GeotechIE report
The 125th OGC Member Meeting

Mickael Beaufils, BRGM
22 February 2023
What is the Geotech Interoperability Experiment?

• An effort to federate the geotechnical community around standards
  • Enhance existing standards / Highlight complementarity

• An activity lead by the OGC Geoscience DWG (second IE after Borehole IE)
  • Started on February 2022
  • Estimated end in mid 2023
Motivation: Digital continuity for geotech

NB: Non exhaustive list of existing formats and standards

IFC

.AGS

diggsml

GeoSciML

GroundWaterML2
Geotech IE objectives and Work Packages (reminder)

Community oriented goals
- Contribute to federate the geotechnical community around a common position / proposal for geotechnical data,
  - Scientific – IT connection
  - BIM – GIS and more connection
  - Users – Solution providers connection

Technical oriented goals
- Propose effective solutions to enable digital continuity between GIS and BIM

Work packages:
- #1: Common conceptual model
- #4a: White paper
- #4b: Technical paper
- #5: Implementation Guide for Software Vendors
- #2: Extension of OGC Geoscience standards,
- #3: Technical documentation on the use of OGC APIs
- #3bis: Implementation forum

Image courtesy © ESRI
Work organization – “Workspace”

- Mail list: geotech.ie@lists.ogc.org
- GitHub: https://github.com/opengeospatial/Geotech
- Wiki: https://github.com/opengeospatial/Geotech/wiki
#1: Common conceptual model

- **Conceptual model:**
- Technology agnostic
- Base for all implementations

ICF Tunnel GeoSubgroup

Conceptual model

GeoScienceDWG

GT1-5 Geotechnics

TC222 BIM & Digital Twin for Geotechnics

AGS

and many more...
Common conceptual model - Usage

Based on existing working groups / organizations on February 2022

IFC Implementation

bSI Conceptual Model for Geotechnics

OGC Logical model

OGC Conceptual Model for Geotechnics

Common Conceptual model for Geotechnics

Lead: IFC Tech Team

Lead: IFC Tunnel Geosubgroup

Lead: GeoSciML SWG, GWML2 SWG, etc...

Lead: GeoScienceDWG

ISSMGE TC222
Geotechnical BIM & Digital Twins
As representative of FedIGS
#1: Geotechnics is « simple » as A, B, C

- Following the terminology from AFTES GT32 (also used in bSI IFC Tunnel WG)
  - AFTES = French Association of Tunnel and Underground Space

Book C: Design report: « Projection »

Book B: Models and interpretations

Book A: Observations and measurements

- Book C depends on Book B which depends on Book A
#1: Contents of each book
(based on current discussion and cover intentions by the standards / formats)

<table>
<thead>
<tr>
<th>Objects</th>
<th>Associated properties</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Book A</strong></td>
<td>Observation Supports or Sampling Features</td>
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* partial cover
#1: eg. Borehole page

Borehole
Mickaël Beaufils edited this page on Jan 12 · 31 revisions

What is a Borehole?
A Borehole is the generalized term for any narrow shaft drilled in the ground, either vertically, horizontally, or inclined.

Realizations

<table>
<thead>
<tr>
<th>Data model</th>
<th>Concept name</th>
<th>Definition</th>
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<td>OGC GeoSciML</td>
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<td>IFC</td>
<td>Borehole</td>
<td>Same as OGC GeoSciML</td>
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<td>LOCA</td>
<td>AGS LOCA includes exploratory holes of any type, A sampling feature feature that is a deep, narrow shaft</td>
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Properties

FAQ

What about Trial Pit?
Despite a lot of similarities with borehole, the Trial Pit is proposed as a different concept.
See https://github.com/opengeospatial/Geotech/wiki/TrialPit for its description.

What about Borehole core?
A borehole core is considered as a MaterialSample.
See https://github.com/opengeospatial/Geotech/wiki/MaterialSample for its description.

• 1 page per concept
• Same structure
• Definition
• Realizations with OGC, bSI, AGS and DIGGS standards
• FAQ
#1: Borehole properties

- Same as for the concepts
- Have a name + definition (either one existing or made for the project)
- Define realizations with the different standards
Semantics alignment

- **Topics:**
  - Observable Properties
  - Interpreted Properties
  - Procedure

- **Sources:**
  - DIGGS
  - AGS
  - MINnD
#1: Top discussions

- Observation with a complex result vs a collection of observations
- Observation vs Measurement
- Observation/Measurement vs Interpretation
- Observations nested in the procedure vs Observations and associated procedures
- Sample vs Specimen
#1: Conceptual model governance?
#2: OGC standards extensions

- New concepts to be proposed:
  - GeotechnicalUnit
  - DiscreteDiscontinuity

- Existing concepts that will be proposed properties for geotechnics: including GeologicUnit, ShearDisplacementStructure, Contact, Fold, HydroGeoUnit, FluidBody, FluidBodySurface.
  - Aligned with the IFC Tunnel 4.4 candidate

- Concepts that might worth being revisited: GeoSciMLBorehole
  - Cf. BoreholeIE conclusion suggesting to have a Borehole SWG
  - Interesting similarities between the DIGGS borehole concept and the solution envisaged by BoreholeIE (see Kathi’s presentation)
Main interest for geotechnics is (but is not limited to):
- Features
- Observations & Measurements

OGC APIs for consideration (non-exhaustive)
- OGC API Feature
- OGC SensorThingsAPI
#3: OGC APIs for Geotech - Implementation

- Known implementations based on
  - Borehole description – WFS
  - Borehole data (Geology logs) – SOS
  - GeologicUnit – WFS
  - ShearDisplacementStructure (faults) – WFS
  - Borehole data – OGC API Feature* (not based on a standard semantic)

- Current implementations on development
  - Borehole data – SensorThingsAPI > See Kathi’s presentation
#3: OGC APIs for Geotech – usage

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Served with: OGC API Feature OGC SensorThingsAPI
#3: OGC APIs for Geotech

- **Intention**
  - Be able to discover existing data
  - Be able to get / download them

- **Requirement**
  - Meta description of data
  - Appropriate data formats for usages
  - Shared data!

- **Proposed solution**
  - Data discovery: Catalogs + search functionality
  - Data accessibility: OGC APIs
A fisherman’s dream…

Different recipe of geotechnical data
#3: OGC APIs for Geotech - Documentation

- Already existing material
- API for INSPIRE
  - Studying the fitness of OGC API Features and SensorThings API as an INSPIRE Download service
- To be extended with geotech examples

#3: bSI Implementation forum

- Launched in January 2023

- Proposing to test the IFC 4.4 candidate standards that includes geotechnics

- Several big players of AEC already engaged but also new solution providers

- Contact:
  - Michel Rives – bSI IFC 4.4 project manager (michel.rives@vianova-systems.eu)
  - Jonas Weil – Geotech Team Lead (j.weil@ic-group.org)
#4a: White paper (starting Geotech IE)

## Paper objective
This paper exposes a position regarding Digital Continuity for Geotechnics at the BIM era. It introduces challenges and also envisions solutions to address it.

The co-authors listed below share this vision and propose to collaborate to develop or support this initiative.

### Co-authors / supporters
- Scott Simmons, OGC, Chief Standards Officer
- Richard Petrie, buildingSMART International, Chief Executive
- Mickael Beaunfils, BRGM, OGC GeoScience DWG Chair
- Michel Rivée, Vianova Systems, IFC Tunnel Project Leader
- Jonas Weil, IC-Group, IFC Tunnel Geo-Subgroup Leader
- Neil Chadwick, AGS Data Management Working group
- Dan Ponti, DIGGS Steering Comittee
- Magnus Romoén, NGI, ISSMGE TC222 Chair
- Harvey Thorleifson, Minnesota Geological Survey, CGI-IUGS Chair
- Andrew Hughes, BGS, OGC MUDDI SWG Co-chair
- Isabelle Halfon, BRGM, Geotechnical Engineer
- Elodie Vautherin, COLAS, Geotechnical Engineer
- Pierre Garnier, COLAS, Geotechnical Engineer
- Sylvie Brethelle, Antea Group, Geotechnical Engineer

#4b: Technical paper (closing Geotech IE)

- Will mostly be an index of the production of the group
#5: Implementation guide for software vendors

- Not yet started
- Geotech IE report plan for the next bSI Summit (Roma, March ‘23)
News from ISSMGE TC222

- Discussion to have a workshop dedicated to BIM and Digital Twins for Geotech
Questions?

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