MINnD UC8-GT: Geotechnical data standardization and management for BIM and Smart Cities

108th OGC Technical Committee, Joint IDBE / Smart Cities / LandInfra session
Stuttgart, Germany
Mickaël Beaufils (BRGM), on behalf of the MINnD UC8-GT team
11 September 2018
- A French collaborative program to extend BIM methods and standards from building to infrastructure modeling
- In connection with buildingSmartFrance (MediaConstruct)
- 70 partners
Context: MINnD UC8

- MINnD UC8: Underground Infrastructures (mid 2017-2018)
  - Focus on tunnels, underground spaces
  - Focus on the design part (not construction and exploitation of the infrastructure)
  - 14 partners involved

- Two teams:
  - GC: describe construction and equipments
  - GT: describe environment and interaction with construction

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Context: MINnD UC8-GT

• Concrete applications / feedback
  – Lyon-Turin (rail)
  – Grand Paris Express (rail)
  – CIGEO project (rail)
    • Long term and deep storage of radioactive waste
    • Several connected tunnels

• Objective
  – Sustainable organization of data to ensure smooth transition between design, construction and maintenance
  – Being able to retrieve data in 100 years
Challenges

• A very cross-frontier topic
  – Geoscience / Civil Engineering
  – GIS / BIM (+ geomodelling tools!)
  – OGC / bSI

• « Which kind of interoperability do we want? »
  – Extending IFC with geo* concept (An, 2017), (China BIM alliance, 2015)?
  – Integrating BIM data into earth models? city models including subsurface, natural + anthropic?
  – Something else?

• Think outside the (project) box
  – Data maintenance, reuse > the last «Ds» of BIM
  – From smartbuilding and infrastructures to smart cities
Tasks of the MINnD UC8-GT group

- Explicit the geoengineering activity
- Determine which data are exchanged

- Conceptual model / Data Dictionary
  - Propose data organization
  - Define semantics

- How to fulfill the exchange requirements?
  - How to get / update data

Information Delivery Manual (IDM)

...in connection with the other group (GC)
...and in connection with the current dynamics
A definition of geoengineering activity

• A very mis-used term. A lot of confusion with geology, hydrogeology.

• Geoengineers aim at characterizing subsurface to help civil engineers to define how to build (if it is possible)

• Thus:
  – They propose infrastructure sizing
  – They propose construction methods
  – They assess risks of the project and impacts on:
    • Surrounding constructions and existing utility networks,
    • Environment (pollution, excavated materials to evacuate)
Comprehension of the geoengineering activity

- 9 main topics

<table>
<thead>
<tr>
<th>Designation</th>
<th>Id</th>
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<td>CALC</td>
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<td>Construction methods</td>
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<td>Risk and uncertainty assessment</td>
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<td>Observations and Measurements</td>
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GEOL, HYDRO, GTCH
AVOI, ENVI, RISK

Model(s)

Combine data to build an interpretation of a phenomenon

Use model(s) to define « How to build »

Observation(s)

Get data from the field or feedback

Preconisation(s)

Build following preconisations

Real world

CALC
MECO
Expliciting the geotechnical activity processes

- Information Delivery Manual (IDM)
  - Workflow description
  - ISO 29481-1:2016
  - 1 per subject

- Highlight basics
  - Who does what?
  - Which data?
  - Which results?

- Focus on knowledge construction
  - Not methods and tools
Some feedback from the geoengineering activity study

- Several kind of geoscientists involved in a project
  - Geologist, hydrogeologist, geoengineer, driller, geodata manager, …
  - Sometimes two roles can be addressed by only one person

- Tools heterogeneity
  - Each actor may have its own kind of tool
  - Several software / editors for the same kind of tool

- Semantic heterogeneity
  - Importance of common vocabs (eg. IUGS-CGI)

- 3D geomodelling is only 5% of the projects
<table>
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<th>Concepts to address</th>
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<td>Observations on the field</td>
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<td>Existing networks</td>
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<td>Risk zones</td>
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<td>Survey / Campaign</td>
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<td>Geomodel</td>
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Proposition of mapping with OGC + INSPIRE data models
Lyon-Turin tunnel hydrogeological modeling

• Cross-section view along the project axis

• Geological model as the base for the hydrogeological model

• Adding refinements (layer merge) to represent homogeneous area regarding hydrogeological parameters

• Additional data according to hydrogeological « issues » that can be faced along the axis of the project
  – Ex : aggressive water presence, hot water presence
Other propositions from the group

• Attaching geotechnical information to the alignment
  – Being able to know what « geo » issue can be faced at each step on the tunnel axis
    • Risk concerning hydrogeology: hot water, aggressive water,
    • Risk concerning geologic formation property change
    • Risk concerning geologic structure: fault presence
    • Risk concerning surrounding construction
    • Risk concerning pollution on environment
  – API to get those information from geomodels on demand?

• Define which IFC properties of an element can be impacted by each « geo » particularity
  – Eg. Expected speed of the train have an impact on the alignement geometry
  – Some geotechnical property may have direct impact on choice of some equipments
Summary

• Geoengineering is not (only) provision of « map » of the subsurface
  – It goes further with the proposition of structure sizing, construction methods and risk assessment
  – At least, a lot of O&M to deal with

• Several (if not all) needed concepts are already in a OGC / INSPIRE data model
  – Relying on them would facilitate compatibility between geoscience data for constructions and other geoscience data
  – It would also help aggregation of geodata
  – Activities of geoscience data harmonization are already on the run (BoreholeIE)

• A very cross-frontier topic
  – To be addressed by bSI and OGC together, targetting common conceptual models
  – Thursday 13th Expert panel on geotechnics for BIM organised by bSI
Thanks for your attention!

• Questions ?

• Contact:
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• Useful links: