DIGGS
Digital Interchange for Geotechnical and Geoenvironmental Specialists

Presentation to TransXML Workshop

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FHWA Pooled fund study TPF-5(111)
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Ohio DOT Grant
Caltrans Experience

- 30,000 project files
- 2 million documents
- 300 projects/year
- 80 years of data
- Difficult to access information
Ohio DOT Experience

- 20-30 person hours per week to retrieve information
DIGGS Evolution

- Pooled Fund Study to create DIGGS
  - TPF-5(111), started 2005 (run by Ohio DOT)
  - Merger of existing XML standards:
    - COSMOS standard (CA, Earthquake group)
    - AGS standard (UK)
    - FDOT/UF Pile standard
  - GML Compliant (International Geo-Spatial XML standard)
  - Version 2 to be final result from study (June 2012)
  - Partners: USGA, EPA, COSMOS, AGS, UK-HA, UF, GINT, KeyNetix, State DOTs, FHWA, EarthSoft
The HA Geotechnical Data Management System (HA GDMS)

- Internet-based GIS
- Stores data on:
  - spatial context (mapping and aerial photos)
  - assets
  - reports
  - boreholes
- Supports UK AGS data transfer format
  - data storage/retrieval
  - summary logs
  - summary test sheets
AGS Implementation Timeline

UK Milestones
- UK Spec for GI (SISG Pt 3)
- Increased adoption by UK industry

HA Milestones
- HA Specification requires AGS-2
- HA Standard requires AGS data
- HA GDMS goes live
- HA GDMS update improve AGS data handling

No. of Reports
- With AGS
- Without AGS

Additional milestones:
- Revised GI Spec (draft)
Florida

- FDOT Geotechnical Database
- Bridge Software Institute (BSI) has developed three unique pieces of software that can access the database
  - FB-Deep
  - Pile Technician
  - Database Spreadsheets
Example of In-situ spreadsheet
The DIGGS Advantage

Data Acquisition

Database

Software Applications

Data Review And Processing
Key Activities

- Borehole Data
  - Point Location
  - Drilling Operations
Key Activities

- Borehole Data
  - SAMPLES!
Data TRANSFER

- Site Information
  - Field
  - Lab Testing
  - Soil and Rock

- Depth Information
Data TRANSFER

- Lab Data (results and/or test data)
Logs and Log Data

- Electronic / Paper
Data TRANSFER

- Borehole data
  - From field to office
  - Intraoffice (among software)
  - Interoffice (among staff)
  - From office to External
QC/QA Testing

- PDA/CAPWAP
- O-Cell/SLT
Sensor Data

- Manual
- Automated
Cost Savings

- Ohio DOT:
  - 10-20% less drilling, savings $12-24M per year

- Florida DOT:
  - Fewer borings saving $250,000 - $500,000 on one project

- Missouri DOT:
  - 10-15% fewer borings per bridge
  - $81,000 savings per year in boring log preparation by using electronic data entry in the field

- California DOT:
  - 20% savings ($200k/year) with laboratory data management system implementation
Samples, Cores and Specimens

sample gml:id="bf6615a0-6a74-11da-8cd6-0800200c9a66">
  <gml:name codeSpace="keylab1">12345678452</gml:name>
  <depthTop uom="m">1.00</depthTop>
  <type>B</type>
  <reference>1</reference>
  <specimen> ← tests are preformed on a specimen
    <gml:name codeSpace="keylab1">12345678452</gml:name>
    <depthTop>1.00</depthTop>
    <depthBase>1.00</depthBase>
    <description>Soft brown Clay</description>
    <reference>23</reference>
    <remarks/>
    <subsamplingMethod/>
    <roles/>
    <description>-</description>
  </specimen>
</sample>
Laboratory Tests

<Specimen gml:id="">
  <gml:name codeSpace="keylab1">12345678452</gml:name>
  <gml:name codeSpace="NWH">8452</gml:name>
  <depthTop>1.00</depthTop>
  <depthBase>1.00</depthBase>
  <description>Soft brown Clay</description>
  <reference>23</reference>
  <remarks/>
  <subsamplingMethod/>
  <roles/>
  <moistureContent> Tests then hang off specimen
    <moistureContent uom="%">23</moistureContent>
    <role> --- who tested, checked and QAd it etc
    <specification> --- BS xxxyyy clause 2
    <preparation>-</preparation>
    <remarks/>
    <isNatural/>
  </moistureContent>
</Specimen>
Example 2 – Sample Taken from an Exploratory Hole, tested for NMC, LL and PL

Real World

Data Construction

“FIELD”

“LAB”

Project

locations

Hole

ID = ABCD-1

samples

Sample

ID = ABCD-12
Source = ABCD-1

Sample

ID = ABCD-123
Source = ABCD-12

Sample

ID = ABCD-124
Source = ABCD-12

samples

laboratory Testing

Sample

ID = ABCD-12
Source = ABCD-1

Sample

ID = ABCD-123
Source = ABCD-12

Sample

ID = ABCD-124
Source = ABCD-12

laboratory Testing

Sample

Moisture Content

ID = ABCD-12345
Source = ABCD-12

Sample

Atterberg Limits

ID = ABCD-12345
Source = ABCD-12

Sub-sample collected from exploratory hole

Sub-samples created in laboratory

Sample collected from exploratory hole

Sub-sample tested for NMC

Sub-sample tested for LL

Sub-sample tested for PL

Moisture Content

Atterberg Limits

Source = ABCD-12

Source = ABCD-123

Source = ABCD-124

Source = ABCD-12

Source = ABCD-123

Source = ABCD-124

Source = ABCD-12
### Example 5 – Sample Taken from an Exploratory Hole, tested by 3 stage, 3 sample triaxial test

#### Real World

- **Project**
  - **locations**
  - **Hole**
    - ID = ABCD-1
  - **samples**
    - Sample
    - Sample
    - Sample
    - Sample
    - Sample
  - **laboratoryTesting**
  - **CompressiveStrength**
    - ID = ABCD-1234
    - Source = ABCD-20

#### Data Construction

- **Sample from Hole**
  - ID = ABCD-12
  - Source = ABCD-1

- **Sample from Sample**
  - ID = ABCD-20
  - Source = ABCD-20

- **Sample from Sample**
  - ID = ABCD-123
  - Source = ABCD-12

- **Sample from Sample**
  - ID = ABCD-124
  - Source = ABCD-20

- **Sample from Sample**
  - ID = ABCD-125
  - Source = ABCD-20

- **CompressiveStrengthDetail**
  - ID = ABCD-1234
  - Source = ABCD-20

#### Linkage

- **Sample from sample**
  - ID = ABCD-123
  - Source = ABCD-123

- **Sample from sample**
  - ID = ABCD-124
  - Source = ABCD-124

- **Sample from sample**
  - ID = ABCD-125
  - Source = ABCD-125

- **CompressiveStrengthDetail**
  - ID = ABCD-23456
  - Source = ABCD-123

- **CompressiveStrengthDetail**
  - ID = ABCD-34567
  - Source = ABCD-124

- **CompressiveStrengthDetail**
  - ID = ABCD-34567
  - Source = ABCD-125
This is one example of a considerable number of complex examples that have been considered.
Data Interchange for Geotechnical and GeoEnvironmental Specialists (DIGGS)

DIGGS is a coalition of government agencies, universities and industry partners whose focus is on the creation and maintenance of an international data transfer standard for transportation related data. The coalition came into existence through coordination from the US Federal Highway Administration sponsoring meetings and eventually forming the pooled fund study project. The initial base schema consists of geotechnical data including Borehole, soil testing, site information and more. The first SIG is extending the schema to include Geo-Environmental testing. More SIGs and expanded membership are in the works.

The draft DIGGS standard is available for review and comment. In order to act as a reviewer, you must create an account. You will then have access to download the schema and documentation as well as participate in the online discussion forum. The forums will be monitored and the DIGGS team will answer questions to help in the understanding and implementation of the schema and will be the main point of contact for review comments. The schema will be updated monthly with corrections and additions during the review. Review
Forum >

Recent Blog Entries (Full Blog Listing)

Status of Work on the DIGGS v1.2 Release
September 4, 2010 - 1:13am — LTurner
It’s been several months since the release of DIGGS v1.1 this past April. At the roll-out meeting we had anticipated having a version 1.2 ready by July. However, the changes in version 1.2 have required far more analysis and work than originally anticipated. (Read more...)

LTurner's blog Read more 3 attachments

DIGGS v1.1 Release
May 19, 2010 - 10:30pm — LTurner
We are pleased to announce the release of DIGGS v1.1. This release includes a number of significant schema changes. The net result is a schema that is more robust and easier to use, far less complex in organization and file size, loads and validates much quicker, and is compliant with GML 3.2 standards.

LTurner's blog Read more 1 attachment

Pooled Fund Project TPF 5(111)
The Pooled Fund Project is a US Federal Highways Administration project administered by the state of Ohio. Multiple states commit funds to create a larger project under which all organizations receive the benefit from the project. The DIGGS project was created to develop an international standard interchange format for geotechnical data. The project brought together the existing formats created by Association of Geotechnical and Geoenvironmental Specialists in the United Kingdom (AGS), Consortium of Organizations for Strong-Motion Observation Systems (COSMOS) and Florida Department of Transportation (FDOT) created by the University of Florida (UF). The project has a governance structure for developing the base schema as well as Special Interest Groups (SIG) to create extensions. The result of the project is the DIGGS schema. Pooled Fund Project >
DIGGS Current Status

- DIGGS Version 2.0α - July 2012
  - Update of Data Dictionary
  - Update of Schema
  - Creation of “DIGGS to Excel” Tool
  - DIGGS Website Update
DIGGS Implementation

- ODOT Contract with Geo-Institute-2 years
  - October 2013 – October 2015

- Goals of Contract
  - Finalization of DIGGS Schema standard from 2.0α to 2.0β and Public Release of DIGGS 2.0
  - Transition of ownership to Geo-Institute
  - Development of Long Term Business Plan and Management Structure
DIGGS Implementation

- Engagement of DIGGS Advisory Board
- Survey of DIGGS User Community
- DIGGS Training Materials
- Pilot Testing of DIGGS 2.0α
  - State DOTs & EPA, Software/Hardware Vendors, Federal Agency
- Update XML Schema and Data Dictionary
DIGGS Implementation - Tools

- Refining of existing “DIGGS to Excel”
- AGS 3.1 to DIGGS
- Excel/Web Form to DIGGS
- Validation