data interchange for geotechnical and geoenvironmental specialists

Overview and Vision for the DIGGS standard

(v1)

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Geohazards in Transportation

IN THE APPALACHIAN REGION

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Disclaimer: The examples and schema are preliminary and the final version will be available when the official version is released.

Need for Collaboration

- US is behind in standardization efforts
- UK through AGS has rich organization, experience and a well developed standard
- Collaboration can open markets
- International standard can improve practices and software
- New standards can improve products

- Future goal is asset management systems

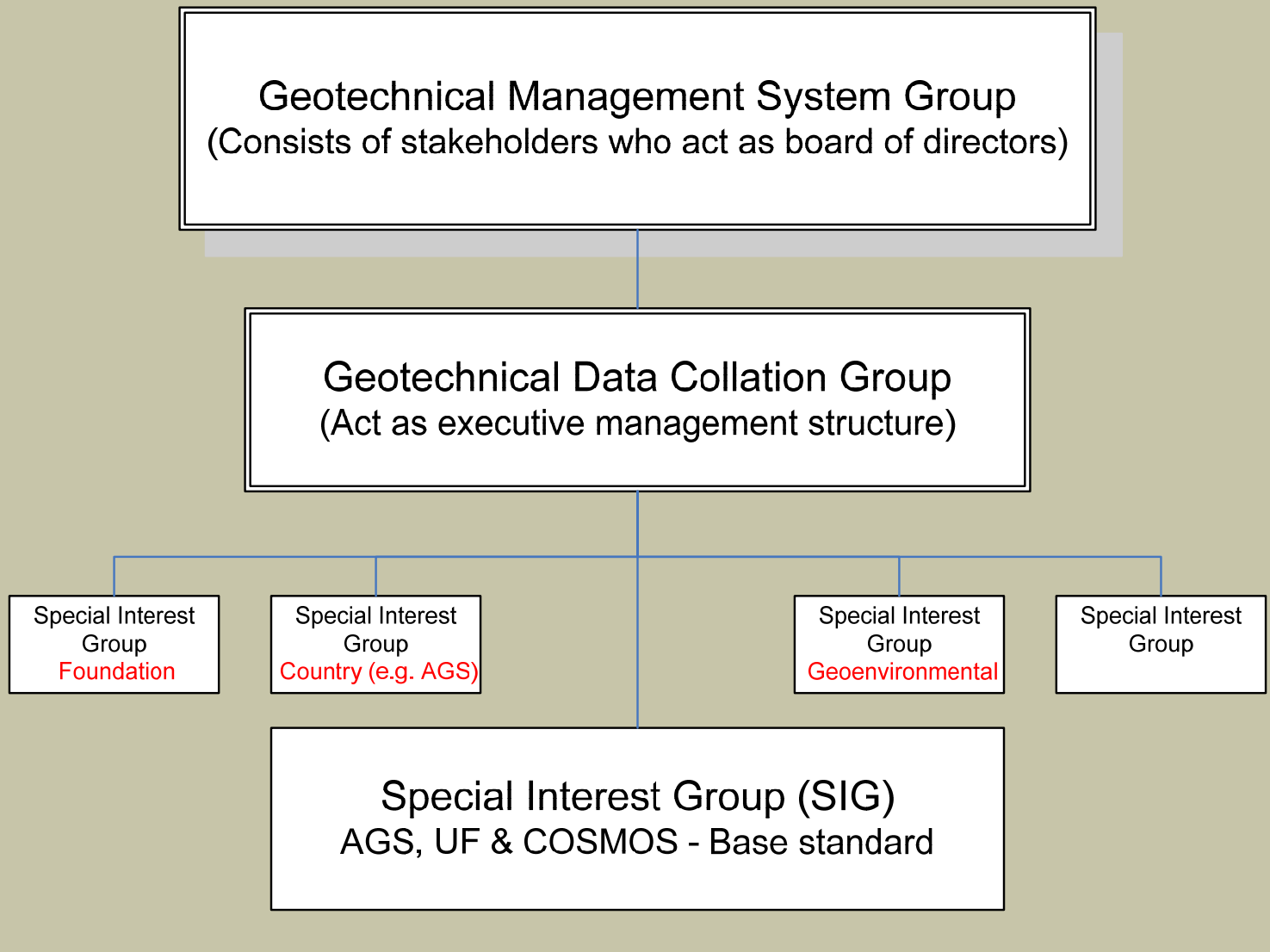
Benefits of Data Standards

- Means for information sharing
  - single entry of data
  - reusable data
  - QA/QC – allows for software verification
  - More accurate bids (using existing data)
- Saves money, time and energy in system development
- Assists software makers in the development of programs that fit within the framework
- Allows for unified asset management and assessment

USA Pooled Fund Project TPF-5(111)

- $643,000 in funding
- Combine existing geotechnical data standards (AGS, UF, COSMOS)
- Expand to include other data (i.e. geohazards, geotechnical assets)
- Develop international organization to manage and enhance standard

Pooled Fund Organization



Project Timeline

- May 2005 – Pre-planning meeting
  - Agreement on skeleton structure and path forward
- August 2005 – Schema and Dictionary draft development
  - Base Draft developed
- November 2005 – Finalize Dictionary
  - Complete dictionary merger
- January 31, 2006 – Draft Dictionary and Schema
  - Distribute drafts for comment to management team
- May 15, 2006 – Internal Review of Draft
  - Perform an internal review of the proposed draft
- August 4, 2006 –Distribution of draft for limited review
  - Distribute for detailed review of dictionary, schema, guides
  - Comments returned by Sept 15
- November 1, 2006 – Distribution of full public review
- January 1, 2007 - Finalized version 1.0 of schema released

What will DIGGSML be?

- DIGGS format has two parts
  - A Data Dictionary
    - Merger of AGS, UF & COSMOS defined tables and fields
    - User defined tables and fields
  - Transfer Format Rules
    - Hierarchy of data (Sample from a hole)
    - Tags (<hole>), data type (string, number) etc
    - Rules to structure and verify the data

DIGGSML Benefits

- Enumerated Lists
  - Some fields can only be filled from predefined lists (codelists)
  - Codelists are stored in a separate XML file
  - Codelists can be updated/changed independently from the schema
    - Stored on a universal website
  - Users can share codelists items locally or over the Internet

DIGGSML Benefits

- Attached Files
  - Files can still be attached at any level of the DIGGS table hierarchy
  - File information can be encoded in XML to describe the file in greater details than present
  - Files can be referenced locally or on the internet/intranet
- Dictionaries
  - Predefined rules for adding fields and tables – better software interpretation
  - Users can share dictionaries locally or over the Internet

DIGGSML Benefits

- Units
  - All standard units are declared in a single XML file (POSC standard)
  - Users can write their own Unit definitions
  - Units can still be declared once for each header or can be defined at item level
  - Conversion between units is pre-defined

Generic Draft Schema Structure

- Document Information
- PROJECT
  - Location, date, etc
  - Excavation (future)
    - Face
      - Sample
        - Specimen
    - Layer
    - In-Situ Tests
  - Hole
    - Hole Parameters (dia, casing, etc)
    - Layer Information
    - Sample (type = core, etc.)
      - Specimen
        - Lab Tests
    - In-Situ Tests
      - SPT, CPT, Dilatometer
    - Monitoring Point
      - Monitoring Data
  - Surface Line (future)
    - Line
  - Foundation
    - Pile
      - Construction
        - Driving
      - Capacity
      - Section Information
      - Load Tests
    - Shaft
  - Geophysics
    - Well Logging
- Business Associate
- Equipment
- Dictionaries

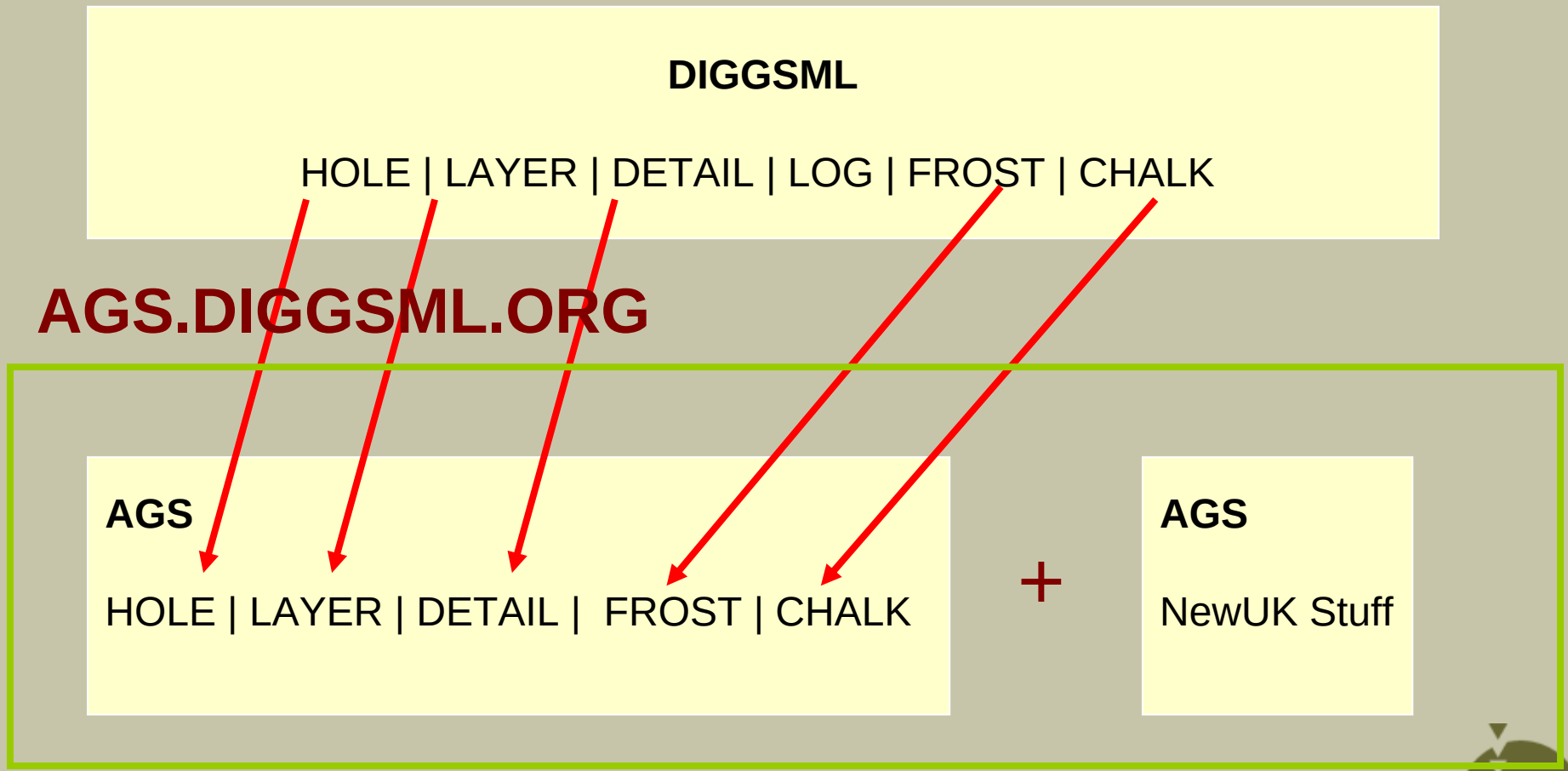
Project Deliverables

- Phase I&II – Internationally developed:
  - Data Dictionary
  - Schema (XML description of data)
    - Base AGS Tables
    - UF Pile data
    - COSMOS Geophysics (WITSML)
  - Allow local extensions and customizations
  - Electronic data structure for database development
  - Electronic data structure for the metadata

Global Structure - Profiles

- DIGGS allows for a hybrid system that will cope with everything we can think of for the US, UK and the Netherlands
  - There are methods for adding new fields and codes – details are left for the release
- The DIGGS format can be seen as a base standard that can be customized for an country or industry.
  - If something you need is not included then add it.
  - If there is something you do not need, restrict it's use
- Care needs to be exercised so multiple standards do not emerge

Example Country Based Profile



What is XML?

- XML is an industry wide standard for transferring data.
- XML uses < and > with tags

```
<sequenceNumber>1</sequenceNumber>
<pileSection>
        <material>Concrete</material>
        <depth uom="ft">0</depth>
        <crossSection uom="in^2">576</crossSection>
        <base uom="in">24</base>
        <width uom="in">24</width>
        <void uom="in^2">254</void>
</pileSection>
```

Benefits of XML

- Many software tools available
- Easily Validated
- Extensible
- Transformations
- Mix with other XML formats
- Platform independent

What is GML?

- An ISO standard XML format for geographic (location) data
- Encodes geometric, topological and temporal properties of “things” in the world
- Provides a standard framework for any geographic or spatial data
- Understood by all GIS systems

Benefits of GML

- Enables data to be shared
  - Sharing common framework
- No need to reinvent wheels
  - No need to develop mechanisms to handle coordinates, lines, curves, polygons, etc as these already a part of GML
- Industry tools available
  - Several companies are in the process of developing toolkits to aid the use of GML data

Transfer vs Database

- DIGGS is a transfer standard
  - We focus on information that needs to be shared or transferred between entities
  - We do not cover all possible data developed during a process
    - e.g. Lab tests may have calibrations, notes etc that are stored in the lab test software but are NOT needed by the engineer
  - DIGGS is not expected to develop a database that covers ALL data used in transportation
    - Many databases will exist (Lab, Field, Design etc)
    - Different software will exist that contain their own databases
    - DIGGS is not a universal database standard - NOT a single database to store all data
  - Key is what data would be transferred for the next process step
    - What would the engineer need from the test?

Data Types

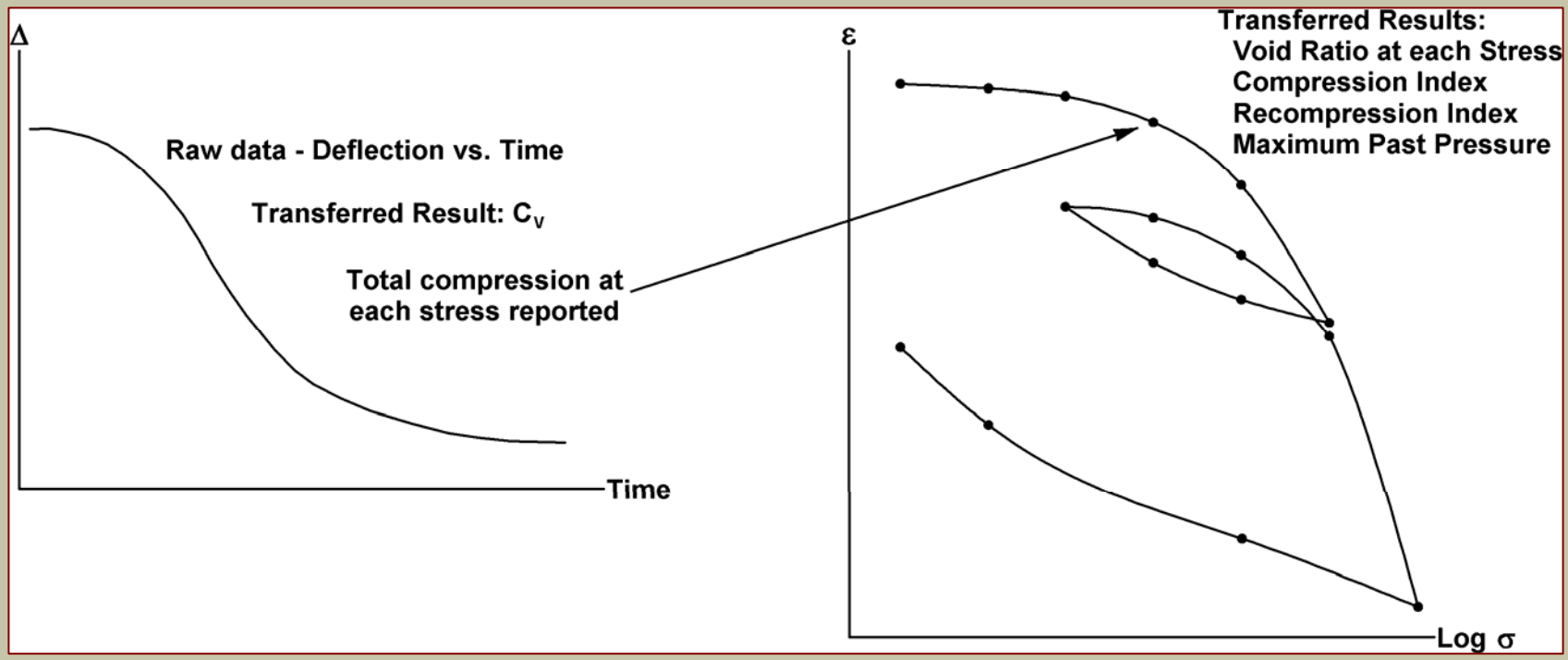
- There exist 4 types of data
  1. Metadata about the test (date, time, location)
  2. Parameters derived from the test
  3. Raw from the test form which the parameters can be derived
  4. Calibration data

- The DIGGS transfer standard only includes 1) and 2) for most information

Consolidation Data Example

- Consolidation Test Metadata
  - Equipment, date, person etc
  - Rebound slope & consolidation index
- Detail data
  - Per stress measured
    - CV
    - Stress
    - Void ratio
- Raw Data (**NOT TRANSFERRED**)
  - Deflection
  - Time

Consolidation Data Example



Raw Data

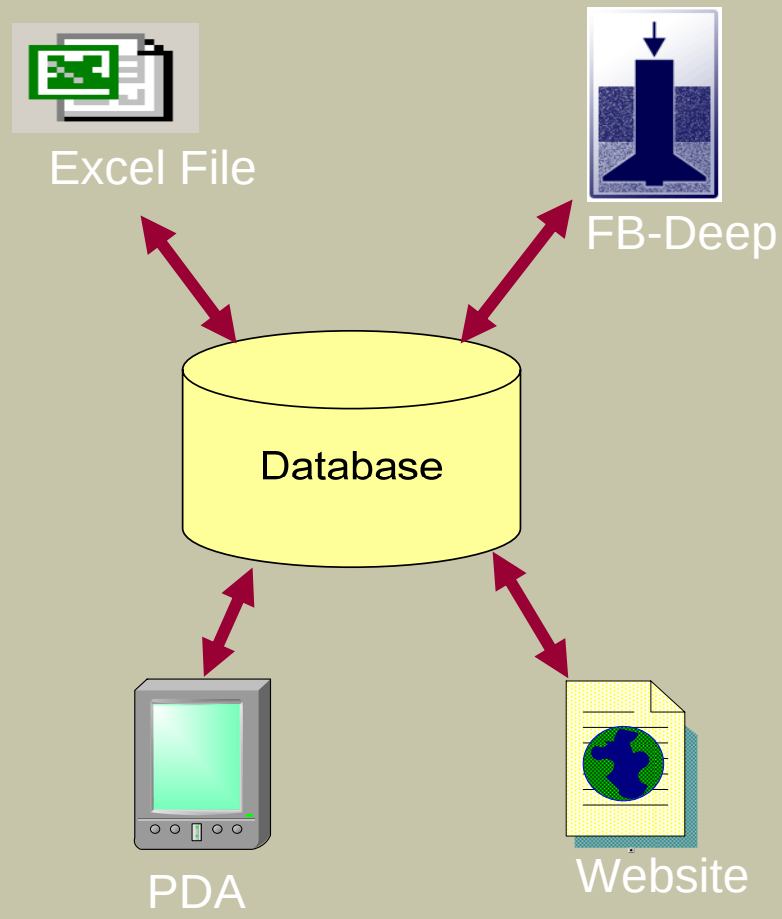
Result Data (transferred)

Florida Database Implementation

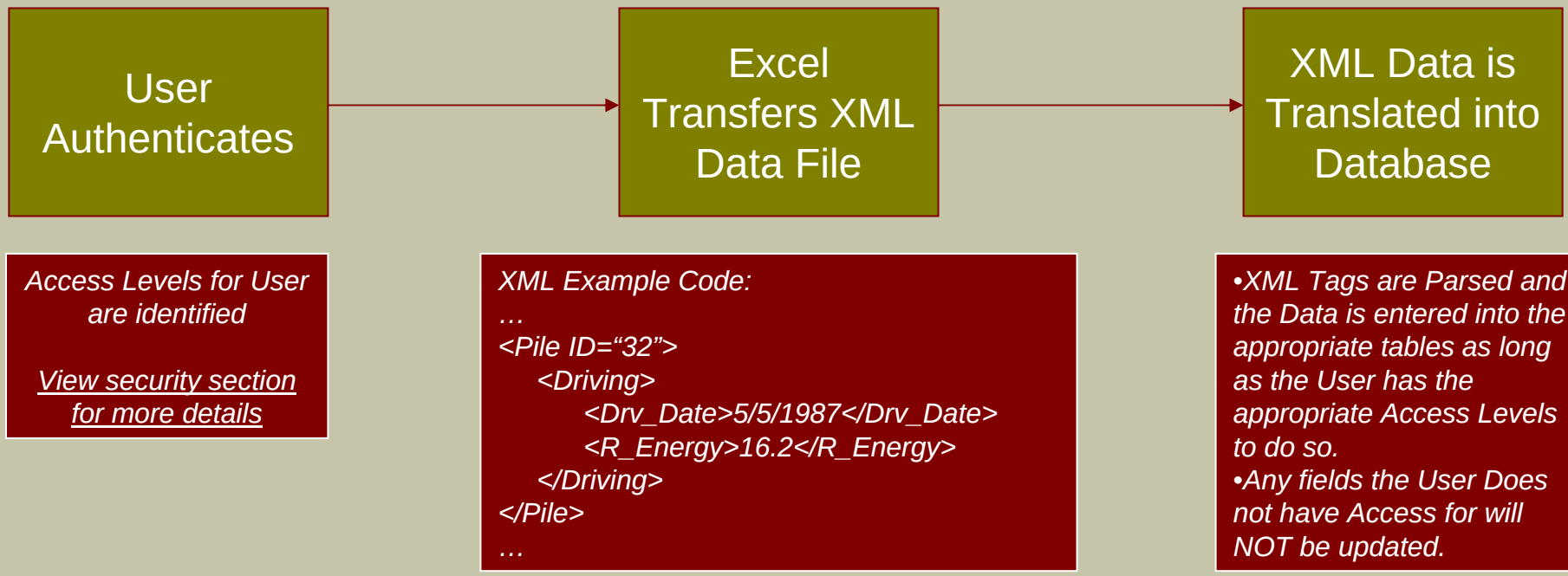
- FDOT funded the development of an XML based database
- Data restricted by user security
- Upload and retrieve through XML file
  - Web App controls conversion to DB format
  - DB format is not seen by users or applications
- Application centric – general access
- Browser access to view, update or retrieve in Excel
- Data controlled by designated users
  - Add users, create projects and data
- FDOT contract to implement DIGGS for 06-07

Application Centric Architecture

- Database is application centered
- Repository for project data
- Designed for using data in decision process
- Acts as archive
- Security is table based and hierarchical
  - Access established by FDOT



Extract or Submit any data fragment



Only data for which the user has security is available

Standardized Documentation

XML Schema Documentation

Table of Contents

Schema Document Properties

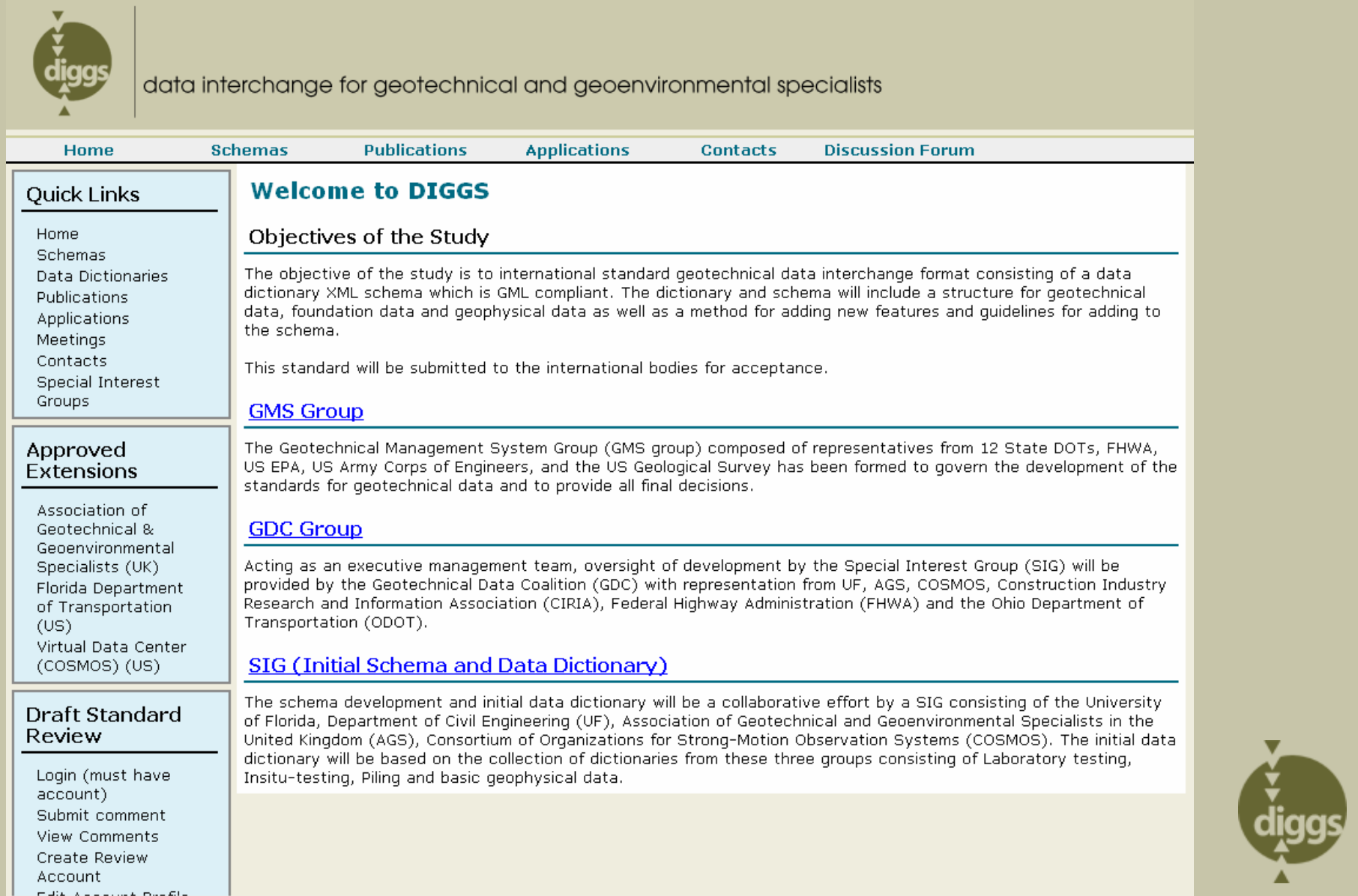
Target Namespace	http://www.diggsml.org
Element and Attribute Namespaces	• Global element and attribute declarations belong to this schema's target namespace. • By default, local element declarations belong to this schema's target namespace. • By default, local attribute declarations have no namespace.

Schema Composition	• This schema imports schema(s) from the following namespace(s):
	  ○ *http://www.opengis.net/gml* (at ../GML/3.1.1/base/feature.xsd)
	  ○ *http://www.w3.org/1999/xlink* (at http://schemas.opengis.net/gml/3.1.0/xlink/xlinks.xsd)
	• This schema includes components from the following schema document(s):
	  ○ documentInfo.xsd
	  ○ businessAssoc.xsd
	  ○ equipment.xsd
	  ○ dictionarys.xsd
	  ○ projects.xsd

Declared Namespaces

Prefix	Namespace
Default namespace	http://www.w3.org/2001/XMLSchema
xml	http://www.w3.org/XML/1998/namespace
gml	http://www.opengis.net/gml
diggs	http://www.diggsml.org

Website with Namespace Documents
http://DIGGSml.org



Benefits of New Structure

- GML Compatible
  - International GIS standard compatible with mapping software
- Extensible
  - Has built in methods for local additions
  - Allows profiles (local definitions of acceptable portions of standards – but sharable)
  - Operational structure developed for sharing of proposed standard additions

Coexistence with Other Standards

- Process and structure need to be developed for compatibility with other standards
  - TransXML (USA - Transportation)
  - XXML
  - EPA
  - POSC (Oil Industry)
- Many have areas the are complementary with DIGGS Geotechnical Data
  - Some overlap with DIGGS
    - Equipment
    - Business Associates
- Need to resolve the overlap

Summary

- International collaboration producing XML standard for Geotechnical & Geoenvironmental data transfer
- New standard incorporates best existing standards
- New standard addresses weaknesses of existing standards
- Limited Public Review is underway and v1 is expected January 07