STATEMENT

Archive geotechnical reports in the department contain valuable information such as site maps, photographs, borehole data, laboratory and field test data, and design analyses. A proper use of these information may bring significant cost saving for future projects.

Currently, thousands of archive geotechnical reports are stored in paper file boxes in the material division of the department. About half of the reports are sorted by county. Other reports are mostly sorted by project engineers' names or sometimes by project names. The current way of file storage makes it cumbersome to access information, not to mention the chance of missing and misplacing reports over the time.

New geotechnical reports also face a similar problem. Since 2007, the Geotechnical engineering branch has digitized a small fraction of the Geotechnical reports in portable document format (pdf). As of today, about one hundred pdf reports files are available in a network folder in the material division. These reports are sorted by division and county in the network folder of the material division, which is easier to access and distribute than the paper reports. However, as the number of files increases, it becomes more advantageous to use a database system to manage these reports.

1.2 OBJECTIVE AND SCOPE

The primary objective of the current proposal is to develop a proof-of-concept geotechnical report database that best fit the current need of the ODOT material division. As a minimum, the system will feature data stemming from (1) in-house archived files, (2) in-house files currently being recorded in a quasi-automated recall-system, and (3) data provided to the department via contract services.

The scope of work performed during the 12-month period of the project includes:

- 1) A literature review and a survey of current practice in other states;
- 2) An assessment of the current reports storage practice in the division;
- 3) The design and development of a prototype database; and
- 4) The development of a user manual for the database

1.3 ORGANIZATION OF THE REPORT

This report consists of five chapters and one appendix. Following this chapter, Chapter 2 presents the results from the literature review and a survey of current practice at other DOTs. Chapter 3 documents an effort to assess of the current geotechnical file storage in the division. Chapter 4 details the design and development of the prototype geotechnical report database based on the current need of the department. Chapter 5 summarizes the project findings and provides recommendations for future work. A user manual of the database is provided in the Appendix of this report.

2 CURRENT PRACTICE IN OTHER STATE DOTs

2.1 LITERATURE REVIEW

The rapidly increasing volume of archive geotechnical reports and the burden of managing the hard copies of these reports is probably a common problem faced by all state transportation agencies. According to a synthesis study conducted in 2004, 35 state DOTs (mapped in Figure 1) in the United States have developed some format of geotechnical information database system [1]. The advantage of using database system over the conventional paper report system is obvious. The database system allows users to search, access, and distribute geotechnical reports and other documents in a much faster and easier fashion. Some geotechnical information systems also bear network data sharing, data exchange between field/laboratory devices, and data analysis functions.

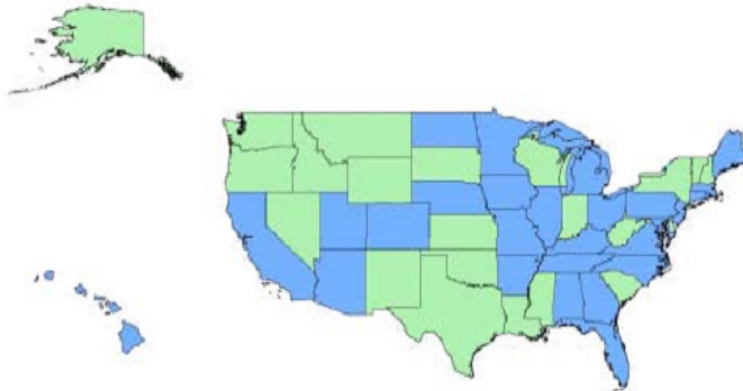


Figure 1. States that have geotechnical database systems (indicated in blue color) [1]

In the past few years, several states have documented their progress in the development and implementation of geotechnical information databases in research papers and reports [2-12]. In general, the function of a geotechnical information system are (1) to manage the existing paper reports, (2) to accommodate the new data collection, or both.

(1) Managing the existing paper reports

Managing existing paper reports is the main purpose of using the geotechnical database. Paper documents may be digitized into image (such as TIFF format) or PDF format first. For example, Kentucky DOT developed a web-based database (<http://kgs.uky.edu/kgsmap/kytcLinks.asp>) to manage the historical PDF geotechnical reports. The database was linked to a GIS server so that users can easily retrieve all the existing geotechnical reports in a specified area on a map (as shown in Figure 2).

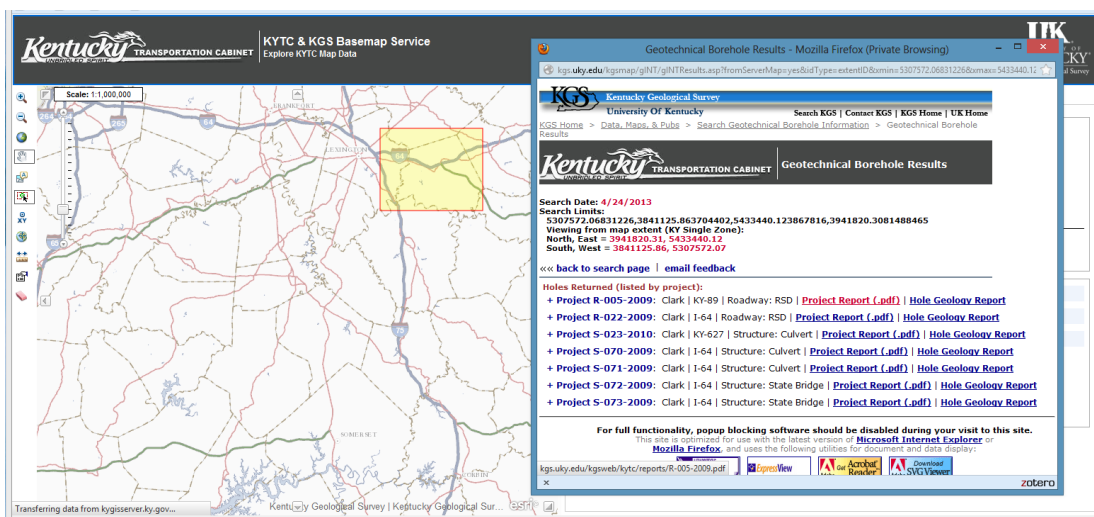


Figure 2. KYDOT web-based geotechnical report GIS database [12]

To build such a system, each scanned PDF report has to be indexed with a project number which is then associated with a geographic location (latitude and longitude). More information (e.g., date of report, file creator, control section and log mile, etc.) can be cataloged, typically by manual input. However, this process is very labor-intensive. Although semi-automatic indexing is possible through special text recognition programs, a manual review of the indexed files for quality control is still desired.

A better solution is to link geotechnical database to other existing DOT databases and extract more information about the project automatically. For example, in Louisiana DOTD (Department of Transportation and Development), project information such as project number, date, longitude and latitude, contractor, and project manager are available in the Tracking of Projects

(TOPS) database. The scanned geotechnical reports (stored in the Content Manager database) can be easily associated with TOPS to form a GIS database. Figure 3 presents a web-based GIS application interface developed for LADOTD, from which users can search for pavement base and subgrade information based on project number or control section.

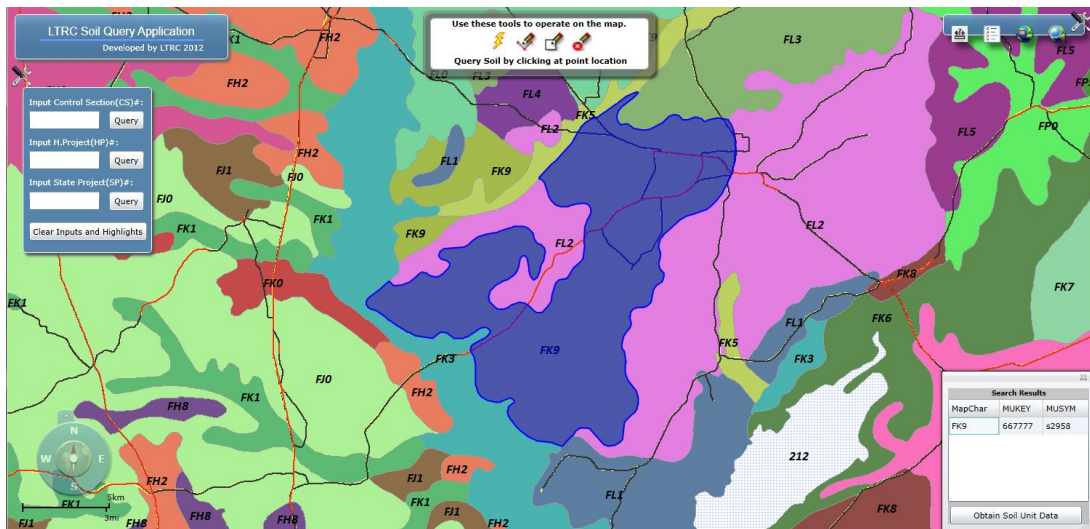


Figure 3. LADOTD web-based geotechnical GIS database

(2) Automatic data exchange

Handling historical files is just one of the desired functions of a geotechnical report database. Today, geotechnical reports and boring logs are often generated with computers. Laboratory and field test data are often collected automatically by data loggers (often in ASCII format). It has been recognized by many states that automatic data exchange between computer programs, test devices, and the database server is a future trend of geotechnical information management. For example, Louisiana DOTD is currently asking contractors to submit gINT format geotechnical reports.

In 2005, a Pooled fund study (TPF 5(111)) was initiated to develop an international standard for geotechnical and geoenvironmental data exchange between test devices, computer programs and geotechnical information databases. The project was led by Ohio DOT and jointly supported by Federal Highway Administration (FHWA), US Geology Survey (USGS), as well as ten other state transportation agencies. The end product of this project is the standard of Data

Interchange for Geotechnical and Geoenvironmental Specialists (DIGGS). The standard of DIGGS consists of a data dictionary and a XML (extensible markup language) schema. The XML schema is GML (geographic markup language) compatible, thus DIGGS can be incorporated into a GIS system. DIGGS 2.0 was released to public (<http://www.diggsm.org/schema-v2-0a-released>) in 2012 and a final report of the research project was submitted to Ohio DOT and FHWA [13].

Based on the literature search, some technical details of eight recently developed DOT geotechnical databases are summarized in the Table. Most of these databases were developed using the ArcGIS, a program that has already been widely used in state DOTs. ArcGIS provides three APIs (application programming interface) for developing a web based GIS: JavaScript, Silverlight, and Flex. According to ESRI, all of the three APIs have similar functionality.

Table 1. Geotechnical Databases in Eight State DOTs

| DOT | Year of Development | System Description |
|------------|----------------------------|--------------------------------------|
| ALDOT | 2005 | ArcGIS + FLEX |
| Caltrans | 2002 | ArcGIS + DIGGS XML |
| Ohio DOT | 2004 | ArcGIS + EQUIS + DIGGS XML |
| LADOTD | 2003 | ArcGIS + FLEX+ASP.net + DB2 database |
| MnDOT | 2003 | ArcGIS + DIGGS XML + Oracle database |
| VDOT | 2001 | ArcGIS + JavaScript |
| DelDOT | 2010 | GEOSYSTEM® + Oracle database |
| KYDOT | 2005 | ArcGIS + Oracle database |

2.2 SURVEY RESULTS

Survey questions were sent through email to other 41 state DOTs for which no published record was found in the literature search. Three questions were asked in the survey:

1. Does your department keep historical geotechnical reports in a database?
2. If yes, is that an ArcGIS database? Access database? or something else?
3. Is the database on only a single computer or accessible through network?

Thirty of the 41 states responded to the survey. The survey responses are combined with the literature search results and the findings are summarized in Figure 4.

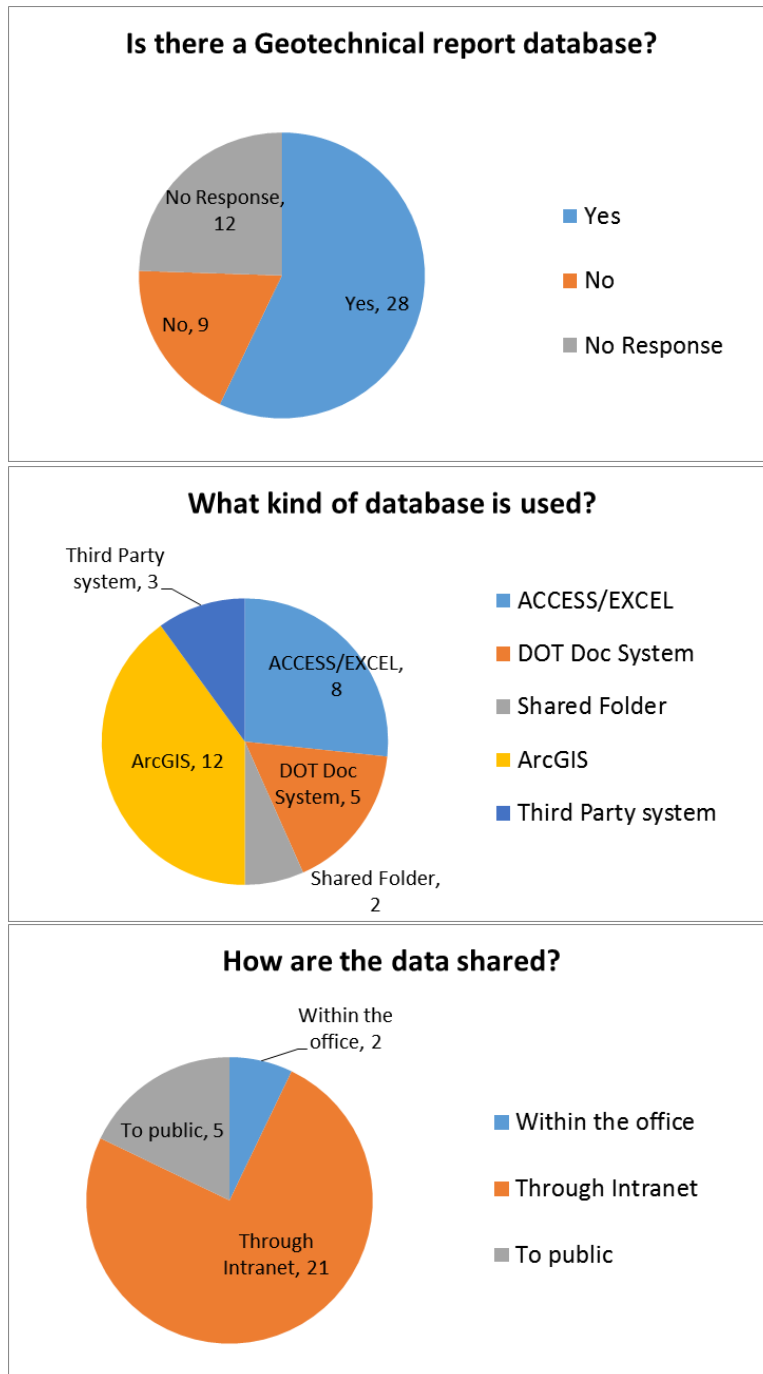


Figure 4. Combined results from the survey and literature search

2.3 SUMMARY

Based on the combined results from the survey and the literature review, at least 28 other state DOTs are currently using certain type of database to keep track of the historical geotechnical reports. ArcGIS is the most popular type of database, followed by Microsoft Access/Excel. The majority of these geotechnical report databases are capable of data sharing through either internet (5 states) or intranet (21 states).

3 ASSESSMENT OF THE CURRENT PRACTICE

An assessment the efficiency of the current geotechnical report system of the material division was performed four students from Oklahoma State University. The purpose of the assessment is to quantify the benefit of the research in terms of the time saved for an engineer to locate certain geotechnical report(s).

3.1 ASSESSMENT TASKS

In this assessment, the students were asked to perform 25 search tasks for historical geotechnical report(s) at a certain county, route, and of certain type of work. For example, "I-44 over Red River, Cotton Co., Bridge Foundation". Before the assessment, the students were trained to be familiar with basic types and typical contents of ODOT geotechnical reports.

Each student was assigned with one task at a time. He/she should go through a computer folder (where some PDF reports are stored) and all the file boxes until the report(s) was located. After that the student was asked to fill a Geotechnical Information Inventory Sheet, where the location of the report and the starting and ending times were entered.

3.2 ASSESSMENT RESULTS

The time (in minute) spent on each of the assessment task is presented in Table 2 and Figure 5. It is shown that the average time for a person to find a target report(s) is approximately 31 minutes through the file boxes. According to the geotechnical engineers in the material division, the average time they usually spend on a report request is considerable more than half an hour. The reason for the difference may be due to the fact that nine (marked out on Figure 5) of the 25 search tasks were accomplished by just exploring through the computer folder and no further effort was made to search the file boxes, which greatly reduced the average search time in the assessment.

Even with the underestimated time required to find target file(s), the assessment result clearly demonstrated the difficulty to locate useful information with the current way of file storage. If the engineers in all DOT divisions are able to search and access the geotechnical reports in their own office with a network database, the engineers in the material division may save a great amount time in responding to all the report requests.

Table 2. Time spent on the 25 assessment tasks

| Task | Report Description | Time (minutes) |
|------|--|----------------|
| 1 | I-44 over Red River, Cotton Co., Bridge Foundation | 10 |
| 2 | US-412, Major/Woodward Co., Laboratory Findings or Soil Borings | 42 |
| 3 | SH-99, Lincoln Co., General Information | 48 |
| 4 | US-60, Osage Co., Landslide Investigation | 80 |
| 5 | Airport Testing, Focus on Central, Western, or Eastern Oklahoma, General Investigation | 40 |
| 6 | SH-59, West of Wayne, McClain Co., General Information | 23 |
| 7 | US-70, Carter Co., Soil Boring and Seepage Investigation | 61 |
| 8 | County Road, West of Ringwood, Major Co., Field Testing Findings | 106 |
| 9* | SH-518, Wagoner Co., General Information | 30 |
| 10 | US-287, North of Boise City, Cimarron Co., Deflection Testing & Coring Data | 34 |
| 11* | US-75A, NW of Okmulgee Co., General Information | 15 |
| 12 | SH-19 over Coon Creek, Pontotoc Co., Bridge Foundation | 72 |
| 13 | SH-82, Red Oak to Lequire, Latimer Co., Landslide Investigation | 52 |
| 14* | SH-78, South of Durant, Bryan Co., General Information | 11 |
| 15 | US-283 over Wolf Creek, North of Shattuck, Ellis Co., General Information | 4 |
| 16 | SH-66, East of Chandler, Lincoln Co., Seepage Investigation | 5 |
| 17* | SH-95, West of Guymon, Texas Co., General Information | 42 |
| 18 | US-271, SE of Clayton, Pushmataha Co., Landslide Investigation | 4 |
| 19 | US-66, Claremore, Rogers Co., Field Testing and Seepage Investigation | 6 |
| 20* | SH-10C, East of Miami, General Information | 14 |
| 21 | SH-15 over Red Rock Creek, East of Enid, Garfield Co., General Information | 16 |
| 22 | SH-3, Between Atoka and Antlers, Atoka Co., Seepage Investigation | 20 |
| 23 | SH-9 over King Creek, Haskell Co., General Information | 9 |
| 24 | SH-1 over Blue River, North of Rolf, Pontotoc Co., General Information | 4 |
| 25 | I-35, Truck Climbing Lane, Murray Co., General Information | 8 |
| | Average | 31 |

* Dummy Tasks

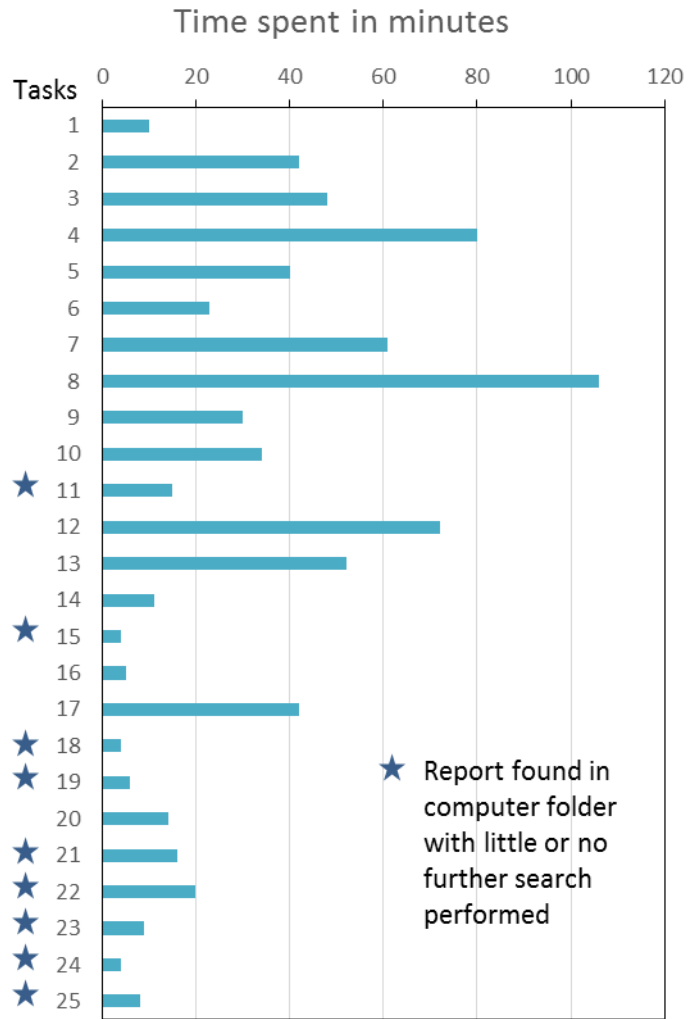


Figure 5. Time spent on each assessment task

4 DESIGN AND DEVELOPMENT OF THE DATABASE

Several database options were initially considered by the research team, including ArcGIS database, Microsoft Access database, and Google/Bing map application. The research team finally decided to develop a Microsoft Access database for a number of reasons. First, it is easy to provide a user-friendly program interface in Microsoft Access by creating forms for users and administrators to manipulate the data. Second, Microsoft Access is readily available in almost all DOT computers. Last, Microsoft Access database can be easily imported into an ArcGIS map if GIS application is desired. The main drawback of the Microsoft Access database is that it does not support data search on a map view. However, this can be overcome by converting the database into a Keyhole Markup Language (KML) file which can be read by Google Earth, Google Map, or ArcGIS.

4.1 DATABASE DESIGN

The prototype geotechnical report database was designed for managing and sharing archive geotechnical reports throughout the department. The potential users of the database are geotechnical, pavement, bridge, or other engineers who want to search and access existing geotechnical information near a certain location. The administrator of the database is the geotechnical engineers in the material division who need all the user functions but are also responsible for cataloging archive reports and editing the information in the database.

4.1.1 Conceptual Design

The conceptual design of the database is illustrated in Figure 6. The database file is a Microsoft Access 2010 file which stores all the catalog information of the reports and the report folder on the network hard drive. Each report also has a unique report ID (RID) which links to the location of the hard copy file(s). The information in the database are also available in a KML file which allows users to view all geotechnical report locations in a state map using a number of computer programs such as Google Earth and ArcGIS.

The database file and the associated geotechnical report files (in PDF) is stored under a network folder of the material division. Any computer under the ODOT network is able to access these files. A software manual is provided in the appendix of this report which explains the user and administrator functions in more detail.

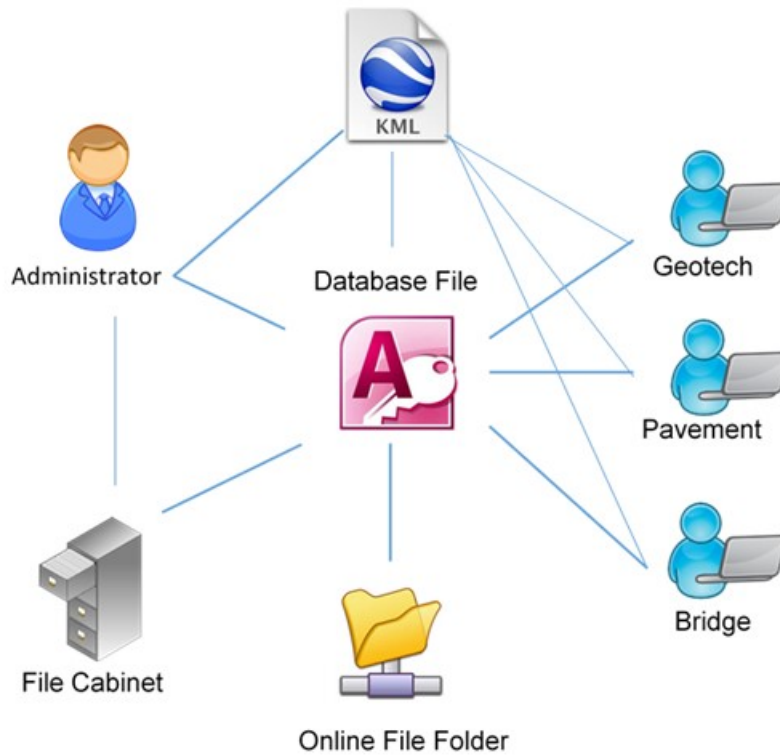


Figure 6. Conceptual design of the database

The access database consists of four tables. The relationship between the tables are illustrated in Figure 7. The REPORT table stores all the catalog information of the geotechnical reports. The COUNTY Table and the PROJECT Table are used to provide a dropdown menu to help the administrator to enter these information. The WORK table stores all the typical works (for example, boring log, basic soil test, pavement coring, etc.) that may be involved in a geotechnical report and the corresponding test standard. These information are useful when a user is just looking for a specific type of data available in a certain area.

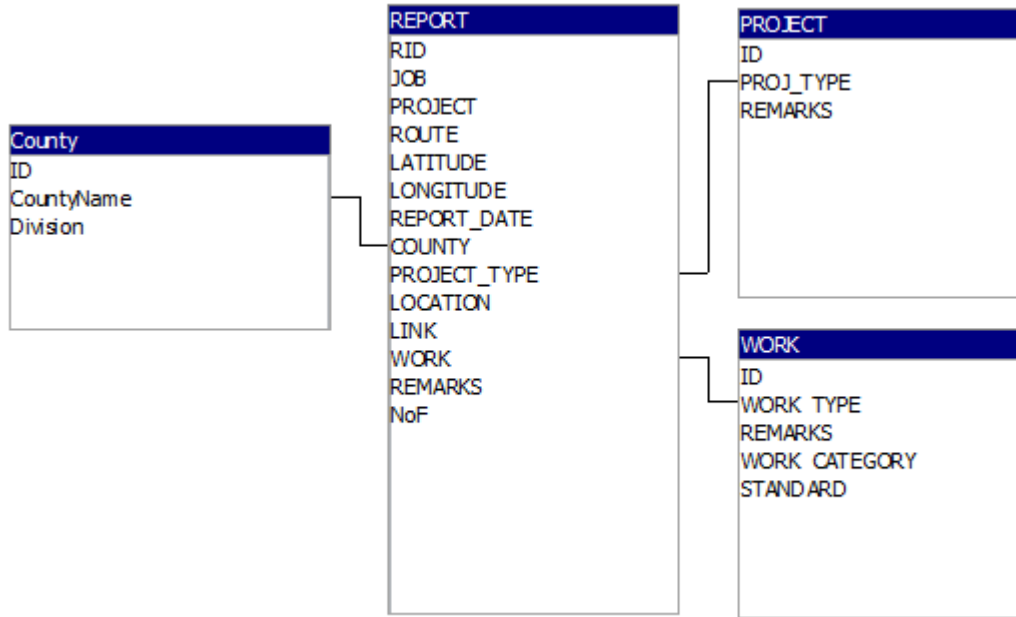


Figure 7. Tables in the database and their relationship

4.1.2 Catalog Information

Catalog information are the information entered by the administrator and maybe used as a search criterion by the user of the database. Table 3 lists the catalog information that are currently available in the database.

4.1.3 Project Type

Project type describes the nature of the geotechnical investigation which usually indicates the types of work involved in the report. For example, a landslide investigation is conducted after a landslide and may involve boring log, standard penetration test, basic laboratory soil tests, and a slope stability analysis. Eight project types are currently used in the database:

1. General Investigation
2. Foundation Investigation
3. Seepage Investigation
4. Cut Section Investigation
5. Landslide Investigation

6. Settlement Investigation
7. Pavement Investigation
8. Special Investigation

The first seven project types are selected by investigating about a hundred geotechnical reports that are provided by the material division at the beginning of the project. Any report that does not fall in any of the first seven types may be designated as a special investigation. This list can be further revised by the administrator by modifying the PROJECT table.

Table 3. Catalog information in the database

| Catalog Items | Description |
|----------------------|--|
| RID | A unique ID for each report automatically generated at the time of entry |
| JOB | Job piece number, for example, 16928(04) |
| PROJECT | State Project Number, for example, SSP-101A(052)SS |
| ROUTE | The route of the project, for example, US-59 |
| LATITUDE | Latitude of the project location |
| LONGITUDE | Longitude of the project location |
| REPORT DATE | The date on the report |
| COUNTY | County |
| PROJECT TYPE | Project type, for example, General Investigation |
| LOCATION | Detailed description of the exact location of the project |
| LINK | Link to the report folder on the network drive |
| NoF | Number of files available in the report folder |
| REMARKS | For making notes about a project |

4.1.4 Work Type

Work type is the specific work involved in a geotechnical investigation. Each geotechnical report may involve a combination of field work, laboratory work, and some analysis work. Twenty six work types are currently available in the database as shown in Figure 8. The boring log and

basic soil testing are the default work types when entering new report information into the database.

The image displays a software interface with three distinct sections, each containing a grid of buttons for selecting work types. The 'Field Work' section includes buttons for Boring Log, FWD, In-situ Moisture, SPT/TCP, LWD, In-situ Density, CPT, DCP, Seismic Refraction, DMT, Pymt Coring, and Plate Load Test. The 'Lab Work' section includes buttons for Basic Soil, UC, Mr, Triaxial, Point Load, Proctor, Direct Shear, Slake Durability, Consolidation, Collapse, Resistivity, and Soluable Sulfate. The 'Analysis' section includes buttons for Settlement Analysis and Slope Stability Analysis.

| Field Work | Lab Work | Analysis |
|--------------------|------------------|--------------------------|
| Boring Log | Basic Soil | Settlement Analysis |
| FWD | UC | Slope Stability Analysis |
| In-situ Moisture | Mr | |
| SPT/TCP | Triaxial | |
| LWD | Point Load | |
| In-situ Density | Proctor | |
| CPT | Direct Shear | |
| DCP | Slake Durability | |
| Seismic Refraction | Consolidation | |
| DMT | Collapse | |
| Pymt Coring | Resistivity | |
| Plate Load Test | Soluable Sulfate | |

Figure 8. Work types available in the database

4.2 DATABASE DEVELOPMENT

In order to create a user-friendly interface, all the administrator and user functions were programmed into a number of forms. A form allows users to access the information in the database in an environment similar to a regular Windows program.

Figure 9 shows a screenshot of the “Main” form, which is loaded by default when the database file is opened. In this form, the users can browse all report data or use some criteria (county, route, project time, and work) to narrow down the number of reports shown in the window.

By clicking on the RID field of an entry, the user can view the details of the report including all the catalog information and a map to show the location of the project in a popup form named "DATAVIEW", as shown in Figure 10. The users can then click the "OPEN FOLDER" button to access the PDF report file(s) if it is available.

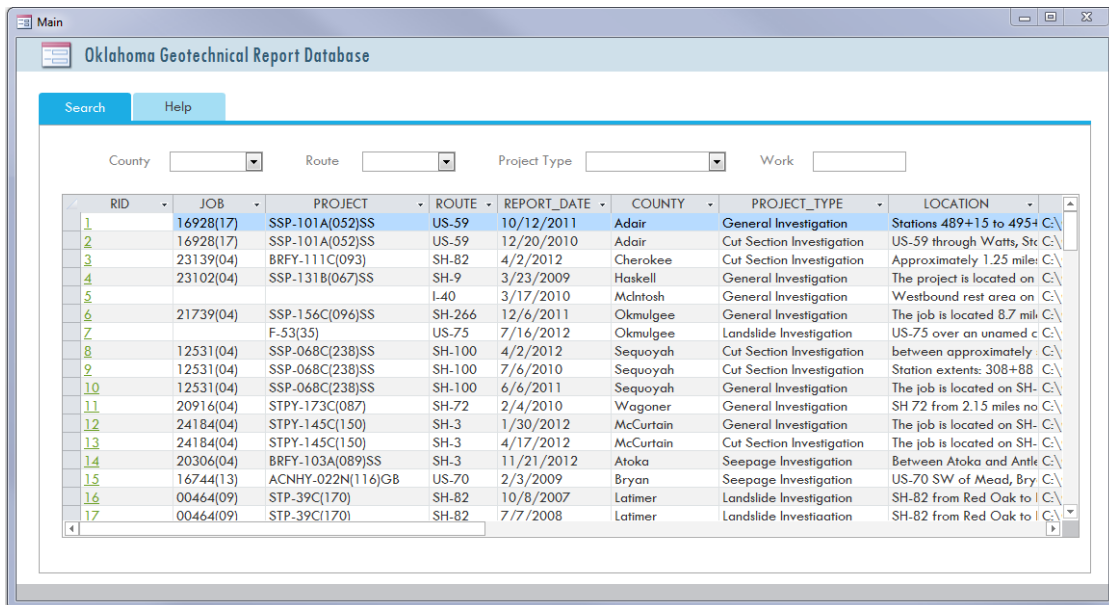


Figure 9. Main form

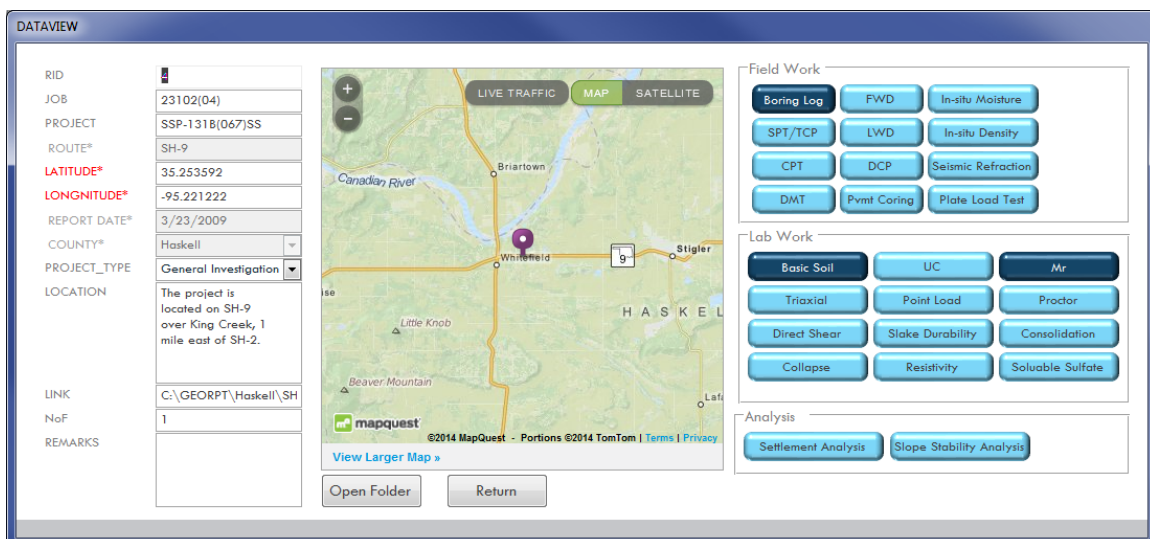


Figure 10. DataView form

The data entry tab (Figure 11) in the “Main” form is invisible to the user but can be unlocked by a 4-digit PIN number of administrator. This form allows the administrator to enter new report information into the database. On entering a new record, a folder for the project will be created on the network hard drive of the material division. One or more report files can be copied to folder by clicking the “Attach File” button at the bottom of the form.

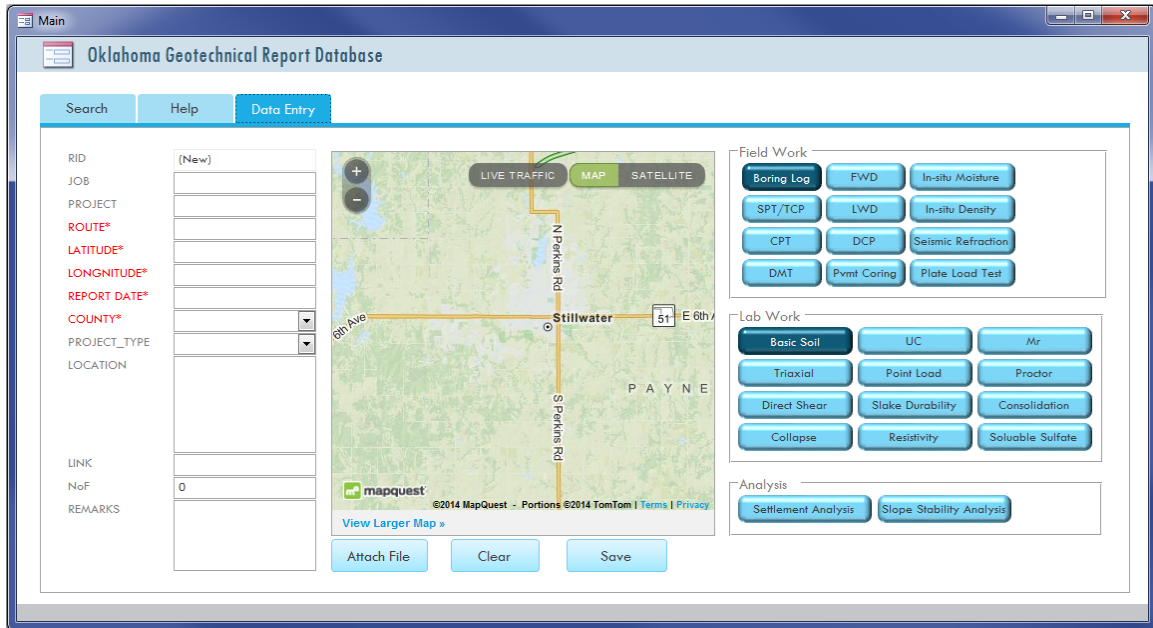


Figure 11. Data entry tab

For the development and demonstration purposes, the information of a total of 101 reports (all in PDF) have been entered into the prototype geotechnical report database. These reports were provided by the material division at the beginning of the project.

5 SUMMARY AND RECOMMENDATIONS

5.1 SUMMARY

A prototype geotechnical report database have been developed in this study to allow easy report archiving and accessing in the department. The research team investigated the practice and recent development of other state DOTs and assessed the efficiency of the current file storage in the material division. The prototype database developed currently allows all computers under ODOT network to search and view about one hundred geotechnical reports in pdf format. The database was developed using Microsoft Access. However, the information in the database can also be accessed from an equivalent KML file using Google Earth, Google Map, ArcGIS desktop, ArcGIS explorer or other compatible programs. With the KML file, users can view all available reports on a state map and access the PDF reports by clicking the hyperlink on the map.

5.2 RECOMMENDATIONS

Compared to the total amount (more than 5,000) of archive geotechnical reports currently in the material division, only a small fraction of the reports have been entered into the database. The will not gain its full strength until it is populated with the data. Considering the amount and the current condition of the archive geotechnical reports, the following future work are recommended:

1. Re-organize the paper files of all the archive reports. It is recommended to use lateral file cabinets or shelves to store the paper files. The reports may be sorted by year first or without sorting but later on labeled with a sequential report ID (RID) generated by the geotechnical report database during the data entry.
2. Extract and enter the catalog information of the archive reports into the database. Use a label printer to create new labels on each report folder so that it is easy to search in the future. The recommended format of labeling each file folder is "RID – County – Route - Year".
3. Digitize the archive geotechnical reports into PDF format. It is recommended to use Acrobat Professional which automatically applies optical character recognition (OCR) to

the scanned files. This will help the development of “search-within-file” functions in the future.

4. Continuously evaluate the database program and provide feedbacks to the development group at Oklahoma State University to improve the functionality of the database in the next few years.

6 REFERENCES

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7 APPENDIX SOFTWARE MANUAL

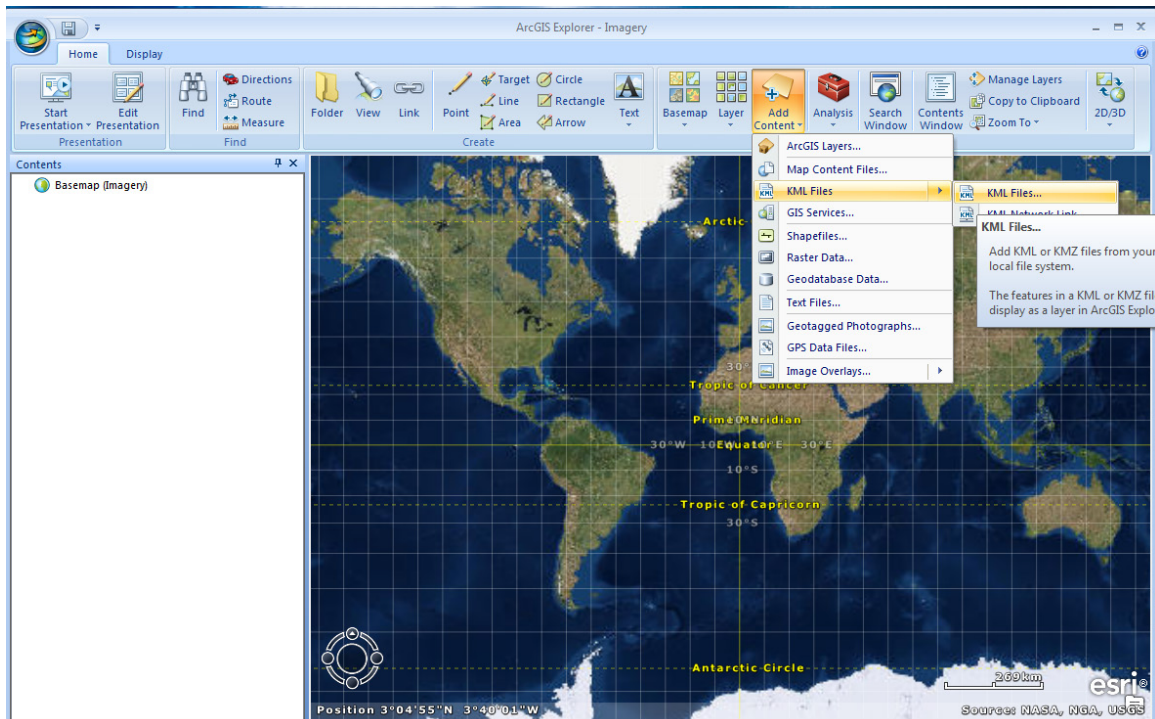
7.1 USER'S MANUAL

Users can access the information in the geotechnical report database through either (1) the KML (Keyhole Markup Language) file or (2) the database file. Both of the two files are located under the folder “Y:\geotechnical\GEORPT” in the material division network hard drive.

7.1.1 Use the KML file

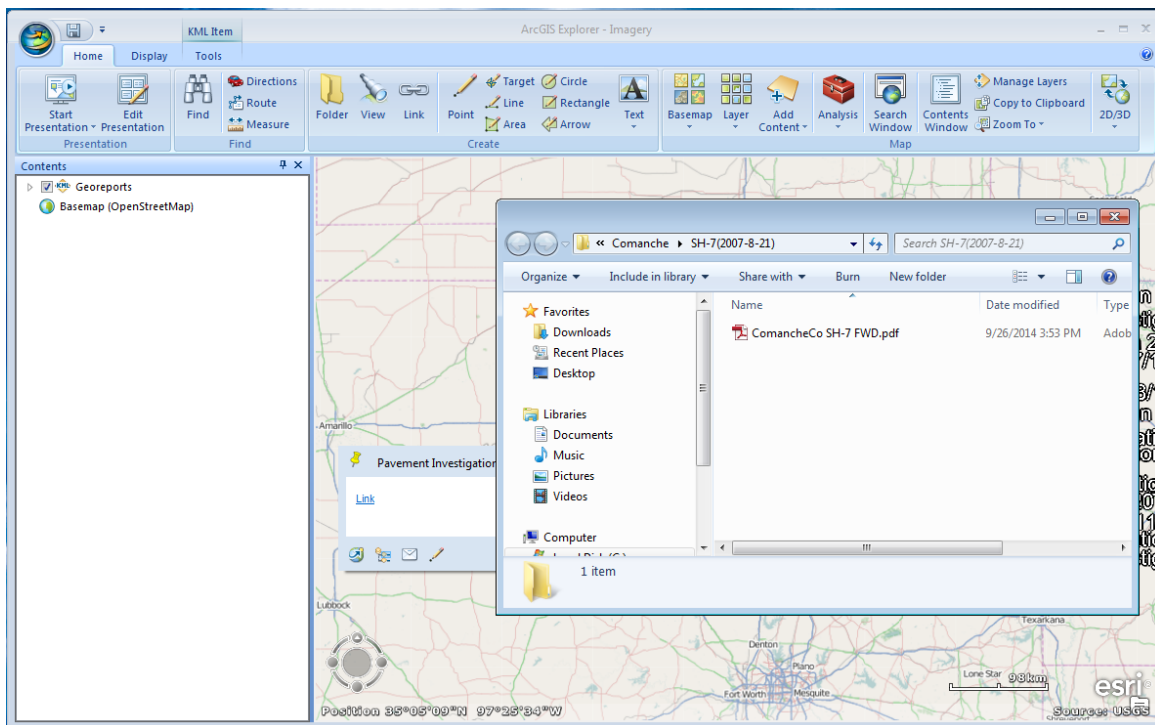
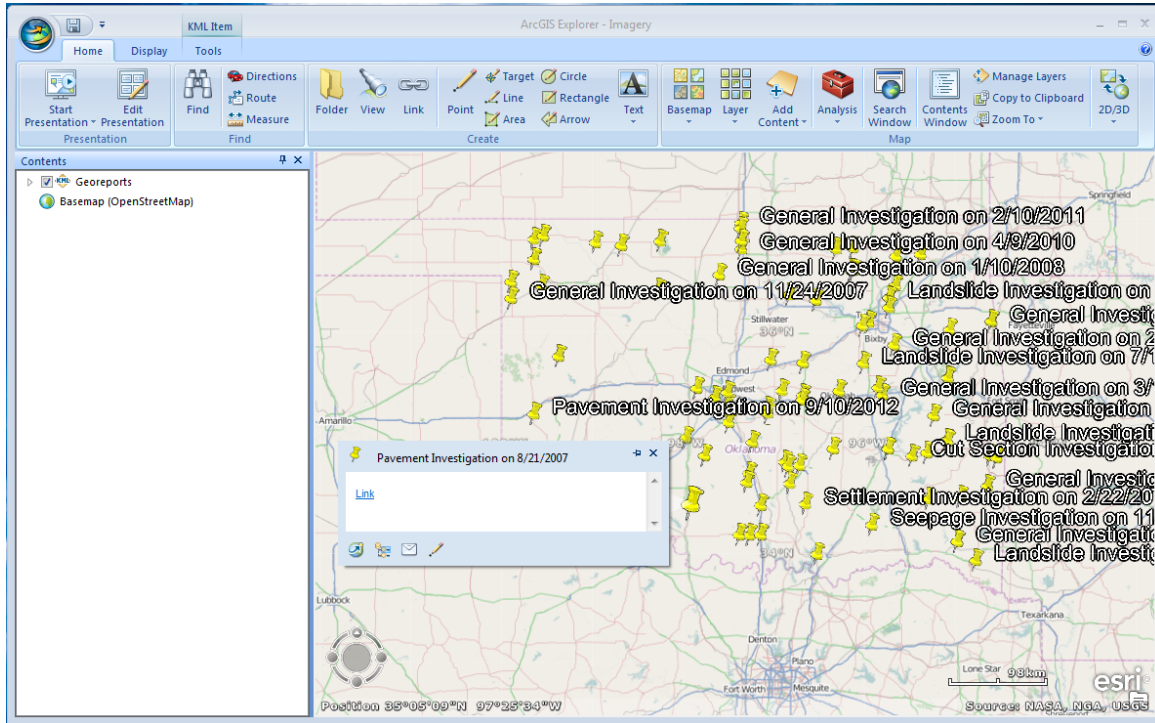
The KML file can be directly opened by applications such as Google Earth, ArcGIS desktop, and ArcGIS Explorer. The following contents demonstrates the use of ArcGIS Explorer, which is free to download from www.esri.com.

To import the KML file into the ArcGIS Explorer, click the “Add Content” Button and then select “KML Files” → “KML Files ...” from the dropdown menu. Then browse into the network folder from the popup window and select the “Georeports.kml” file.



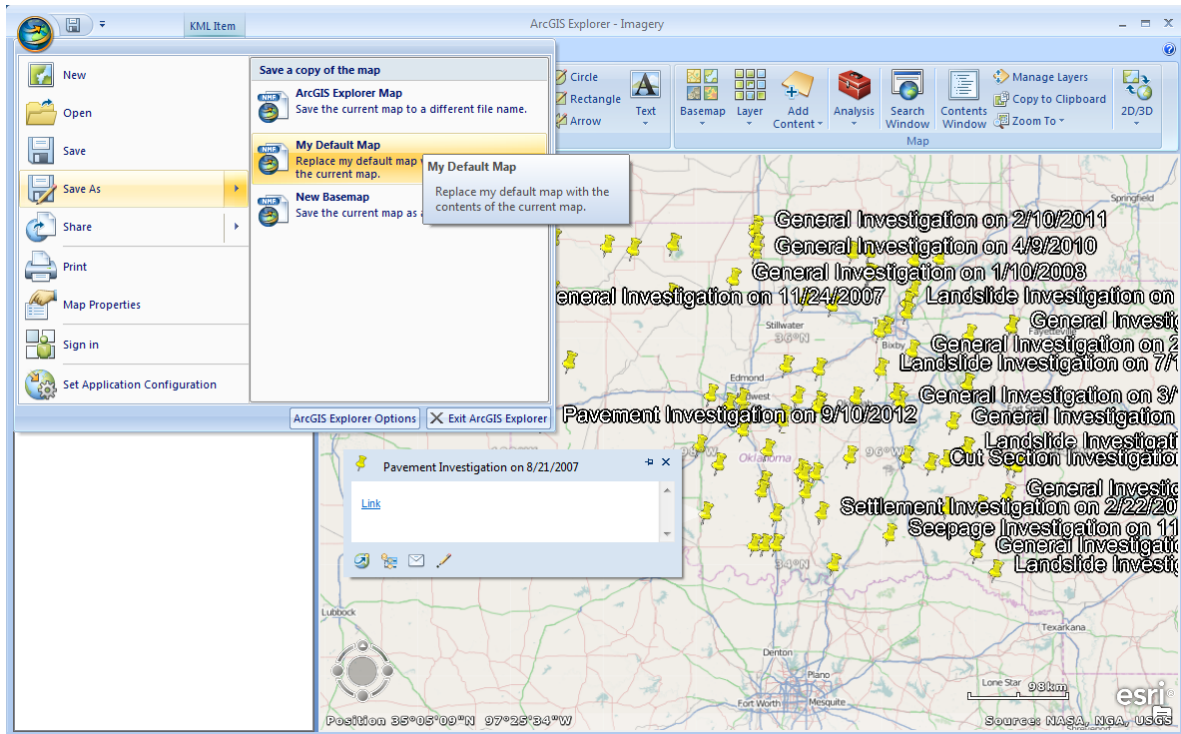
When the KML file is loaded into the current map, you can view the location of all existing geotechnical reports in the database. By default, they are marked by yellow pin symbols. Now zoom into the location of interest to check if there is an existing report. Click on the yellow pin to

open a popup window titled with the project type and the date of report. The text “Link” in the popup window provides a hyperlink to the report folder. If an empty folder is opened, that means the report has not been digitized yet.



You can also add other ArcGIS layers or shape files (for example, the county line) that are available in the department into the map to help the data searching. To do this, just click on the “Add Content” button and select the corresponding options.

You can also save the current map as the default map so that the most updated geotechnical report data is loaded every time you open the ArcGIS Explorer in the future.



A Google Earth user can simply drag the Georeports.kml file into the Google Earth window to open the KML file.

7.1.2 Use the Access file

The Microsoft Access database file “Database1.0.accdb” provides more options for searching geotechnical reports based on the catalog information. Double click the file to open it in Microsoft Access. By default the “Main” form should be loaded.

There are two tabs in the “Main” form. The “Search” tab provides all user functions of browsing and searching information. The current database allows users to search reports by county, route, project type, and work type. The “Help” tab provides a brief introduction about the database and its basic functions.

Oklahoma Geotechnical Report Database

Search Help

County Route Project Type Work

| RID | JOB | PROJECT | ROUTE | REPORT_DATE | COUNTY | PROJECT_TYPE | LOCATION |
|-----|-----------|-------------------|--------|-------------|-----------|---------------------------|--------------------------------|
| 1 | 16928(17) | SSP-101A(052)SS | US-59 | 10/12/2011 | Adair | General Investigation | Stations 489+15 to 495+4 C:\ |
| 2 | 16928(17) | SSP-101A(052)SS | US-59 | 12/20/2010 | Adair | Cut Section Investigation | US-59 through Watts, Str C:\ |
| 3 | 23139(04) | BRFY-111C(093) | SH-82 | 4/2/2012 | Cherokee | Cut Section Investigation | Approximately 1.25 mile C:\ |
| 4 | 23102(04) | SSP-131B(067)SS | SH-9 | 3/23/2009 | Haskell | General Investigation | The project is located on C:\ |
| 5 | | | I-40 | 3/17/2010 | McIntosh | General Investigation | Westbound rest area on C:\ |
| 6 | 21739(04) | SSP-156C(096)SS | SH-266 | 12/6/2011 | Okmulgee | General Investigation | The job is located 8.7 mil C:\ |
| 7 | | F-53(35) | US-75 | 7/16/2012 | Okmulgee | Landslide Investigation | US-75 over an unamed c C:\ |
| 8 | 12531(04) | SSP-068C(238)SS | SH-100 | 4/2/2012 | Sequoyah | Cut Section Investigation | between approximately C:\ |
| 9 | 12531(04) | SSP-068C(238)SS | SH-100 | 7/6/2010 | Sequoyah | Cut Section Investigation | Station extents: 308+88 C:\ |
| 10 | 12531(04) | SSP-068C(238)SS | SH-100 | 6/6/2011 | Sequoyah | General Investigation | The job is located on SH- C:\ |
| 11 | 20916(04) | STPY-173C(087) | SH-72 | 2/4/2010 | Wagoner | General Investigation | SH 72 from 2.15 miles no C:\ |
| 12 | 24184(04) | STPY-145C(150) | SH-3 | 1/30/2012 | McCurtain | General Investigation | The job is located on SH- C:\ |
| 13 | 24184(04) | STPY-145C(150) | SH-3 | 4/17/2012 | McCurtain | Cut Section Investigation | The job is located on SH- C:\ |
| 14 | 20306(04) | BRFY-103A(089)SS | SH-3 | 11/21/2012 | Atoka | Seepage Investigation | Between Atoka and Antle C:\ |
| 15 | 16744(13) | ACNHY-022N(116)GB | US-70 | 2/3/2009 | Bryan | Seepage Investigation | US-70 SW of Mead, Bry C:\ |
| 16 | 00464(09) | STP-39C(170) | SH-82 | 10/8/2007 | Latimer | Landslide Investigation | SH-82 from Red Oak to C:\ |
| 17 | 00464(09) | STP-39C(170) | SH-82 | 7/7/2008 | Latimer | Landslide Investiaaion | SH-82 from Red Oak to C:\ |

Simply select options from the dropdown menu and/or input work type (such as SPT). The reports list in the form should automatically update. For example, two landslide investigation reports are found in Latimer County that has standard penetration test (SPT) data. Note that the work type input is not case-sensitive and does not require an exact match of the whole term in the database.

Oklahoma Geotechnical Report Database

Search Help Data Entry

County Route Project Type Work

| RID | JOB | PROJECT | ROUTE | REPORT_DATE | COUNTY | PROJECT_TYPE | LOCATION |
|-----|-----------|--------------|-------|-------------|---------|-------------------------|-------------------------------|
| 17 | 00464(09) | STP-39C(170) | SH-82 | 7/7/2008 | Latimer | Landslide Investigation | SH-82 from Red Oak to I C:\GE |
| 18 | 00464(09) | STP-39C(170) | SH-82 | 3/31/2008 | Latimer | Landslide Investigation | SH-82 from Red Oak to I C:\GE |

Now click the RID field to view the details of any report. The work involved in this investigation are highlighted in darker color on the right side of the form. The location of the project is marked out in a map (internet connection is required for the map to work).

DATAVIEW

| | |
|--------------|--|
| RID | 17 |
| JOB | 00464(09) |
| PROJECT | STP-39C(170) |
| ROUTE* | SH-82 |
| LATITUDE* | 35.034429 |
| LONGNITUDE* | -95.07931 |
| REPORT DATE* | 7/7/2008 |
| COUNTY* | Latimer |
| PROJECT_TYPE | Landslide Investigatio |
| LOCATION | SH-82 from Red Oak to Lequire, about 7 miles north of Red Oak, Latimer county. |
| LINK | C:\GEORPT\Latimer\SH |
| NoF | 1 |
| REMARKS | Slide 1 |

Map: MapQuest showing location near Lequire, Long Mountain, and Red Oak. Includes 'View Larger Map', 'Open Folder', and 'Return' buttons.

Field Work

- Boring Log
- FWD
- In-situ Moisture
- SPT/TCP
- LWD
- In-situ Density
- CPT
- DCP
- Seismic Refraction
- DMT
- Pvmt Coring
- Plate Load Test

Lab Work

- Basic Soil
- UC
- Mr
- Triaxial
- Point Load
- Proctor
- Direct Shear
- Slake Durability
- Consolidation
- Collapse
- Resistivity
- Soluable Sulfate

Analysis

- Settlement Analysis
- Slope Stability Analysis

Now you can access the PDF report file (if available) by clicking the “Open Folder” button. If the report is not interested, click the “Return” button to return to the “Main” Form

DATAVIEW

| | |
|--------------|--|
| RID | 17 |
| JOB | 00464(09) |
| PROJECT | STP-39C(170) |
| ROUTE* | SH-82 |
| LATITUDE* | 35.034429 |
| LONGNITUDE* | -95.07931 |
| REPORT DATE* | 7/7/2008 |
| COUNTY* | Latimer |
| PROJECT_TYPE | Landslide Investigatio |
| LOCATION | SH-82 from Red Oak to Lequire, about 7 miles north of Red Oak, Latimer county. |
| LINK | C:\GEORPT\Latimer\SH |
| NoF | 1 |
| REMARKS | Slide 1 |

Map: MapQuest showing location near Lequire, Long Mountain, and Red Oak. Includes 'View Larger Map' and 'Open Folder' buttons.

Field Work

- Boring Log
- FWD
- In-situ Moisture
- SPT/TCP
- LWD
- In-situ Density
- CPT
- DCP
- Seismic Refraction
- DMT
- Pvmt Coring
- Plate Load Test

Lab Work

- Basic Soil
- UC
- Mr
- Triaxial
- Point Load
- Proctor
- Direct Shear
- Slake Durability
- Consolidation
- Collapse
- Resistivity
- Soluable Sulfate

Analysis

- Settlement Analysis
- Slope Stability Analysis

Windows Explorer: C:\GEORPT\Latimer\SH. File: LatimerCo SH-82 Slide1.pdf (7/31/2014 10:05 AM, Adobe PDF). 1 item.

To perform another search or clear the already input criteria, simply click the “Search” tab. The tab will reload and all the search criteria are now cleared.

7.2 ADMINISTRATOR'S MANUAL

The administrator of the database can perform all user functions such as searching and accessing geotechnical reports. Refer to the User's Manual for help on these functions. The functions that are restricted to the administrator are (1) adding a new record and (2) editing and deleting an existing record from the database.

7.2.1 Add a New Record

First, locate the Microsoft Access database file "Database1.0.accdb" under the folder "Y:\geotechnical\GEORPT\" in the material division network hard drive and open it.

To unlock the "Data Entry" tab, go to the "Help" tab and input the 4-digit PIN number in the PIN field. Then click the "Unlock" button. Now a third tab named "Data Entry" should show after the "Help" tab.

The screenshot shows a web browser window titled "Main" displaying the "Oklahoma Geotechnical Report Database" application. The interface has a top navigation bar with "Search" and "Help" tabs. The "Help" tab is active, showing a "User's Guide" on the left and "For Administrators" on the right. The "User's Guide" contains a welcome message and instructions for users. The "For Administrators" section includes a "Database Status" table, a PIN input field with an "Unlock" button, and a "Create a KML File" button.

| Database Status | |
|-------------------------------|-----------|
| Number of Report Records: | 101 |
| Number of Counties with Data: | 44 |
| Number of PDF Report Files: | 105 |
| Last Modified on: | 11/7/2014 |

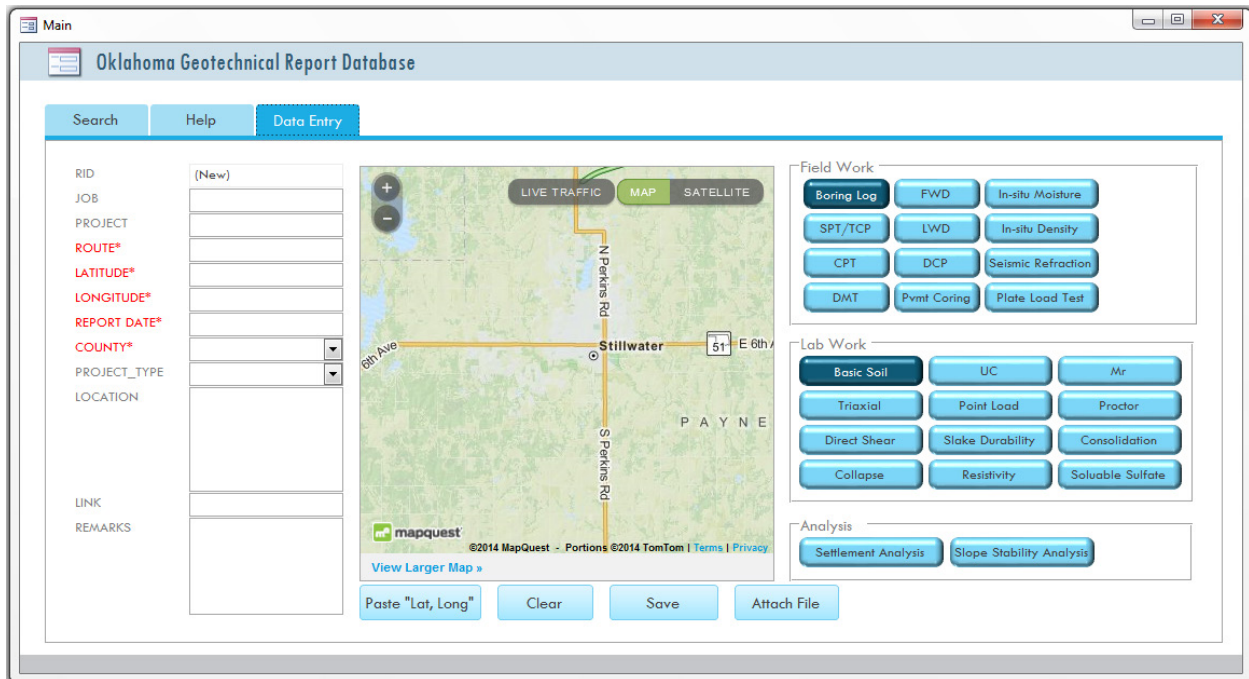
Input the PIN to Enable Data Editing

PIN:

Create a KML File to the GEORPT Folder

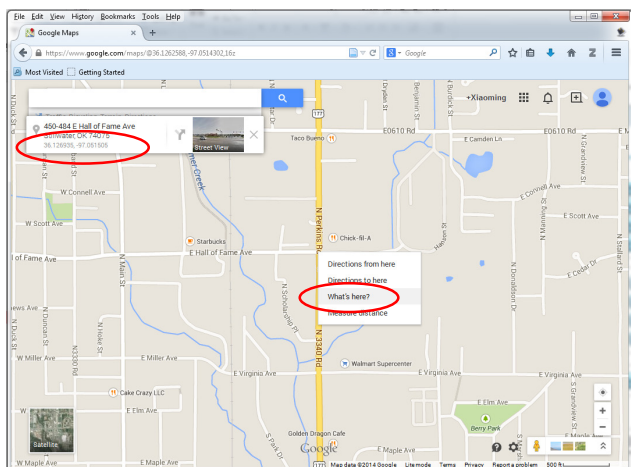
On load, all the catalog information fields in the form should be blank and the map should be centered at the current location of the computer. Two work types (Boring Log and Basic Soil) are highlighted by default because they are commonly performed in most of the investigation.

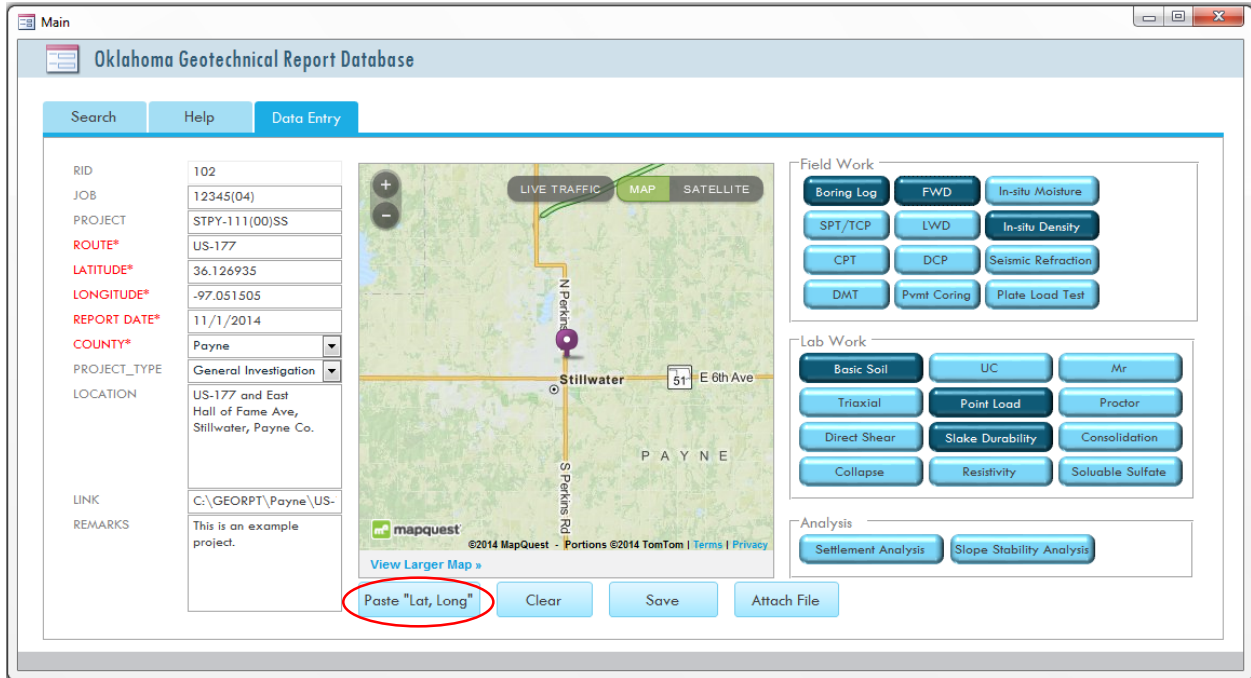
Now start to input the catalog information of the report. The four red colored fields must be filled accurately, and the other fields are either optional or calculated automatically.



The longitude and the latitude should be found manually from Google map or other map service websites. For example, in google map, zoom into the location of the project, right click on the location and select “What’s here?” The latitude and longitude value should show up on the upper left Corner of the window. Now you can copy the two numbers to the corresponding field in the “Data Entry” tab.

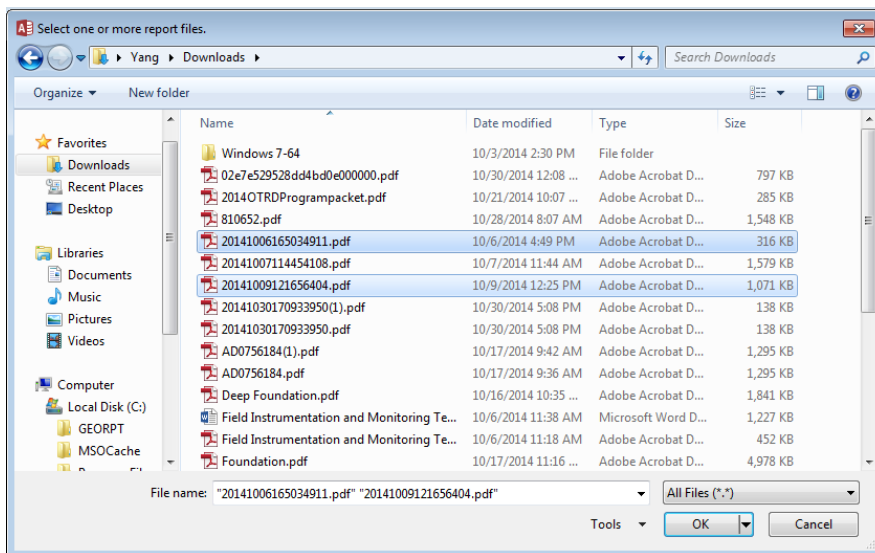
A slightly easier way to copy the coordinates is to copy the entire line of “36.126935, -97.051505” from the google map, and then click the ‘Paste “Lat, Long” ’ button on the database form. This button will run a function which breaks the “lat, long” string in to latitude and longitude numbers and paste them to the corresponding fields.



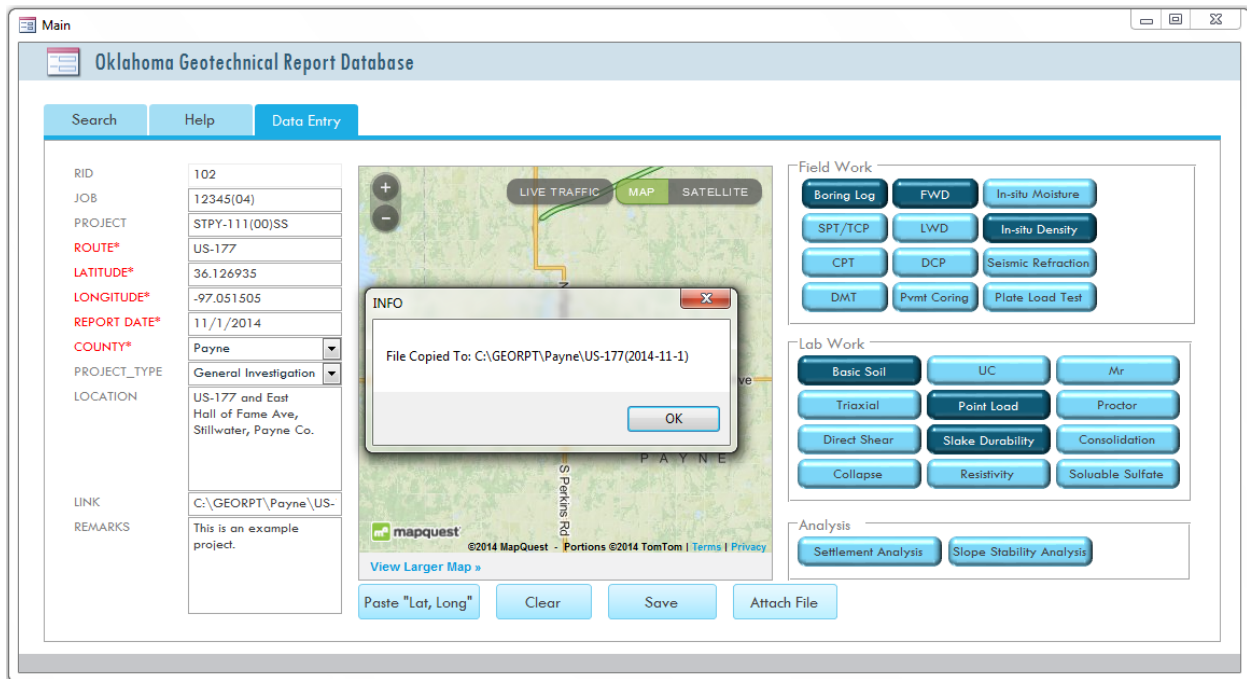


After inputting all the catalog information of a report, highlight all the work involved in the report by click the toggle buttons on the right side of the window. Highlighted buttons are shown in a darker background color. These information are helpful for future search.

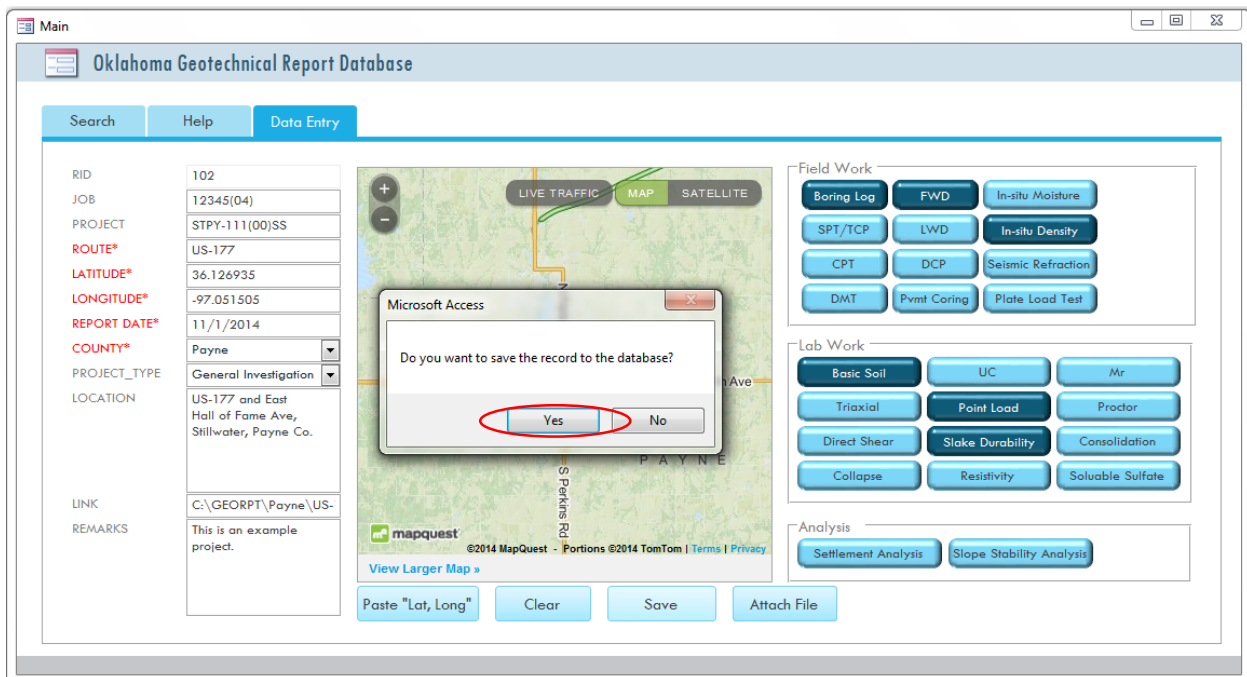
If electronic report files are available, click the “Attach File” button and then select the report file(s) from the popup window. Then click “OK”.



Now a confirmation message should appear which shows the files have been copied to a folder that is named by the county, route, and date of the report.



Next, double check all the input information and click “Save”, and then confirm your action by click “Yes”. The new report record is now saved into the database. And the “Data Entry” tab is now reset.



7.2.2 Edit or Delete an Existing Record

To edit or delete an existing record, first make sure the administrator function is unlocked by input the 4-digit PIN into the “Help” tab.

Then go to the “Search” tab and navigate to the record you want to edit or delete. Click the “RID” field of the record to open the “DataView” form. Since the administrator PIN has been entered, the information shown in the form becomes editable.

| RID | JOB | PROJECT | ROUTE | LATITUDE | LONGITUDE | REPORT_DATE | COUNTY | PROJECT_TYPE |
|-----|-----------|--------------------|--------|-----------|------------|-------------|--------|--------------------------|
| 93 | 25779(04) | ERSTPY-166A(223)ER | SH-20 | 36.308658 | -95.712881 | 5/10/2008 | Rogers | Landslide Investigation |
| 94 | 25779(04) | ERSTPY-166A(223)ER | SH-20 | 36.308658 | -95.712881 | 9/8/2008 | Rogers | Special Investigation |
| 95 | 25779(04) | ERSTPY-166A(233A) | SH-20 | 36.307344 | -95.709963 | 5/31/2012 | Rogers | Landslide Investigation |
| 96 | 25779(04) | ERSTPY-166A(223A) | SH-20 | 36.307344 | -95.709963 | 8/9/2010 | Rogers | Landslide Investigation |
| 97 | 25779(04) | ERSTPY-166A(223)ER | SH-20 | 36.308658 | -95.712881 | 7/28/2008 | Rogers | Landslide Investigation |
| 98 | 25779(04) | ERSTPY-166A(223)ER | SH-20 | 36.308658 | -95.712881 | 9/22/2008 | Rogers | Landslide Investigation |
| 99 | | | US-66 | 36.218829 | -95.715584 | 4/16/2009 | Rogers | Seepage Investigation |
| 100 | 06374(50) | IMY-044-2(402)227 | I-44 | 36.089864 | -95.940097 | 8/17/2009 | Tulsa | Special Investigation |
| 101 | 12938(04) | NHY-014N(048) | US-75 | 36.061035 | -96.006642 | 12/7/2009 | Tulsa | Settlement Investigation |
| 102 | 12345(04) | STPY-111(00)SS | US-177 | 36.126935 | -97.051505 | 11/1/2014 | Payne | General Investigation |

RID: 102

JOB: 12345(04)

PROJECT: STPY-111(00)SS

ROUTE*: US-177

LATITUDE*: 36.126935

LONGITUDE*: -97.051505

REPORT DATE*: 11/1/2014

COUNTY*: Payne

PROJECT_TYPE: General Investigation

LOCATION: US-177 and East Hall of Fame Ave, Stillwater, Payne Co.

LINK: C:\GEORPT\Payne\US-

LAST_MODIFIED

REMARKS: This is an example project.

View Larger Map »

Open Folder Return Delete This Record

Field Work

Boring Log FWD In-situ Moisture

SPT/TCP LWL In-situ Density

CPT DCP Seismic Refraction

DMT Pvmt Coring Plate Load Test

Lab Work

Basic Soil UC Mr

Triaxial Point Load Proctor

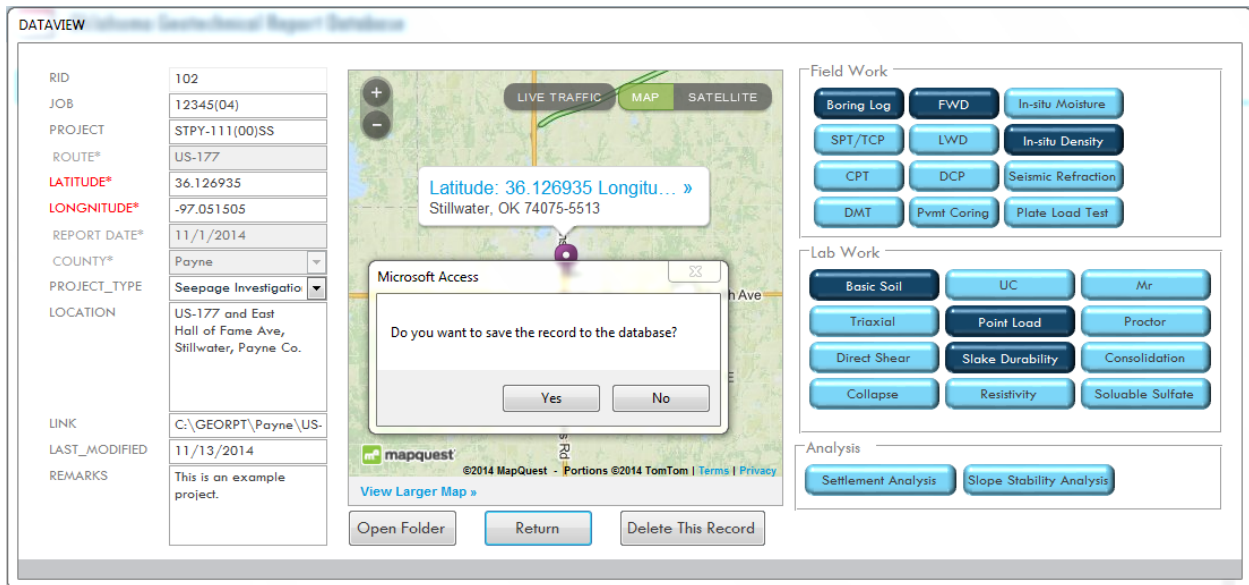
Direct Shear Slake Durability Consolidation

Collapse Resistivity Soluable Sulfate

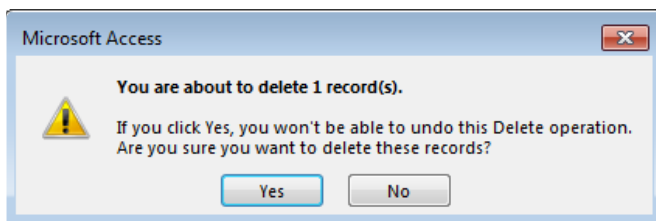
Analysis

Settlement Analysis Slope Stability Analysis

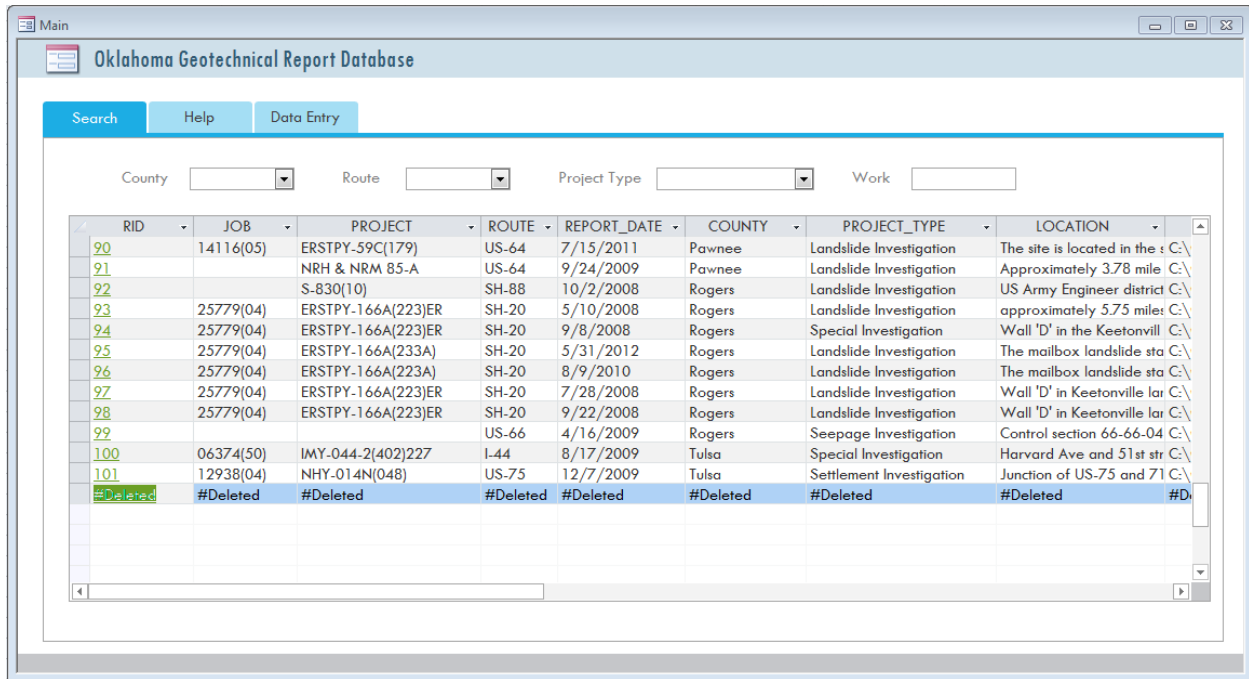
When any of the information is changed, a confirmation window will show to ask whether to save the change or not. Click “Yes” to save the change or “No” to cancel the change.



To delete the record, simply click the “Delete This Record” button at the bottom of the form, and confirm the action in a popup window. This action will delete the record from the database and also the associated report folder on the network hard drive.

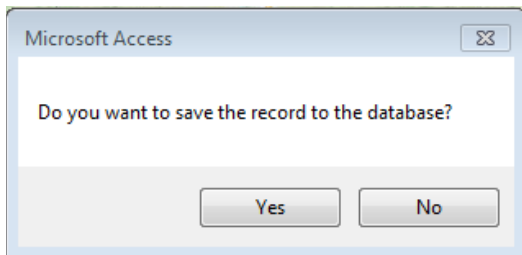


The “Search” tab should now show a row of “Deleted” fields. This row should disappear the next time you load the “Search” tab.



To edit the record, just make changes on the “Data Entry” form. Since the administrator PIN has been entered, all the fields (except the calculated ones) in the form should be editable.

When you click the “Return” button at the bottom of the form, the program will detect if there are any changes made by you. If so, a confirmation message should show. Click “Yes” to save the changes, or “No” to cancel the changes.



7.2.3 Create a KML File

In the “Help” tab, some general information about the data is shown in the “Database Status” box, including the current number of report records, the number counties that has at least one report, the number of pdf reports in the database folder, and the last date the dataset was modified. The last two numbers helps the administrator detect accidental loss of file and unrecognized changes to the database.

It is recommended that the administrator click on the “Create a KML File” button to update the KML file with the latest changes in the database. By clicking this button, a new KML file named “Georeports.kml” will replace the original one in the database folder.

