DIGGS: Geotechnical Data Collection and Use

Geohazards in Transportation
In the Appalachian Region—6th Annual Technical Forum
August 2-3, 2006
Lexington, Kentucky

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EarthSoft
A Word on Standards

What makes a standard successful?

What makes a standard fail?

Will DIGGS be ‘just another standard’?

(Our own selfish reason for wanting a standard)
Case Studies

From the Environmental and Hydrogeologic Industries

- MODFLOW (USGS)
- SEDD (USACE, USEPA HQ)
- ERPIMS (US Air Force)
- STORET
- NWIS (USGS)
- dbQuery (NOAA)
- NIRIS/NEDD/NEDTS
- EarthSoft experience with EPA Regions 2, 3, 4, 5, and states of WV, NJ, CA, CO, NY, and others
A Word on Standards

- Open
  - JAVA, XML (we acknowledge Microsoft/ESRI exceptions!)
  - Consultants are generally unable to set standards
- “Bottom-up” rather than “Top-down” standards are more powerful
  - MODFLOW
- Solves a ‘real’ problem?
- Scalability
- Sense of Urgency?
- Volume/Price (Microsoft, Oracle, Java, XML, ESRI)
- Complexity vs. Simplicity
  - SEDD (DEEMS)
Volume:

- Adopted by state DOTs
- Adopted by federal agencies
- Adopted internationally
- Adopted by consultants
- Mandated by state DOTs
- Mandated by federal agencies
- Mandated internationally

--- the DIGGS format needs to be **used** to be successful ---
## Electronic Data Deliverable (EDD): Data Format

Tab or comma-delimited text EDD

- aka ‘flat file’ or ‘ASCII file’

<table>
<thead>
<tr>
<th>SB-01</th>
<th>SB-02</th>
<th>SB-03</th>
<th>SB-04</th>
<th>SB-05</th>
<th>SB-06</th>
<th>SB-07</th>
<th>SB-08</th>
<th>SB-09</th>
</tr>
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<tbody>
<tr>
<td>4.6</td>
<td>7.5</td>
<td>23.5</td>
<td>41</td>
<td>41</td>
<td>9.503</td>
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<tr>
<td>Sand</td>
<td>Silt</td>
<td>Clay</td>
<td>Gravel</td>
<td>Limestone</td>
<td>Silt</td>
<td>Clay</td>
<td>Gravel</td>
<td>Limestone</td>
</tr>
<tr>
<td>Aquifer 1</td>
<td>Aquifer 1</td>
<td>Aquifer 2</td>
<td>Aquifer 2</td>
<td>Aquifer 2</td>
<td>Aquifer 1</td>
<td>Aquifer 1</td>
<td>Aquifer 2</td>
<td>Aquifer 2</td>
</tr>
</tbody>
</table>

**Summary:**
- **SB-01:** Sand Aquifer 1 (light olive gray to olive gray with some mod. brown; moderately fine-grained; very well sorted; sub-rounded; approximately L-1)
- **SB-02:** Silt Aquifer 1 (moderate brown to very pale orange; abundant calcite; Subsection 6-5)
- **SB-03:** Clay Aquifer 2 (very fine-grained; very well sorted; sub-rounded; approximately L-1)
- **SB-04:** Gravel Aquifer 2 (light gray (N7) and grayish orange pink (10R 8/2); angular to subangular; approximately L-1)
- **SB-05:** Limestone Aquifer 2 (low to moderate plasticity; gravel primarily quartzite; some calcareous mineralization and black (carbonaceous?) minerals; Subsection 6-2)
- **SB-06:** Silt Aquifer 1 (moderate brown to very pale orange; abundant calcite; Subsection 6-7)
- **SB-07:** Clay Aquifer 2 (very fine-grained; very well sorted; sub-rounded; approximately L-3)
- **SB-08:** Gravel Aquifer 2 (light gray (N7) and grayish orange pink (10R 8/2); angular to subangular; approximately L-3)
- **SB-09:** Limestone Aquifer 2 (low to moderate plasticity; gravel primarily quartzite with some calcareous mineralization and black (carbonaceous?) minerals; Subsection 6-7)
### Electronic Data Deliverable (EDD): Data Format

#### Spreadsheet EDD

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
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<td>start_depth</td>
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<td>geo_unit_code_1</td>
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<tr>
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<tr>
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<td>7.5</td>
<td>Silt</td>
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<tr>
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<td>Gravel</td>
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Geohazards in Transportation—August 2-3, 2006
XML/GML EDD

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  <reference>1</reference>  
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</sample>
XML/GML is great for programmers (and programs), but not user friendly for people. Few human users are going to sit down and write XML without advanced user interfaces, which may not be available at first.

SEDD: A Case Study

After 4 years, the largest lab in the country has told us that EVERY time they deliver the SEDD XML EDD, the client says “Can you send us the spreadsheet?”

ie. They find XML un-readable by humans

PS. These are users that are VERY EXPERIENCED with EDDs!

How will the geotechnical market, new to EDDs, respond to XML?!
Electronic Data Deliverable (EDD): Data Format

XML

• XML-only EDDs are possible, but is this practical?

• Many of the users are human, they are not code, ie, other software.

• Most of the users are NOT programmers!
Electronic Data Deliverable (EDD): Data Format

EDD formats

EarthSoft’s recommendation:

Publish the exact same EDD in 3 forms: flat file, spreadsheet, and XML, with conversion parsers.
What Will Make DIGGS Used?

- Tools that generate data in DIGGS format
- Tools that consume data in DIGGS format
- Tools that check for DIGGS correctness/ completeness
- Enterprise-level implementation (Automated Workflow)
- Added value: application of validation rules
- Added value: facilitation/simplification of data transfer
- Added value: enhancement of data use
- Added value: improvement of modeling and analysis

... implementation by many independent software developers...
How is EarthSoft Implementing DIGGS?

1. Intelligent Data Entry Form (IDEF) that creates DIGGS EDDs

DIGGS EDD:
- Flat file,
- XML/GML or
- Spreadsheet
How is EarthSoft Implementing DIGGS?

2. The EQuIS Data Processor (EDP) will check DIGGS EDDs, using validation rules.
3. DIGGS EDDs imported into EQuIS using EDP

Import tool is ‘mirror image’ of checking tool....

How is EarthSoft Implementing DIGGS?

DIGGS EDD → EQuIS Data Processor (EDP) → EQuIS™
How is EarthSoft Implementing DIGGS?

4. EQuIS exports data in the DIGGS EDD

- DIGGS EDD:
  - Flat file,
  - XML/GML or
  - Spreadsheet

EQuIS™
How is EarthSoft Implementing DIGGS?

5. EQuIS 5 Enterprise Architecture

Access vs. SQL Server or Oracle
a few boreholes vs. thousands of boreholes in the same database…
  a few concurrent users vs. hundreds of concurrent users…

Access
  VB

SQL Server
  Oracle
  .NET, C#, Java

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How is EarthSoft Implementing DIGGS?

5. EQuIS 5 Enterprise Architecture
How is EarthSoft Implementing DIGGS?

Agents: Reports (or graphics) delivered automatically via email or web portal (dashboard)

• May be event-driven, i.e.
  “a new borehole was entered into the database so AUTOMATICALLY email me the gINT log” (don’t make me come over there and ask…) 

Or

• May be scheduled, i.e.
  “every Friday at 1 p.m. email me the report plus the updated logs of all new drilling activity for the week.”
How is EarthSoft Implementing DIGGS?

Data Provider

Standalone EDP
Data Correct?

Yes

Enterprise EDP
on your server:
Data Correct?

Yes—email
confirmation to
data provider

SAME CODE
& CHECKS !!

No

No

Automated Data Loading
*For very large operations*

EQuIS™
What Will This Exchange of DIGGS Data Mean?