DIGGS: A Dream Becomes Reality: Implementation Status

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8th Annual Geo3T2 Conference
North Carolina DOT
Raleigh, North Carolina
9 April 2015

Let's Start with a Test

- Who has heard of DIGGS?
- Who has heard me talk of DIGGS?
- What is DIGGS
- Why was DIGGS Developed?
- Where is DIGGS Today?

www.theblackboxclub.blogspot.com

Standardized Geotechnical Data

- Bury that Sucker…not interested
- Only Heaven Could be Better

I hope that within the next 25 minutes I can convince you that the answer is closer to the latter

www.thebeausejourpulpit.wordpress.com

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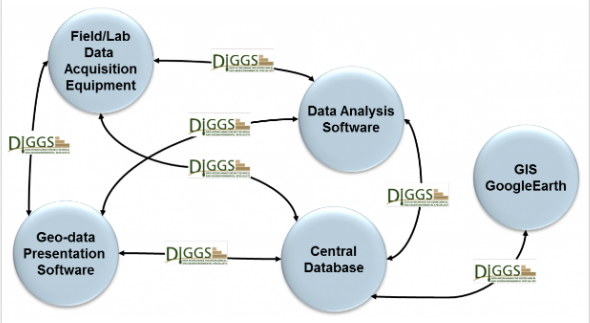
What is DIGGS? (www.diggsml.org)

The DIGGS project involves development of a GML (XML-based) geospatial standard schema for the transfer of geotechnical and geoenvironmental data within an organization or between multiple organizations. DIGGS can work with existing software, hardware, databases and data storage facilities to easily transfer and share your data.



Once implemented by your organization, the DIGGS data transfer standard will help meet your needs for information and data asset management. It is anticipated that DIGGS will save state and federal agencies, and other public and private organizations millions of dollars. Savings will be realized through a combination of avoided drilling and laboratory testing costs, and efficiencies afforded by the availability of geotechnical data for multiple projects in a standard format.

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Basis for Current Presentation

When you mention “standardized” to most geotechnical engineers, there is a near-universal response:

- Data
- Data Schema and Database
- Standardized Data
- Data Transfer
- DIGGS Development
- DIGGS Implementation

The concept of “standardization” just doesn’t “taste” very good, even though I am told it will be good for me.

www.disneyfilmproject.com

We then lead to the conclusion:

- What is Our Dream?
- What Can You Do to Make it a Reality?

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Data or Information Test?

- Is "It" Data or Information?
  - Can you process "it" into one or more forms without re-entering "it"?
  - Can you process "it" without a Ph.D. in "cut and paste" technology?
- If you answered:
  - Yes = Data
  - No = Information
- How are "Data" or "Information" conventionally handled?
  - Spreadsheet files
  - Word files
  - PDF files
  - Database files
  - "Standard" Data files

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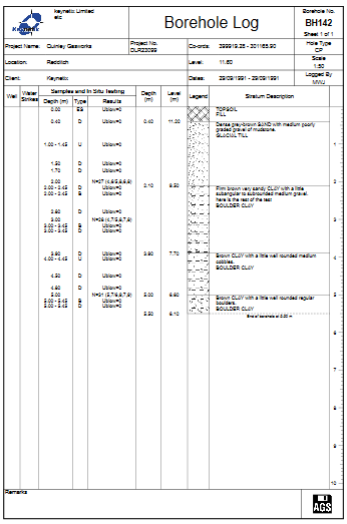
Data or Information?


Borehole Log

BH142

A PDF Boring Log

✘ **Data**

or

✓ **Information**

(after Keynetix, 2014)

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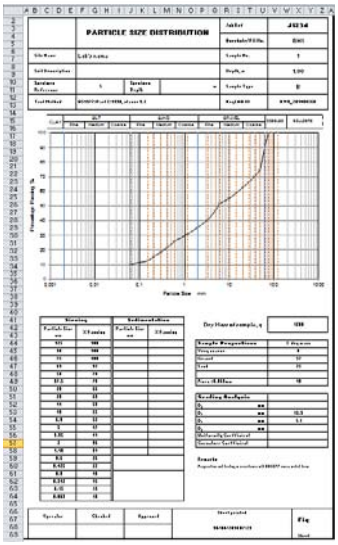
Data or Information?



(after Keynetix, 2014)

An Excel File

✘ Data

or

✓ Information

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Data or Information?

	A	B	C
1	Date	Location ID	Water Depth
2	02/05/2012	BH 1	24.185
3	03/05/2012	BH 1	23.82
4	04/05/2012	BH 1	23.455
5	08/05/2012	BH 1	22.37
6	09/05/2012	BH 1	21.84
7	10/05/2012	BH 1	21.885
8	11/05/2012	BH 1	21.805
9	14/05/2012	BH 1	21.5
10	15/05/2012	BH 1	21.26
11	16/05/2012	BH 1	20.5
12	17/05/2012	BH 1	20.805
13	18/05/2012	BH 1	20
14	21/05/2012	BH 1	20.115
15	22/05/2012	BH 1	20.555
16	23/05/2012	BH 1	20.465
17	24/05/2012	BH 1	20.375
18	25/05/2012	BH 1	20.21
19	28/05/2012	BH 1	20.295
20	29/05/2012	BH 1	20.42
21	30/05/2012	BH 1	20.4
22	31/05/2012	BH 1	19.9
23	01/06/2012	BH 1	19.795

(after Keynetix, 2014)

An Excel File

✓ Data

or

✘ Information

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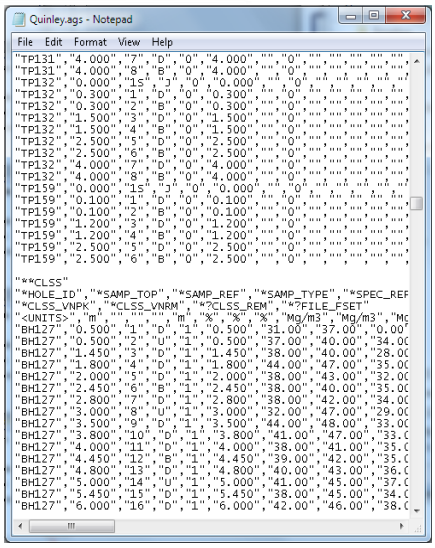
Data or Information?



(after Keynetix, 2014)

AGS Data File

✓ Data

or

✗ Information

The AGS format is a digital data interchange format for the geotechnical community, consisting of a data dictionary, rules, and the file format itself. The Association of Geotechnical and Geoenvironmental Specialists (AGS) in the U.K. set up a Working Party in 1991 to reduce the proliferation of data formats and establish a format to transfer of data between systems. (after Walthall and Palmer, 2006)

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Three Golden Rules of Data Management

- So, we have established that “data” does not have to look good to be effective.
- The sad reality is that most geotechnical engineers are poor “data” managers.
- Good “Data Management” requires 3 things:
  1. Only enter data once
  2. Get someone else to enter the data
  3. Keep data in one place

- How do we accomplish this?
  - Import data whenever possible – don’t type (or re-type)
  - Develop a data management plan and strategy
  - Develop a system to connect all systems together

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Data Schema and Data Dictionary: Groups or Tables

[tblLocation] – stores any construction element, borehole, instrument, etc. that has associated data. Includes element name, coordinates and/or stationing, and element type

Field	Type	Key	Required	Relationship	Example	Description
Location	Text(40)	PK	Y		BH2059	Name of element or instrument
Station	Float				2058.7	Distance along barrier wall to centerpoint of element or instrument (in centerline defined by tblLocation.CenterlineID) [add units to description]
Offset	Float				0.3	Offset from centerline [add sign convention and units to description]
Centerline_ID	Text(20)	FK	Y	vwlCenterline.Centerline		Name of centerline to account for multiple stationing schemes
Northing	Float				49504	Y coordinate of centerpoint of element or instrument [add units and coordinate system to description]
Easting	Float				78990	X coordinate of centerpoint of element or instrument [add units to description]
Top_Elevation	Float				436	Elevation in ft. msl of ground or platform at location
Top_Elevation_Datum	Text(40)				Guide Wall	Description of measurement point for Top_elevation (ground or platform)
Location_Type	Text(20)	FK	Y	vwlLocationType.LocationType	Borehole	Classification of element or instrument (pile, borehole, etc.)
Group	Text(40)				CA 1	User-defined grouping of locations (e.g., critical area, line ID, etc.)
Comments	Text(255)					
Date_Appended	DateTime		Y			Date and time of record creation (applied automatically where possible)
Date_Modified	DateTime					Date and time of last record modification (applied automatically where possible)
Author_Appended	Text(40)		Y			User ID of record creator (applied automatically where possible)

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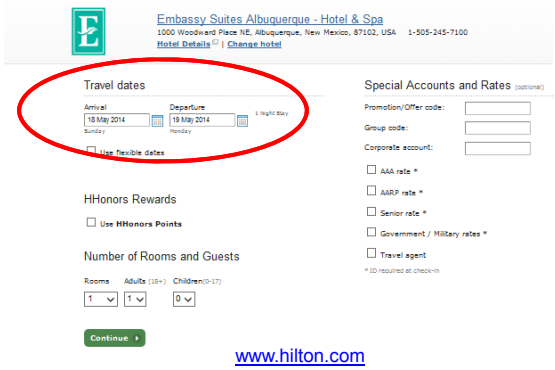
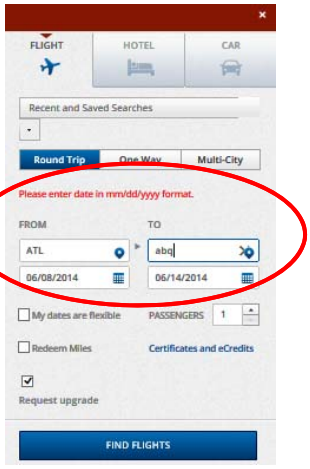
Standardized Data is Part of Our Life



www.hilton.com



www.delta.com

International Organization for Standardization (ISO) defines date format as <year-month-day>

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Data Standardization Works

www.lrn.usace.army.mil

- Wolf Creek Dam – **980** grout holes, **437** PCEW panels, **1314** piles, **207** verification holes…and **11** extensometers, **67** slope inclinometers, **629** piezometers

www.crossrail.co.uk

- Crossrail Tunnels – simultaneous construction of **42** miles of tunnel using **8** TBMs, **39** stations, numerous retaining walls….and settlement stations, hundreds piezometers, hundreds tiltmeters on structures. All data are live within 10 minutes

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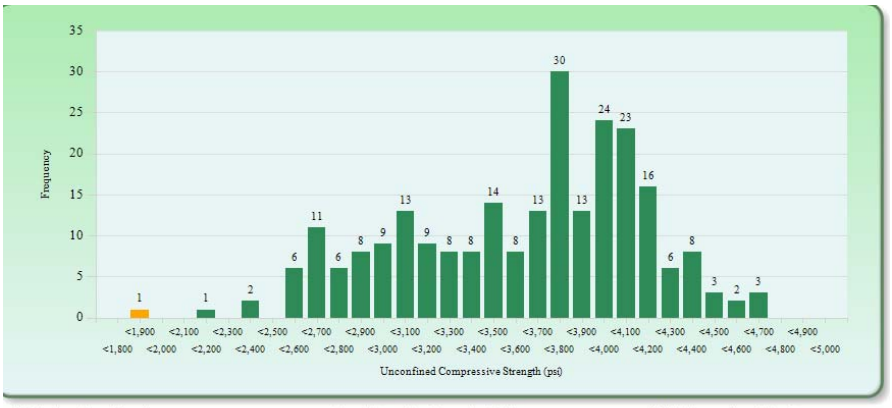
Benefits: Automated Reports



0% Below Specification **Total Samples Tested = 245** **100% Above Specification**

Real-time Data Queries and Reports

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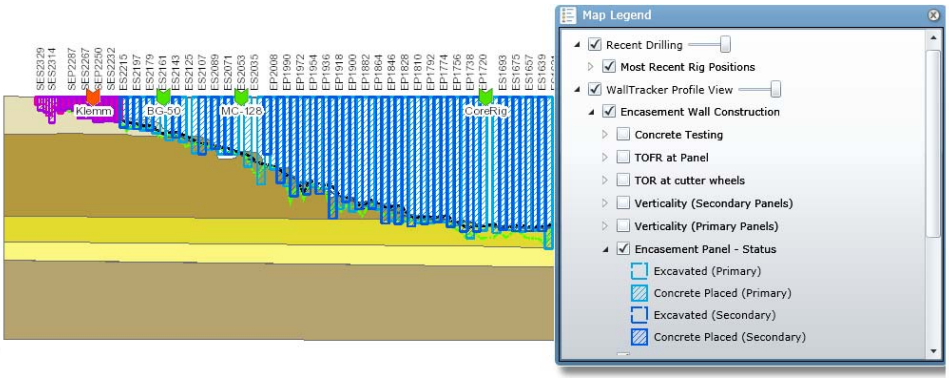
Benefits: CAD Files and Drawings



Direct Connection to CAD, GIS, other Modeling/Visualization Tools

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Three Golden Rules

- Good "Data Management" requires 3 things:
  1. Only enter data once
  2. Get someone else to enter the data
  3. Keep data in one place
- How do we accomplish this?
  - Import data whenever possible – don't type (or re-type)
  - Develop a data management plan and strategy
  - Develop a system to connect all systems together
- Data Transfer: The way to tie all the systems together
  - That was what the AGS format did
  - That is what the DIGGS format will do

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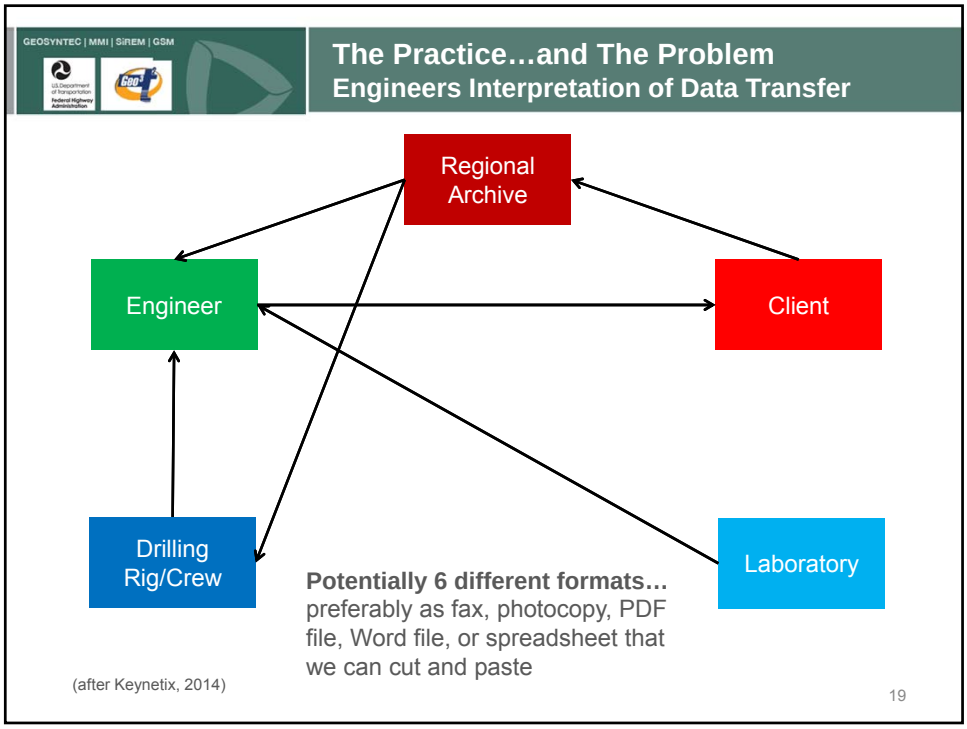
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The Practice…and The Problem
Engineers Interpretation of Data Transfer
Regional Archive
Engineer
Client
Drilling Rig/Crew
Laboratory
Potentially 6 different formats…
preferably as fax, photocopy, PDF file, Word file, or spreadsheet that we can cut and paste
(after Keynetix, 2014)
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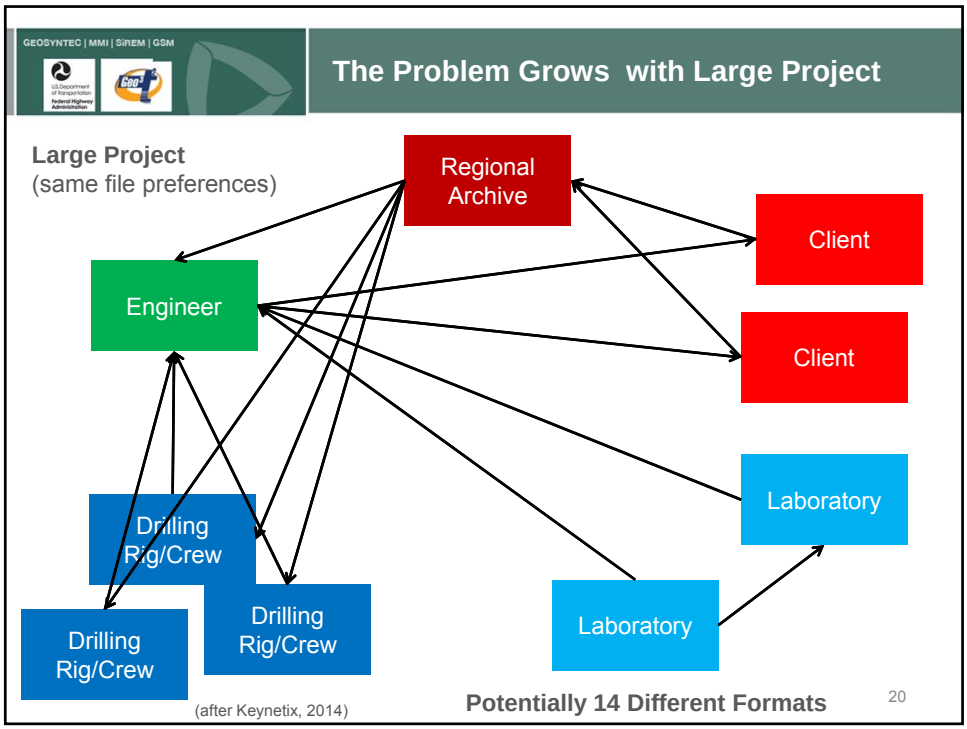
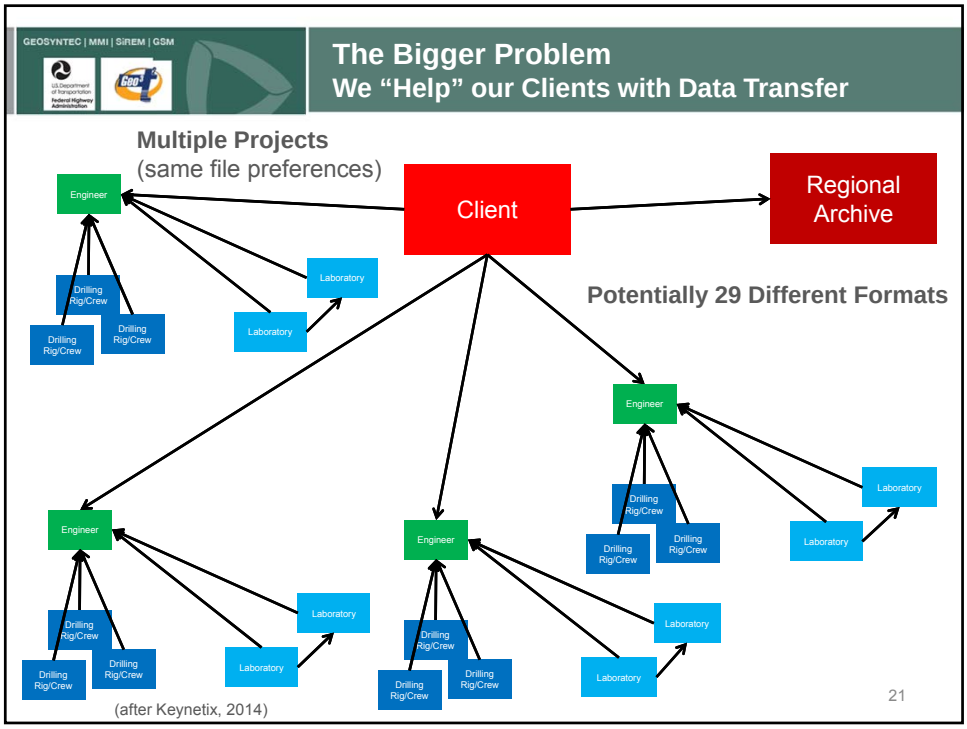
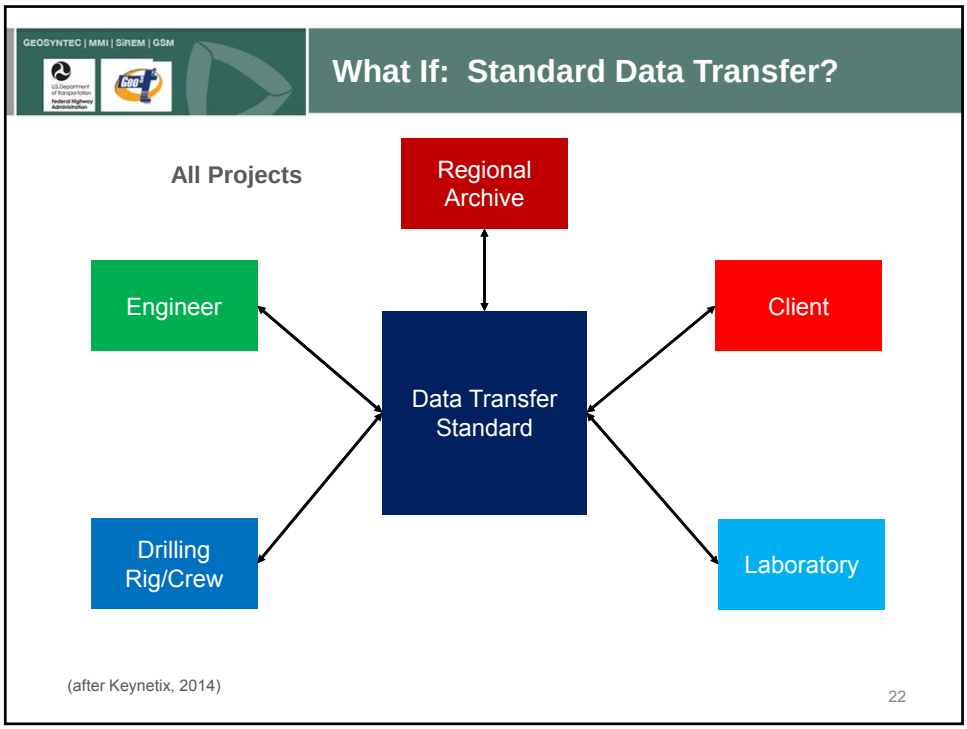

GEOSYNTEC | MMI | SiREM | GSM
The Problem Grows with Large Project
Large Project
(same file preferences)
Regional Archive
Client
Engineer
Client
Laboratory
Drilling Rig/Crew
Drilling Rig/Crew
Drilling Rig/Crew
Laboratory
(after Keynetix, 2014)
Potentially 14 Different Formats
20


GEOSYNTEC | MMI | SiREM | GSM
The Bigger Problem
We "Help" our Clients with Data Transfer
Multiple Projects
(same file preferences)
Client
Regional Archive
Engineer
Laboratory
Drilling Rig/Crew
Potentially 29 Different Formats
(after Keynetix, 2014)
21


GEOSYNTEC | MMI | SiREM | GSM
What If: Standard Data Transfer?
All Projects
Regional Archive
Engineer
Client
Data Transfer Standard
Drilling Rig/Crew
Laboratory
(after Keynetix, 2014)
22

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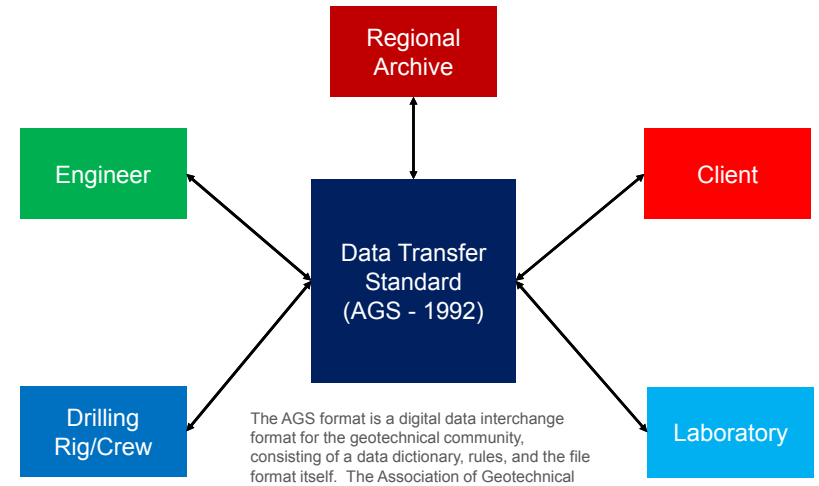
Data Transfer: AGS Format (1992)



(after Keynetix, 2014)

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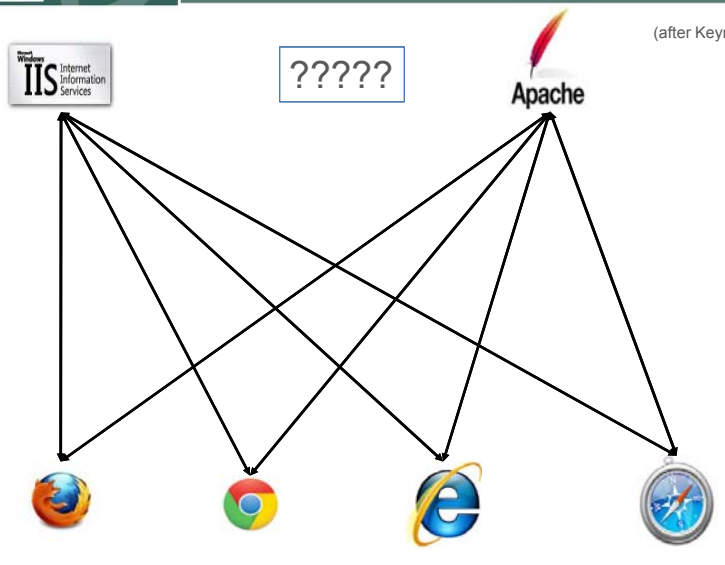
Data Transfer is Part of Our Life

(after Keynetix, 2014)



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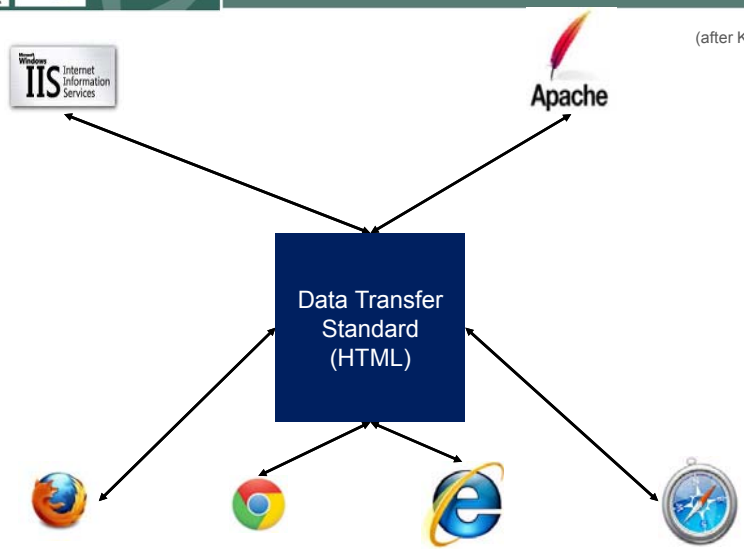
Data Transfer is Part of Our Life (>1995)

(after Keynetix, 2014)



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What is HTML?

- **HTML** or **HyperText Markup Language** is the standard markup language used to create web pages
- The purpose of a web browser (i.e., Internet Explorer) is to read HTML documents and compose them into visible or audible web pages
- The browser does not display the HTML tags, but uses the tags to interpret the content of the page. HTML describes the structure of a website semantically along with cues for presentation, making it a markup language rather than a programing language

Example of HTML Code

```
<!DOCTYPE html>
<html>
  <head>
    <title>This is a title</title>
  </head>
  <body>
    <p>Hello world!</p>
  </body>
</html>
```

(after http://en.wikipedia.org/wiki/HTML)

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Data Transfer (3rd of 3 this morning)

- So here is the HTML Markup

```
<!DOCTYPE html>
<html>
  <head>
    <title>This is a title</title>
  </head>
  <body>
    <p>Hello world!</p>
  </body>
</html>
```

www.gbatemp.net

www.leandroesc.wordpress.com

- Three questions to consider:
  - Did you know what HTML was before today?
  - Do you really care what HTML is?
  - Do you need to understand what HTML is to use the internet?

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Standardized Data Management: DIGGS

- The Geo-Institute of ASCE has assumed responsibility for the support, adoption, and implementation of the ***Data Interchange for Geotechnical and Geoenvironmental Specialists (DIGGS) International Data Transfer Standard***

http://www.diggsml.org

DIGGS DATA INTERCHANGE FOR GEOTECHNICAL AND GEOENVIRONMENTAL SPECIALISTS G-I ASCE

- International geotechnical and geoenvironmental data interchange framework based on XML and GML that was written and used by geotechnical professionals
- Members of the DIGGS Advisory Board have experience with the other recognized standardized format (i.e., the AGS Format) that was developed in the UK, which has been shown to work and save all stakeholders money.

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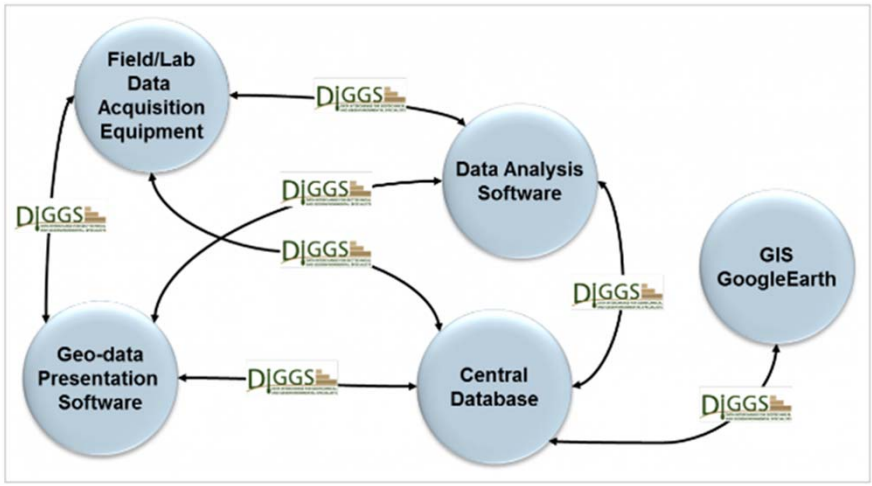
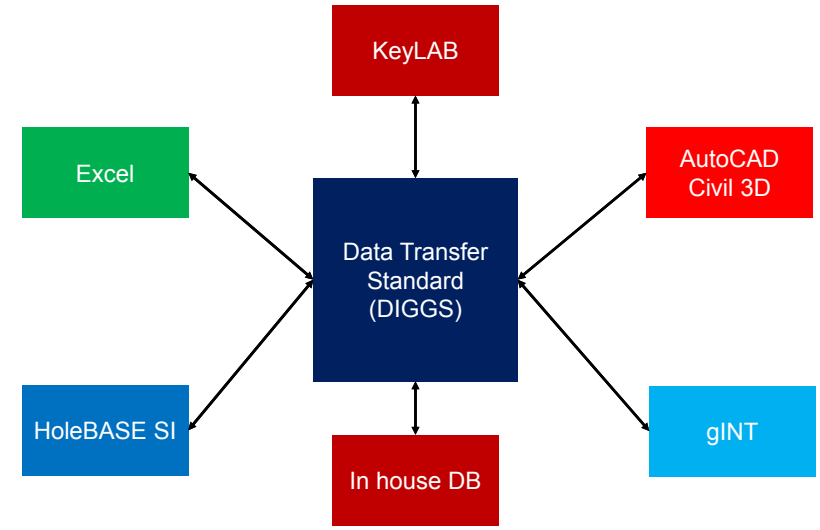
Data Transfer: DIGGS



29

Data Transfer: DIGGS



(after Keynetix, 2014)

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DIGGS Advisory Board

- Currently working together under Geo-Institute of ASCE
  - Scott Anderson – HDR
  - Bob Bachus – Geosyntec
  - Vanessa Bateman - USACE
  - Alan Cadden – Schnabel
  - **Roger Chandler – Keynetix**
  - Scott Deaton – DataForensics
  - Marc Hoit – NC State University
  - Dimitrios Konstantakos – Deep Excavation
  - Khalid Mohammed – FHWA
  - **Dan Ponti – USGS**
  - Rob Schweinfurth – Geo-Institute of ASCE
  - Steve Taliaferro – Ohio DOT
  - Keith Turner – Colorado School of Mines
  - **Loren Turner – Caltrans**
- Our Goal: Make DIGGS work!

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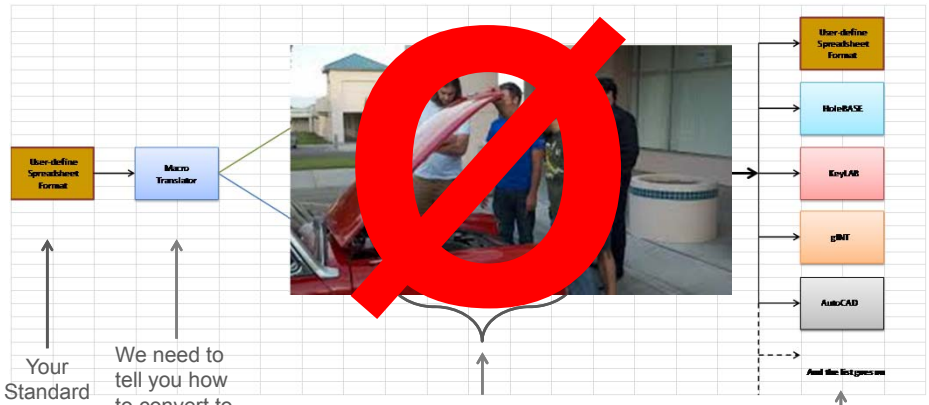
DIGGS: XML Data Transfer Format

DIGGS utilizes an XML and GML format



Realistically, only software vendors and developers can do this

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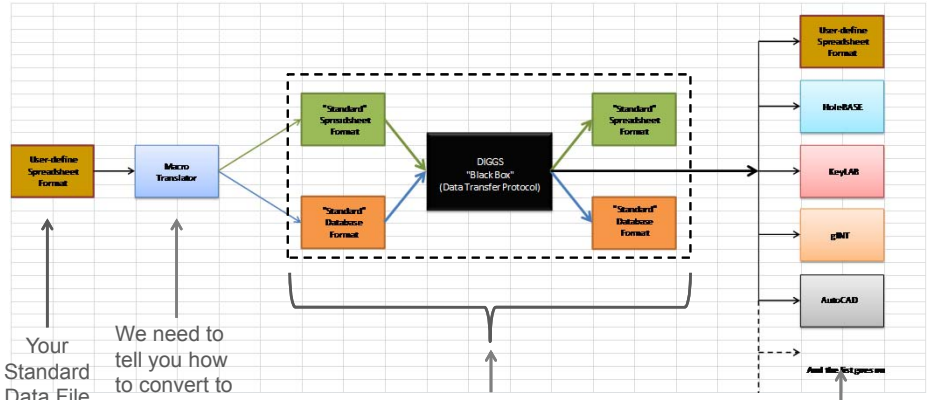
DIGGS: User Concept - 2015

DIGGS utilizes an XML and GML format



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The DIGGS Game Plan

1. **Need to make it user friendly so that it is easy for you to input and output data**
2. Needs to be maintained and updated over time so that the initiative can be sustained
3. Need motivation to continue development – If it works, we need agencies/owners to require the geotechnical professionals to use it

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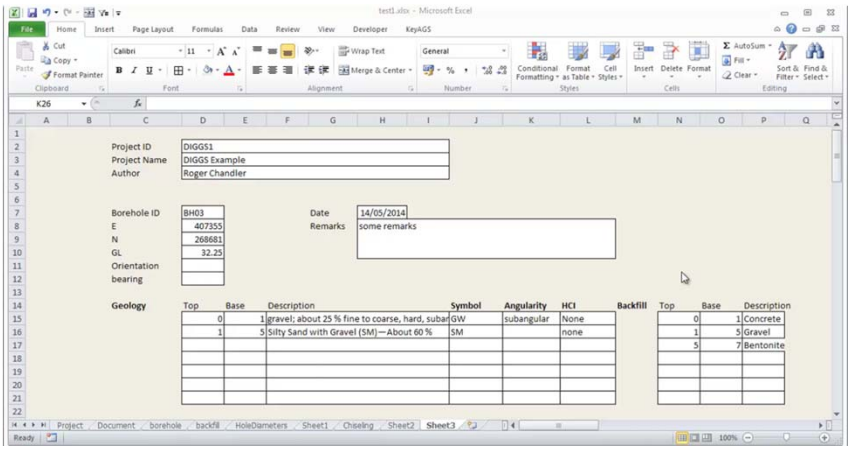
1. User Friendly
Example Standard Boring Log Input

- We provide tool to get your boring log to look like this…automatically
- If it looks like this, it will generate a DIGGS file… automatically



Project ID	DIGGS1
Project Name	DIGGS Example
Author	Roger Chandler

Borehole ID	BH03	Date	14/05/2014
E	407355	Remarks	some remarks
N	268681		
GL	32.25		
Orientation			
bearing			

Geology							Backfill			
Top	Base	Description	Symbol	Angularity	HCI		Top	Base	Description
0	1	gravel; about 25 % fine to coarse, hard, subar	GW	subangular	None		0	1	Concrete
1	5	Silty Sand with Gravel (SM)—About 60 %	SM		none		1	5	Gravel
							5	7	Bentonite

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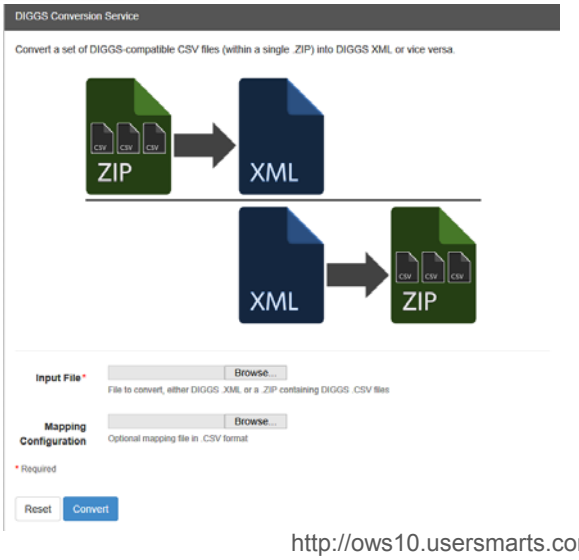
DIGGS Converter



http://ows10.usersmarts.com/diggs/index.html

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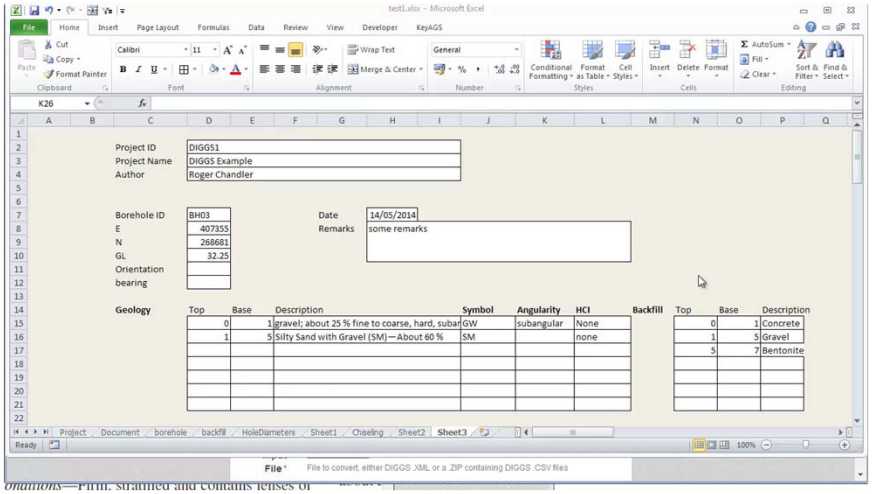
How Will This Work?



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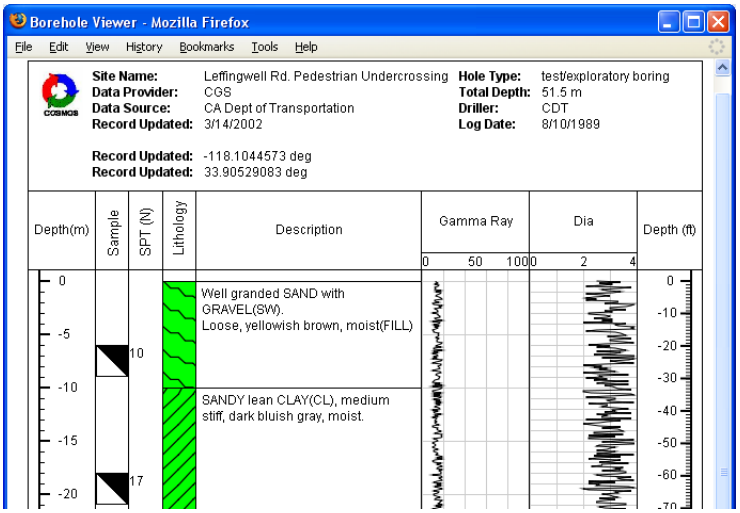
Example Standard Boring Log : COSMOS



Data (and Boring Log) can be instantly transferred across the web

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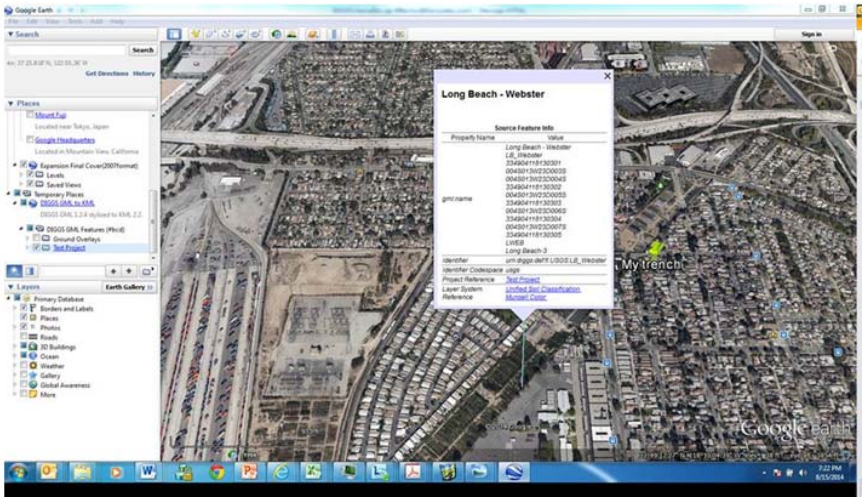
Example Map Interface to Google Earth: DIGGS



Standard format allows interface to other (generic or proprietary) applications

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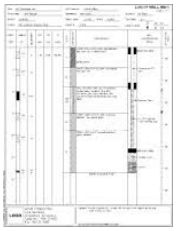
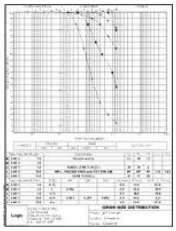
Software Tools to Follow

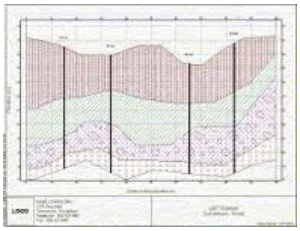
Boring Logs



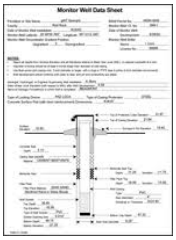
Lab Test Report



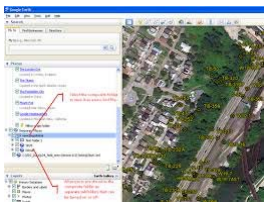
Fence Diagrams



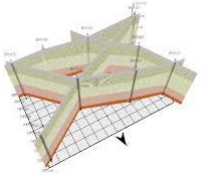
Completion Details



GIS Interface



3-D Graphics



www.scientificsoftwaregroup.com/

www.bentley.com/

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2. Importance of Sustainability DIGGS will Require Care and Feeding

1. Easy to Implement into Current Practice
   - User-friendly to Input Data
   - Adaptable to Current Practice
2. **Business Model to Sustain Development**
   - **Manage Care and Feeding of DIGGS**
   - **Ongoing Development**
3. Required Use
   - Need to have Incentive to Change
   - Owners and Agencies are Key

http://www.betterworldbooks.com

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Pipeline Open Data Standard (PODS)

Other industries have adopted similar concepts

Plus: We envision and organization that can help promote and provide guidance for effective data management

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Sustainability of Data Standards
Evolution of Data Management

The U.K. has (again) set the bar at a high level

- BS 8574:2014 Code of Practice for the Management of Geotechnical Data for Ground Engineering Projects
  - BS 8574 gives recommendations on the management of geotechnical data throughout the life-cycle of civil engineering and building projects at both an organizational and project level.
  - It defines data as a concept and provides recommendations on the collection, verification, manipulation, distribution, presentation and storage of data.
  - It applies to all aspects of ground engineering including ground investigation, environmental investigation, construction, piling, tunneling, and asset management.
  - It provides some explanations on the role of software, databases and electronic data transfer system.

British Standard (BS) is the equivalent to the U.S. American Society for Testing and Materials (ASTM)

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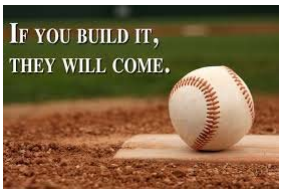
3. Required Use of Standard Data System
Field of Dreams (1989)



Make it User Friendly and Provide Quantifiable Benefits

http://speakoutsarasota.com

http://franklymydearmojo.com

Find a Way for Owners and Clients To Require That It Be Used

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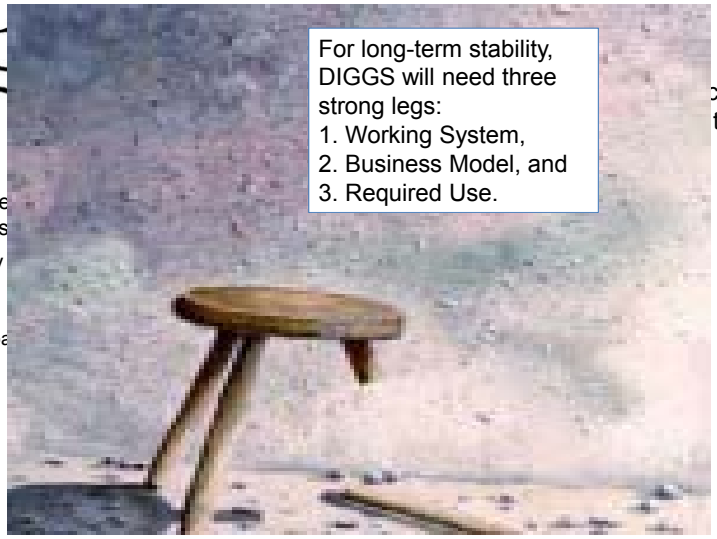
Three Tenets for Success of DIGGS



For long-term stability, DIGGS will need three strong legs:
1. Working System,
2. Business Model, and
3. Required Use.

cceed
three

Re
Us

User-friendly

www.clipa

DIGGS Implementation Schedule

- Commence Development - Pooled Fund Study in 2005
- Release 2.0α – Released July 2012
- Ohio DOT & Geo-Institute – October 2013
- Community Survey – currently ongoing thru October 2014
- Pilot Testing – October thru December 2014
- Release 2.0β – January 2015
- Training Webinars – January thru March 2015
- Management Strategy – February thru July 2015
- Full Release DIGGS 2.0 – November 2015

We know that we have to arm you with sufficient information (e.g., data dictionary, schema, etc.) to make the task easier and to help train you on the use and application of DIGGS if the project is to succeed.

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You Can Help Contribute to Change: Community Survey and Pilot Test

- Community Survey (we welcome critical input from all parties)
  - Identify your organization
  - Identify current data management strategies/practices
  - Identify current data storage and sharing protocols
  - Assess potential value in DIGGS concept
  - Identify needs and/or concerns with adoption
  - Help assess a viable and sustainable business model
  - Contact information for your organization
- Pilot Testing (we need hands-on participation and critique)
  - Review proposed Data Schema
  - Review proposed Data Dictionary
  - Enter some of your data into standard data schema
  - Create DIGGS files
  - Review "generic" DIGGS output for accuracy
  - Provide feedback to committee

www.diggsml.org

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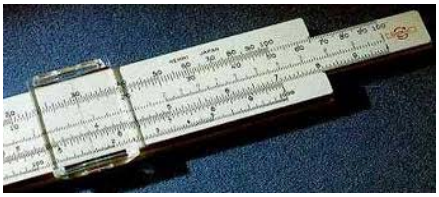
Potential Concerns and Criticisms

- This is one more thing that I have to do in limited time
- It requires a change in practice and culture
- I will have to convince my management
- My data are not secure
- It will be expensive



www.tangible-technology.com

www.bobbiblogger.files.wordpress.com

I hope you will agree…..
Change is inevitable and some changes are good

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Common Critique

- This is one more thing that I have to do in limited time
- It requires a change in practice and culture
- I will have to convince my management
- My data are not secure
- It will be expensive

….it takes longer to get the strategy done (in Japan) because you need to do that *nemawashi* and get everyone behind it. But then the implementation is lightning speed."

Ford Motor Company CEO, Mark Field, talking about how to bring new ideas to the Japanese culture when he was the newly named CEO of Mazda (Delta SKY, April 2015)

nemawashi : Japanese for "planting seeds"

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How Do Some People Initiate Change

….it takes longer to get the strategy done (in Japan) because you need to do that *nemawashi* and get everyone behind it. But then the implementation is lightening speed."

Ford Motor Company CEO, Mark Field, talking about how to bring new ideas to the Japanese culture when he was the newly named CEO of Mazda (Delta SKY, April 2015)

nemawashi : Japanese for "planting seeds"

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Conclusion

- We see no reason to NOT start developing and requiring a "project data schema" as part of project deliverables our large projects… in fact, we encourage it
- We see significant benefits to all stakeholders (including our clients and project owners) when standardized guidelines are imposed…particularly on projects using similar data (i.e., geotechnical data) that are covered by DIGGS. But, do not be afraid to move into new territory
  - Historical knowledge - Contractor experience
  - Institutional memory - Lessons learned
- We think that "standardized data formats" will eventually become THE standard for geo-professionals. We should not be afraid to adopt and maintain an "industry leadership" culture
  - BS 8574:2014 - Canterbury Geotechnical Database
  - PODS (O&G Industry) - Building Information Model (BIM)

If not <u>now</u>….When?
If not <u>you</u>…. Who?

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Goal & Request – Your Important Role

- Our Goal
  - Promote Data Management
  - Make DIGGS Work
  - Make DIGGS a Reality

www.gaultenergy.blogspot.com

- Our Request
  - Participate in Community Survey
  - Adopt DIGGS in your Organization
  - Require DIGGS Format be Used

www.forestviewpta.org

- Your Role
  - Promote DIGGS when you can
  - If you cannot, please offer constructive criticism and give us a chance to address your concern and reticence

www.themiraclejournal.com

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Conclusion

- I appreciate your taking time to listen and allow me time for *nemawashi.* I hope we have your support.
  - Questions
  - Critique
  - Recommendations
  - Actions
- Thank you

www.jonathankirshner.com

www.ourfamalama.blogspot.com

www.mormonsoprano.com

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