Interviews Summary

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

Geotechnical Data Management System User Needs Interviews Summary

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Introduction

The Ohio Department of Transportation (ODOT) Office of Geotechnical Engineering (OGE) has initiated a project with the purpose of providing a comprehensive data management system for geotechnical data. Geotechnical investigations are routinely required for planning, construction support, emergency response, and design on all ODOT projects involving structures and roadway construction. This process generates an enormous amount of data of significant value to a broad geotechnical engineering and construction community. A geotechnical data management system (GDMS) is needed to provide a centralized hub that will incorporate archived data, geologic hazard inventories, ranking matrices, and remediation cost with boring logs, laboratory test results, and technical application software. Ultimately, the data management system will enable internal and external customer access to search, input, and export geotechnical information through a secure geographic information system (GIS) application for planning, design, cost-benefit analysis and modeling support monitoring.

Since a successful project should address the needs of the existing and potential users, it is of a primary concern that those needs be clearly identified. GeoDecisions conducted on-site interviews with a cross-section of ODOT personnel and external users. The purpose of the interviews was to solicit users’ expectations, suggestions, applications, and objectives for using geotechnical data. In addition to the on-site interviews, telephone interviews were conducted with a selected set of users that were unable to attend scheduled interviews.

This report provides a summary of the interviews. The information collected in the interviews is being further analyzed and will be used in the project Assessment Report, the final deliverable of the project.
Geotechnical Data Management System
User Needs Interviews Summary

Interviews Summary

General Overview Questions

The interview participants were asked about their job functions. They described what their units or organization did, and what they did. They described whether they worked directly or indirectly with geotechnical processes and information, and what they did with the information. They described the types of geotechnical information they used, and how they used it. Finally, they were asked what potential applications could be applied to the data that would take them to the “next level” in performance.

The interview participants were generally of three categories. The first category was the ODOT employees who work directly and predominantly with geotechnical processes and information. The second was ODOT employees who make use of geotechnical information as part of their jobs. The third was people from other organizations, who could be a potential outside user group of an ODOT GDMS.

Current Use of Information

The interview participants described their specific use of geotechnical information, and what types of information they used or would like to use. The boring log information was mentioned most frequently; nearly all participants would make use of this information (or knew of a use for it if not part of their direct job function). Participants were also asked about their use of any geotechnical or related software, with no consensus apparent on software usage.

Nearly all participants were information users. The ODOT drilling and lab data creators were interviewed and provided details on the data manipulation process. Most information is in hard copy form. Some logs and other information are supplied in CAD format. The ODOT GQL database, test database, and archiving efforts represent the majority of information in a system-capable format.

Consistency among data was mentioned by several as being important. There needs to be commonality among terms and measures used for geotechnical information, to facilitate proper and wide usage of the information. Referencing systems need to facilitate present coordinate information as well as the ODOT linear referencing system.

GDMS Applications, Perceptions, and Organization

The interview participants were asked to discuss their ideas and needs for the GDMS. This included specific data they would like the system to host and functionality or applications it should provide. They were also asked to provide information about how the system would benefit their jobs, and what benefits it may provide to those that they serve. The participants were also asked what kinds of barriers they saw to a successful implementation of the system.
Boring or drilling data and log information was the most commonly mentioned data item. Generally, interviewees wanted to be able to access the data for drillings/borings, including the actual coordinate location, elevation, drilling/boring notes and data, and lab test data results. Many wanted to be able to select specific areas or groups of borings, and download the data for their own analysis. Landslide, rockfall, and underground mine information was requested to a lesser extent. Specific applications or functions were not mentioned frequently, other than the general ability to search for and view information. Most of the participants would use the system in reviewing or planning potential project work. Depending on the accuracy and reliability of existing data, there should be potentially significant cost savings on future work.

Many participants mentioned benefits and barriers, providing very good information to build a business case for the system. Some of the benefits included:

- Better estimates of work efforts, resulting in more reliable prices and budgets.
- Reduction of extra work on projects.
- Reduction of downtime.
- Better geohazard potential planning.
- Reduction of time spent in finding information (two hours versus two days).
- Improved quality – by perhaps allowing users to be sure they are not going to miss a potential problem.
- Improved information and methodology exchange through standardization.
- Decrease in the cost and increase in the timeliness of the Ohio Department of Natural Resources’ (ODNR’s) geology mapping.
- Improved confidence in knowing that no existing data was “missed”.

Some of the barriers included:

- Cost for equipment and technology.
- Communicating to managers the needs of the system and technical aspects required.
- Lack of support for data sharing between agencies or technical challenges to make it happen.
- Staff time required for the system.
- Cost to convert existing data.
- Compatibility of different data sets.
- Standardization of terminology is a challenge; eventually everyone needs to enter data without re-interpretations needed.
- Quality Assurance/Quality Control (QA/QC) of past data.
- Limits in resources for increasing the exact location of boring samples.
- Need for correction location information, based on a linear distance system instead of on a geographic/projection system.
- Changes in road names/numbers and alignments resulting in linear reference system changes; old project references no longer match to proper place on road.
- Uncertainty in extent of geotechnical information collected by Districts.
Interview 1: Geotechnical Design Section

Participants: Rick Ruegsegger, Bill Christensen, Chris Merklin, Kirk Beach

The Geotechnical Design Section is a division of Planning; formerly under Construction Management. This section handles all design and operations, including drill testing and drafting, and creating plans and procedure documents. The Design Section responds to geohazards such as landslides, mine subsidences, and rockfalls. This section also reviews design plans such as noise walls, retaining walls, and culvert foundations (except for bridge structures).

Over 80 percent of the construction data that is collected is done by consultants, while only 20 percent is generated by ODOT operations. In the past this number was reverse. The 80 percent of data collected by consultants goes directly to the Districts.

As a section, Design staff set policy and procedures, e.g., education of investigation standards or policy on inventories. They wish to establish standard procedures through manuals and technical bulletins. Established manuals include pipeline procedures and methods to standardize methods and communicate among the District Offices and the Central Office.

Project work currently takes precedence but policy issues are where they would like to focus their time. There is a decentralization of work in ODOT and a need to delegate to the Districts. To have all the Districts collect data in a similar manner, the Design Section must set policy that seems reasonable to everyone and make the policy detailed enough to establish methodology.

ODOT has data that goes back as far as the 1920s. There has been a recent effort to scan the cards for the boring logs. ODOT is moving into production scanning (using county, stations, and offset numbers: FRA – 270 – 13.46) to add each of the cards as tiff images. The card files provide reference to the location of the associated reports for previous ODOT projects.

A GQL database was established for the project cards and can perform a query on 18 of the 37 fields. Only 18 of the fields were included in the database and the rest are available on viewing the scanned card. Of the 18 fields that can be queried, project type, data, county, route, section, number of boring logs, total feet of boring, number of samples, and comment fields are extremely valuable.

A viewing package for the scanned cards has not been determined. ODOT was looking into Falcon software from TSA-Advet.

ODOT would like to scan all existing geotechnical documents into electronic format. The future intent is to capture all data electronically and remove the need to produce and maintain cards.

The majority of the documents collected at the District Offices are not sent to the Central Office. Boring logs are only maintained at the District Offices and purged after five to seven
years to save storage space. Current policy does not require the Districts to send copies to the Central Office. The total amount of geotechnical data being lost is unknown. There is not a total collection system established in any District office.

Districts 10 and 11 have some landslide inventories, but this format and use are different from other geotech inventory needs. These are mainly for maintenance/location and priority ratings for risk assessment.

The Central Office is still producing cards for the 20 percent of total data that is collected by ODOT. There is also a redundant entry of some of this data in the GQL database and central repository file.

The following describes a typical workflow of a search for background info for a project. The process generally requires one to two days for two to three people. The search is initiated by a call from a consultant or internally within ODOT. The physical location of the information is first retrieved from the card file. The card files are physically in a different building from the files. The Department can usually get the information (hard copy bore logs, etc.) back to the requestor in a day or two, depending on priority. Consultants are required to make these background checks, but travel, time, and limits in current organization often increase the possibility that data is not found. Changes in project referencing and filing can occur. For example, changes made to the county/route referencing system over the years can cause projects to “move” along the road from their original location. A search of projects for an area may not turn up these records due to the referencing change. Access to electronic bore logs could save time and money, and provide valuable reference material for project pre-planning. Consultants are currently required to photocopy the originals, and are sometimes permitted to take the originals with them, which threatens the security of the originals. Both methods are cause for concern regarding the original documents.

The majority of data being kept in the Districts is of unknown format to the central department. Of the data kept at Districts, the individual samples are often purged. The current rate for drilling is $90 per foot so the savings from using even one bore log from a previous sample could save time and money on new investigations. The data at the district offices is highly important, and typically the soils, geology, and hydrogeologic setting data are not in electronic format.

There is a need to have all of the consultant-collected data cataloged and saved so it can be searched.

Initial desire for the GDMS is to have access to the data via a Web-based system to be able to perform a review of existing information on a particular site. Day-to-day data entry should be performed by districts and pre-qualified consultants, and reviewed for QA/QC prior to incorporation with the main database at the Central Office. This data could be pushed to or pulled by other offices that collect similar data, such as the EPA office of water, ODNR Mineral Resource Management, and the Office of the Chief Engineer. Even a less detailed or more synthesized version of the data could benefit the public during alternative corridor review
processes or local planning efforts. Which data that are most appropriate for the general public to access should be considered.

There is a multitude of other data types that could be beneficial to ODOT and its consultants performing these investigations that would help in the understanding of the geotechnical situation for any given area. A checklist of the most important data resources will help to prioritize their integration with the system. The state will be completing the NRCS SSURGO soils in two years. ODNR is assisting with the electronic delineation of other geologic features on a quadrangle basis. ODNR will be responsible for maintaining these maps (bedrock and surficial geology maps, among others).

ODOT wishes to have 3D Analyst or similar viewing software for three-dimensional (3D) data modeling. ODOT currently uses RockWorks 2002, Visual MODFLOW, Surfer, Minitab, and a variety of other software products. No geotechnical specific software has been promoted.

Maintenance records can also be helpful in the geotechnical investigations, but they are limited in the Districts. How long the records are maintained is not known. Job diaries for construction are useful but hard to access. Time and materials records are maintained in each county garage. The amount of data in the Construction Management System is completely up to each engineer. The ability to inspect and store data both with standard methodology is desired.

**Interview 2: ODOT Perspective**

*Participants:* Randy Morris (Construction Management), Jawdat Siddiqi (Structures), and Jeff Wigdahl (Materials Lab)

The GDMS needs to be compatible with the Federal Highway Administration (FHWA) methodology. There also needs to be an effort to look at surrounding states to determine compatibility and see what the needs of each program are. This could include FHWA’s Synthesis Practice.

There is a need for data from adjacent states, especially for laterally loading members. As well, there is a need to have access to data for shared structures in a similar format to determine if a proposed plan is suitable. A multi-state database is most desirable. If something (method, material, etc.) worked elsewhere, or did not work, they should be able to use that information.

Field data collection should have a geographic component. Only station and offsets are used for recording information. GPS is used to a limited extent in drilling. Currently, the boring logs from these drillings are only recorded in the original x and y State Plane coordinate database and as annotation on the DGN file developed by ODOT.

Consistency and standards are important. Everyone needs to be using the same units.

The design group is trying to get the electronic versions of the plans from consultants. Currently they only receive a tiff image of the plan and not the CADD file itself. Other useful data such as
unconfined compression test results are in a variety of formats and not connected to the DGN file.

Other data such as grouting logs, dynamic loading tests, and re-strikes should all be available to the ODOT staff. It is only by having all of this data available that they can begin to understand correlations in the materials and their use.

Mine permit locations are also needed.

Some surrounding states can provide computerized data while others only provide information in text report form. The database being considered should be sure to list the equipment and methodology that was used during the testing. Standards in nomenclature should also be pursued. For example: nomenclature for strength tests needs to be consistent. Porosity is being used instead of mercury counts to provide mean pore size of aggregates. Do the results from each make sense in terms of what they are seeing in the tests? There is a need to know the chemical constitution of the stone for oxidation affects. These results can be used to determine correlations that can be critical for material planning and re-use.

The ultimate system is one that is GIS-supported, Web-based for access and emphasizes standard formats. The customers for construction estimates are the Districts. The correlation estimates can also be used by quarries to assess the quality of their material. The question is how data can be cross-referenced with other tests to paint the picture of what constitutes bad performance. Performance of any material is key to a successful project.

An example of data being collected that could be useful is pavement ratings. However, these data are only stored by changeable highway markers and really are only based on roughness and aggregates. Other more accurate tests may be needed for best correlation efforts.

It would also be beneficial to access the soil borings, but this data is currently stored in a number of locations and often lack the instructions and notes developed during construction.

As an example of the cost for not having the GDMS developed, there was a $10 million loss in the failure of a structure because this data was not made available. The priority to concentrate on is developing the model for currently collected data rather than placing efforts in historic data. Standardization of data collection and access issues should be top considerations.

Specifically, ODOT needs sub-foot accuracy for boring logs recorded, and the ability to link photo logs and all reports associated with the data collection and analysis. The boring locations need to be recorded as both geographic locations and station/offset.

ODOT has done some investigations into visualization using GeoMedia and ArcView modeling. 3D Analyst and Spatial Analyst would be useful. A spatial overlay would be especially useful in correlating chemistry data. There is a need to work more with chemical data (ODNR has some available).
The US Geological Survey (USGS) has also done work recently with 3D mapping of geologic materials along the Great Lakes region using a multi-layered system. Dr. Stone, of the USGS, has done this work. All of this information can be used to paint the picture of the actual results with the sediment predictions that were estimated. These correlations will help to make future predictions more accurate.

The GDMS should provide quick access to “see what is out there” and make initial redesigns for fatal flaws detected before time and money are spent with further efforts. In Indiana, there is a requirement to predrill a quarry site to see what is available. The results can also be used to direct the highest quality stone to be used for the more appropriate applications. This testing needs to be done on a non-compensatory/bias basis.

The construction input should have electronic diary entry to eliminate the CMS. It should cross-reference other data and have all data eventually move towards electronic format.

**Interview 3: The District Perspective**

*Participants: James Bruner, Rex Yarger, James Graham, and George Beiter*

James Bruner is the GIS coordinator for the Planning Department in District 4. He helps to oversee and does some work with the AUMIRA database. He deals with highway management, public relations, and safety.

George Beiter is in the Planning Department and works with underground mines and slip inventories out of District 5.

Rex Yarger is an assistant construction engineer from District 3 and deals with fills and the AUMIRA database.

James Graham is from District 11 and is in highway management for maintenance and construction but also supplied geotech information for all purposes in the district.

The geological site management program is a process to rank geohazard sites that is currently in use in District 11. It was copied and modified from a Washington State system. It was used to rate sites for the Geologic Sites Managed Program initiated by Gene Geiger. It begins with inventory in a spreadsheet format and also contains a hazard rating in spreadsheet format.

Currently, duplicate inventory data is being maintained in project and other folders. This includes data such as drill logs, photos, correspondence, and other associated documents. Just about all data is electronic, but not all is available in one spot. This current system has been working for about three years. It also contains landslides and rockfall data.

Most of the consultant data (80 percent of the total data) is in hard copy format, including plans and soil reports from the design group. All data gets placed on microfilm. Construction records and boring logs are often destroyed after seven years.
Recently, summer help has been used to scan the hard copy plans and produce half-size hard copies for storage. These documents are stored under a PID number.

The system for storage is {PID number..county/route/section...project number}. All need cross-referenced, including historic changes in county/route/section. If geographic coordinates are added, there needs to be toggles between each system for research and cross-referencing. The unit within the life of a highway section is measured in term of the county/route/section. This system must be maintained. There is currently loss in data because changes in the county/route/section system cannot be referenced due to realignment or re-numbering of the route ID.

ODOT’s drilling operations are only available at the central office. Currently, there are two teams; working on a third. Most drilling data comes from consultants.

The current link/node format in GIS, State Plane Ohio, NAD83 south zone. The state is moving towards a statewide zone.

There needs to be soil boring logs and plans available while in the field or office. There needs to be a system in GIS for querying the data and having construction plans linked. Other data are desired, such as soil profiles, historic and current quadrangle topographic maps from the USGS, abandoned mine maps, historic photos, coal seam base elevation data, bedrock formation maps, glacial deposit mapping, groundwater data and mining, and planimetric overlays. Historic aerial photography is a must. Older photos need referenced by their availability, date, and scale. Correlation (georeferencing) with target features is needed. A system to display this information (based on its appropriate scale and resolution for re-use) would greatly help the understanding of the project site and reduce cost and time on every project.

Outputs of this system would vary from simple responses to lengthy reports depending on the nature of the data request.

Knowing how much auger material to take into the field for any given situation would be beneficial and easily determined from a system that could track older drilling events.

Ties to the county GIS coordinators would be necessary because they tend to have the best data. There is no current standard in projection across the state used by various agencies. Environmental data, such as soils and geologic information, would be critical in any assessment, but the availability of many of these coverages is hit or miss at present. There needs to be an effort among the source agencies to fill in the gaps. This coordination in data needs to occur to have a seamless transfer of data between agencies.

Currently ODOT uses its GIS for Operational Performance Index Mapping. Any new GIS systems should look to incorporate the OPI performance measuring tool.
Some data, such as USGS landslide prone mapping would need to be available to consultants, but may need to be reviewed for sensitivity if the site was made available to the public for comments and data access. Scalability needs to be built into the system as well from the county level query to the small section of road level information. ODNR is currently contracting to develop this type of capability.

Standardization is needed. For example, density checks with moisture density curves are different among users. Landslide work needs soil strength tests of undisturbed samples done in a consistent manner, or at least documented. This data would be used for preplanning and could save time and money. Standardization of the data being provided by consultants is not being followed even with recommendations in place.

What are the potential benefits of a GDMS? The data would provide a ballpark figure for reduction in change orders. From a construction standpoint, there needs to be an elimination of change orders. The system could provide a quicker, better, and lower cost solution for research. It would reduce field downtime and decrease turn-around time for data requests. It would also increase reliability for subsidence occurrence. The efficiency component would help ODOT in times of hiring freeze. The system would provide:

- Better estimates of work efforts, resulting in more reliable prices and budgets
- Reduction of extra work in projects
- Reduction of downtime
- Better mine subsidence potential planning
- Reduction of time spent finding information (two hours versus two days).

The corridor selection process would greatly benefit from the system. Cost estimates for projects could be tightened. Environmental planning activities would be enhanced with additional data. The ability for the public to comment on proposed alternatives could be integrated. Again, scalability for proper data use and sensitivity to certain data types would need to be considered.

Potential barriers towards achieving the goals of the GDMS include:

- Cost for equipment and technology.
- Communicating to managers the needs of the system and technical aspects required.
- Lack of support for data sharing between agencies, or technical challenges to make it happen.
- Staff time required for system.

The system must start with an inventory of the available data and its associated metadata (descriptive codes) first. Organizations and staff must document data holdings. A gap analysis should be performed.

Recommendation was given for a new name for the program – Geotechnical Information Management System.
Interview 4: The Consultant and Outside User Perspective

Participants: Stan Harris (Fuller, Mossbarger, Scott, and May) and Rich Pohana, City of Cincinnati DOT

Stan Harris is a consultant who performs geotechnical investigations for ODOT. His work involves new and rehab landslide repairs. This data produces well logs, soils reports, and scoping from field data and lab analysis.

Rich Pohana works for the City of Cincinnati DOT in the construction and maintenance department. His work involves retaining walls, bridges, and landslide corrective events, and also serves as a source for public involvement. They are currently using mostly hard copy documents, but working toward an electronic landslide system similar to that of the Kentucky DOT.

Rich (City of Cincinnati DOT): FoxPro is being used to store retaining wall data. Where inventoried, there is also a photo and maintenance/repair database.

Searching for existing borings is easy in the copies maintained, but results of the as-built drawings are usually not available. Locating that information is often impossible. Much time is spent tracking down what data is available.

As-built drawings are needed to verify drilling logs – was rock hit where predicted?

Stan (FMSM): Often trying to get structures reports from ODOT is difficult (bridges, etc. not shown on as-built drawings). He understands that ODOT has trouble getting soils profile sheets completed by other consultants.

Their design plans are scanned and made available with an Adobe PDF format viewer.

Other data is needed to enable easy search functions. and data could be made downloadable for further investigations.

Most of the data collected that Stan sees is basically in the same standard format. In addition to bore logs, also having access to reports that were generated from them would greatly help in understanding the project at hand. A synopsis of the reports would be helpful as well.

The data is used for scoping and as supplemental information if available. Geologic quadrangle mapping would also be very useful if it could be overlaid on other electronic maps.

Outside programs like RockWare software may be useful in the future. AutoCAD is still used to interpret and display data. Specifically, AutoCAD is used to display bore logs. Other consultants have different formats. Delivery of products to ODOT has been primarily hard copy, but MicroStation files are now being sent with associated seed files.
The manipulation of the data in a 3D environment would be very helpful in understanding the context of the project.

Potential savings of 10-20 percent is reasonable for most projects if the data already collected was made available. Time of travel for data collection is not as much of a factor as the knowledge and reuse of existing borings, and the ability to avoid drilling additional locations.

There would be costs incurred by consultants if there was a requirement to enter this information online.

The vision for the GDMS includes access to data such as bore logs, reports, design drawings, and as-built notes. There is a need for both on-demand query and pre-programmed query functions. Test data should be made available and be able to be manipulated either online or from download. Consultants should be able to submit data online with QA/QC on ODOT’s end.

There has been some use of GPS by consultants to capture the location of borings. Te AutoCAD plans being developed by most consultants are not in a real-coordinate system.

City of Cincinnati: Currently there are topographic maps available from 1912 in the system. Applications for the data should be a secondary consideration over getting the data available to all users. Such models could include simple plotting and printing function and generation of top-of-rock contours. The priorities for the GDMS should be bore logs, construction records, design plans, and chemistry data.

Benefits to a system include:
- Reduction of the over costing and over burden of developing strength criteria.
- Time savings.
- Assistance with quality by perhaps allowing users to be sure they are not going to miss a potential problem.
- Standardization of information and methodology exchange.

Barriers to the GDMS:
- Cost to convert existing data.
- Compatibility of different data sets.
- Standardization of terminology is a challenge. Eventually everyone needs to enter data without re-interpretations needed.
- QA/QC of past data is an issue.
- Limits in resources for increasing the exact location of boring samples.

The system should focus on new data being generated first. Links to other available data and systems such as the one used in Cincinnati should be made.
Showing some data, such as landslide prone areas, should not be made available to the public due to possible misinterpretation or misuse issues.

**Interview 5: ODOT Information Technology Perspective**

*Participant: Warren Brown*

Each card that is collected for Geotech work has a unique identifier for reference. This reference number is unique to the scan name and is also in the database. The database contains 18 of the 37 fields available on the scan image.

The database was in Access and is now in SyBase IQ. ODOT databases are either decision support (warehouse) or online transaction; GQL can access either side. IT services and Tech Services differ in ODOT. Each is responsible for different activities.

Warren agrees with others that this project must have a modular approach. Strategic objectives of each phase need to correspond with equipment and software requests.

Servers are supposed to upgrade to Windows 2000. Clients are intended to move to Windows XP. It is not certain when this will happen. Windows 95 may be the standard for some time. The Microsoft license is in place for the upgrade but hardware isn’t available.

Technical barriers of the proposed GDMS:
- The infrastructure of the internal and external access to data may be a problem.
- How far into the main database does the data query need to be?
- The question of determining if the public will have a separate server than the ODOT employees needs to be ironed out.

A one-quarter terabyte server was ordered for this project. If additional space is required, it may take two years to procure with the current system.

ODOT is not a certificate authority for digital signatures if this is required on digital documents. Setting up a password access is not a problem.

Communication with District Offices is done through an OC12 line from Central. SOCC uses a pair of T1 lines to communicate with District Offices. Plus, there is a redundant link to adjoining Districts if needed. County offices and larger field crew locations have a single T1 line. Smaller field crews are 56K or less. Other regional offices are a mixed bag of options.

Web applications are currently online. VPN structure has an unknown capacity, possibly a bottleneck for data access. The current system is served off multiple Web servers with two Cisco balancers handling the load. This should be sufficient for incoming requests.

*Note: An additional conversation was held with Warren to discuss the information IT would like to see in the final Assessment Report. A business case and need for GDMS needs to be defined,*
and system benefits must be provided. IT felt that the report would address system components, design, and use more than stating the business case. It was explained that while software evaluation and other system issues are part of the report, the emphasis of the report is on existing business processes, benefits of the GDMS, and impacts to business processes, which is the information IT is looking for.

Interview 6: Field Data Collection/Lab/Planning Perspective

Participants: Alexander Dettloff, Steven Sommers, Mark Stouffer, and Gene Geiger

Mark: ODOT has two drilling crews and is working on a third. The crews perform some site evaluations, but mainly bring the samples back for the lab to test. The drafting room plots results in DGN format and the data is transferred to the appropriate District Office and to Steve Sommers. The lab section also makes a folder (hard copy) for each project that includes:

- Topographic map of the study area
- Request letter
- Utilities information
- Field notes.

The lab data is stored in a separate file for five to seven years. There are tens of thousands of folders for this time frame. Data older than five to seven years is eventually discarded.

Soil samples come in currently as hard copy written notes in the form of two worksheets. Each sample has notes and a unique ID. The data is entered into a Delphi database program. The entire batch for a project is combined in the program. Draftsmen enter the data into the DGN file. Drillers enter notes on cards for visual description and visual moisture.

The lab then assigns a visual description and moisture description (the visual description is different than the one assigned in the field). Calculations are then made of the soils. Typed bore logs and plan/profiles are the deliverable products. Paper copies of each go to the hard copy folder. Eventually hard copy folders are moved to the lateral files and, after five years, moved to the dead storage area.

MicroStation program (BASIC and/or MDL) is used to generate the log drawings. The program prompts for data values and generates the log. The DGNs are backed up on CD and at the main server.

Hard copy folders are organized by county/route/section. The visual description of the bore sample is provided with the moisture content. A semi-unique ID (repeats after 12 years) is provided to each sample. The teams are just starting to collect GPS coordinates for the boring locations with limited success. Time constraint seems to be the limiting factor.
The GPS units used are the GeoExplorer III. The current data collection system was started in 1996 in Delphi. Before then it was in mainframe (Rosco) and is still accessible. This data would take a lot of work to interpret as everything was coded.

The type of data from Delphi is:
- Merged soil samples
- Plasticity
- Gradation analysis
- Water content
- Visual descriptions of bore samples.

Card files are kept on projects. Project level information is maintained. This includes who the driller is and location of the hard copy file. The hard copy file is used to store the detailed data. The DGN files are not coordinate correct. ODOT is not using any unique programs besides MicroStation to display data, although it had looked at other Rockware software in the past. Unique applications in MicroStation (MDL) have been created to speed up the data entry.

The planning section has evaluated products like gINT to coordinate with geology software. The GINT log must be exported into MicroStation.

For new points collected using GPS, the coordinate is written on the card and is also kept in a Paradox database (generated during differential correction). This database would need some work to be made accessible.

Steve: The typical larger project includes a preplan component to walk the site and look for mines, etc. Steve is more involved with projects that are already underway, and during the design phase. Steve uses boring logs and plans with the analysis from the lab to make recommendations on soils. He also reports and reviews ones generated by consultants.

The landslide component of the job is different; a drawing is made in the field and some GPS of the slide itself is made. They attend with the driller for testing and analysis of the slide. Field photos and hand-drawn maps and notes are made. This information is stored in a project file (hard copy), using the county/state/route method for reference. Similar data from consultants also stores slope stability elements using multiple programs for each project.

The GDMS would be useful to understand the history of the site. How many times did the area slide before, and what were the results? As Alex mentioned, one area was corrected repeatedly until there is now 15 feet of pavement meant to keep the road open.

In Stage 1 of a project, letters are sent out with recommendations. Stages 2 and 3 are review periods for recommendations and corrective actions. The reports, corrective actions, soils profiles, and maintenance data all need to be maintained. Currently, consultant reports are only submitted in hard copy form. This needs to change.
The undisturbed records tests especially need to be maintained. There is a need to tie all the data together, including topos and photos.

Alex: Drillers could probably enter basic project data and simple data collection. They currently enter a visual classification and information that others in the lab could not detect, such as where boulders were encountered and where other changes were detected. They collect basic descriptions such as sample number, depth, and descriptions. A system to enter the depth automatically would be beneficial.

To make the GPS collection better, an antenna needs to be mounted above the mast that does not get in the way of the existing equipment. Drillers are still getting used to the GPS equipment. Set up time for GPS is limited. Not enough engineers are available to attend the rig at all times.

The GDMS would be useful to generate a profile across the entire site. 2D and 3D are both useful for this endeavor.

Cross-referencing old referencing systems is a must. Linking the card to the GIS map is also useful. Keeping the old alignments available in GIS would be useful as well as tying in corresponding data to that time frame.

Accessibility to the system for everyone in ODOT who works with this data is essential. A need to enter the information one time is also critical.

Raw data from consultants would be useful to test their assumptions. Raw data would be beneficial for developing correlations such as N.

Gene: the historical data is vulnerable to damage and becoming lost. It is a $500 million investment.

Interview 7: Outside Agency Perspective

Participants: Scott Brockman (ODNR), Dennis Hull (ODNR), and Thomas Lefchick (FHWA)

Dennis: The primary use of the ODNR data is to map and report the mineral resources for the state. Water wells, oil and gas wells, EPA records and ODOT records all go into the evaluation of what is in Ohio.

It is estimated that 320 hours per month is spent in tracking down ODOT records for various purposes. Much of that time is spent trying to retrieve and copy older data. Specifically, the cross sections, engineering properties, notes, reports, and information, even down to the soil logs, are important.
Terminology has differed over the years and standardization is needed. ODNR is currently looking at RockWare products, but is still in a testing mode. The total end-product is ESRI-based.

ODOT has become interested in ODNR's bedrock GIS coverage in quadrangle format. This can be provided to ODOT in GIS. Scale of the intended use is a factor. Much less accurate depth determinations are useable for ODNR mapping.

Of the current 788 quadrangles in Ohio, all are mapped for the Bedrock Geology GIS map. Buried Bedrock topography is also available. Currently ODNR is working on bedrock structure to show elevations in the bedrock surface.

*Thomas:* FHWA uses geotechnical data for its review of ODOT projects. This information is used to assess the quality of the design or assist with potential problems. It makes use of the project data to validate adjacent data.

Querying the data and viewing the results in 2D or 3D are important. The uses are landslides, mine investigations, and preliminary engineering. There certainly is a need to have more information going into these projects.

Pile drawing records and drill shaft data would also be very useful, especially for expanding bridges. The GDMS system could be used for refining tests. Settlement information on structures and other data on slope and wells would also be very useful in a complete system.

FHWA is developing its own geotechnical data management system (AGIDS). It will be critical to have ODOT’s GDMS correspond directly with this system. Carl Leely is the contact for this development. FHWA is currently uploading its data into the system. There is a need to investigate the data format standards being used in this system. FHWA (in cooperation with ODOT) is collecting a synthesis (Practice Synthesis) of what every state is doing, so that all systems can interact. It has started investigating terminology and methods for this purpose. Results from this study won’t be available until next year.

*Dennis:* Most of what has been done pertains to surficial data. The ArcGIS geodatabase needs to be available to revise the Web-based data. Certain data, such as karst information, is something ODNR does not necessarily want to provide to the general public for fear it may be misused.

Other elements are needed, including boring and cross section data, geotechnical reports, spatial locations, soil profiles, test pit data.

Applications and functions desired include correlations between logs and the ability to interactively select an area by quadrangle, county or multi-county area. The ability to call up and download data is wanted.
Other data of interest would include maintenance logs and repair records. Borrow pit test materials need tested and results kept on file as to where they were used. Landslide cost of repair is currently only kept as time and materials. Landslide remediation is used to correlate predictive models. This effort can not be considered a management system without a cost estimator.

Prioritizing where to spend available funds is an absolute benefit of the program.

Benefits to the GDMS would be to decrease the cost and time required for the current mapping effort. It would be an advantage to the decision-making process, especially in the planning stages. Data standardization and reliability would increase, making information available for future research and better engineering design.

This system could open the door to a new public site. There can also be a tie to the groundwater model under development. It could be used as a site to host the latest in geophysical testing, such as the current work with ground-penetrating radar.

**Telephone Interviews**

*John Fulton, USGS, Pittsburgh*

John’s interest is in landslide information. He talked about the USGS Landslide Susceptibility maps, and is going to check on digital availability. He mentioned the Regional Landslide Consortium, managed through Marshall University. The consortium is looking into developing landslide predictive models based on characteristics. He hopes that the GDMS will help to build and support the consortium effort, and will enable ODOT to effectively use landslide information.

*John Ferguson, U.S. Army Corps of Engineers (COE)*

John sees the COE as a potential data supplier to the GDMS from its project efforts. He would like the GDMS to have the ability to allow users to download data. He mentioned the COE’s SDSFIE data effort, but did not have additional information on it.

*Roger Terrill, Wayne County Engineer*

Roger did not have much comment on the system. He feels that most of their geotechnical needs may not be directly addressed by the system, since their projects are generally not on or near the state highway system, where much of the DOT information would be.

*Alan Craig, District 10*

Alan reiterated many of the things that the other District staff mentioned. District 10 does keep the soil sheets that accompany projects, and staff refer to these sheets when they plan other
jobs. District 10 also does a higher percentage of its own drilling work (using ODOT’s drilling crews) than other Districts.

District 10’s GDMS needs include the old borings; they need to look at these first for a project. They also need abandoned underground mine (AUM) information. They need to estimate the top of rock for drilling purposes as there are two different drilling cost rates for above rock and rock.

GDMS benefits include better information in the planning stages of projects, allowing better decisions to be made earlier.

GDMS barriers include getting the old information into the system, and knowing the right location on the route due to changes in the route over time.

**Dave Blackstone, Technical Services/GIS**

Dave was most concerned about the software to be chosen for the system, though he has no preferences for software. He is most familiar with Intergraph software as it is the foundation of the roadway GIS, but recognizes that other products may be better-suited for specific uses. He would like the GDMS to leverage the work that has been done before.