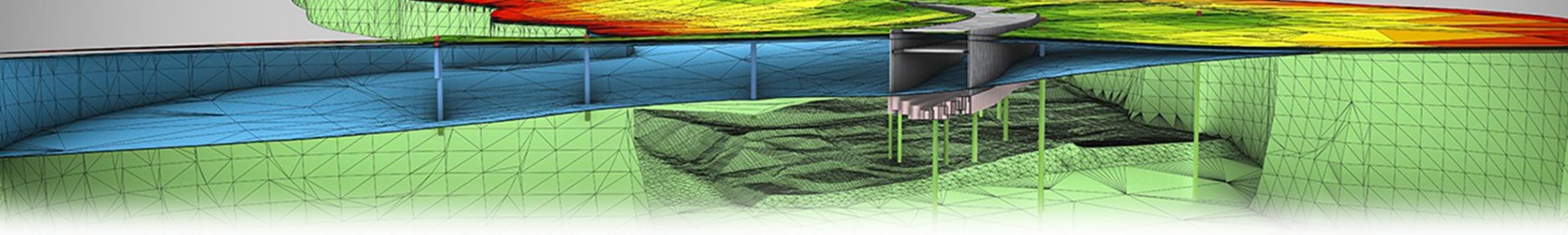


ISSMGE TC222 Geotechnical BIM and Digital Twins

Online Workshop

Digital standards for geotechnical data

Thursday April 4th |14:00 (Paris) | 8:00 (New York) | 20:00 (Hong-Kong)

Duration : 2 hours

with talks from:

Neil Chadwick (AGS Data Management WG), Dan Ponti (DIGGS Steering Commitee),
Jonas Weil (bSI IFC Tunnel GeoSubgroup) and Mickaël Beaufils (OGC GeoScience DWG)

SIMSG ISSMGE

AGS

DiGGS
DATA INTERCHANGE FOR GEOTECHNICAL AND GEOENVIRONMENTAL SPECIALISTS

buildingSMART International

Open Geospatial Consortium

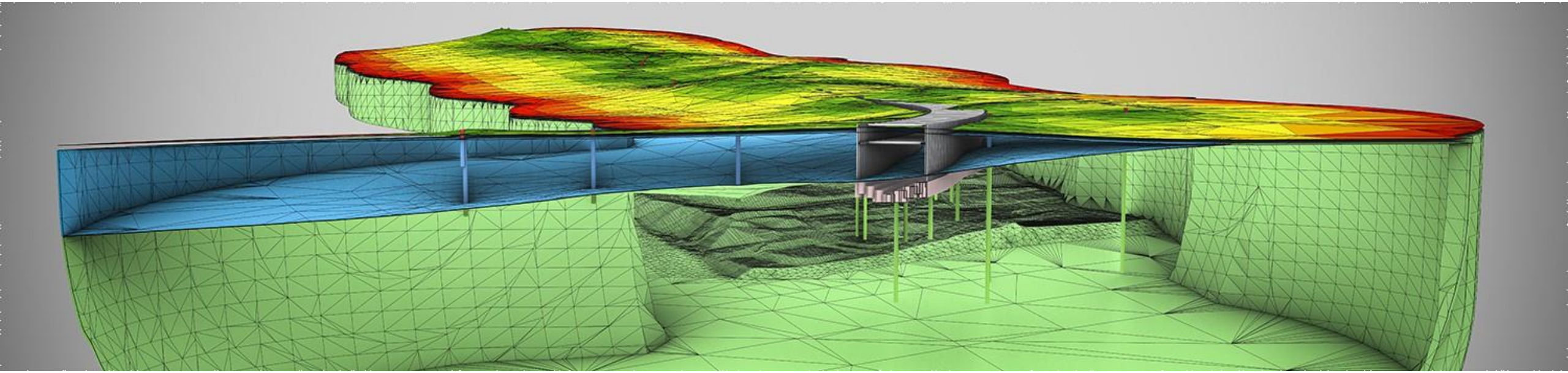
Welcome to the 3rd ISSMGE TC222 online Workshop!

- **Agenda**
  - 14h00: Welcome
  - **14h05: Introduction about ISSMGE TC222 (5min)**
  - 14h10: Introduction about digital standards for geotech (10min)
  - 14h20: AGS presentation – Neil Chadwick (20min + 5 for Q&A)
  - 14h45: DIGGS presentation – Dan Ponti (20min + 5 for Q&A)
  - 15h10: bSI presentation – Jonas Weil (20min + 5 for Q&A)
  - 15h35: OGC presentation – Mickaël Beaufils (10min + 5 for Q&A)
  - 15h50: Wrap-up (5min)

- **For Q&A**

https://app.sli.do/event/rdUsCqYqe4vbqRGiYu6tXX/live/questions

Or go to https://www.slido.com/
Code: #4158 443



Introducing ISSMGE TC222

Magnus Rømoen (Chair, NGI) & Mickaël Beaufils (Vice-Chair, BRGM)

ISSMGE

- International Society for Soil Mechanics and Geotechnical Engineering
- 90 members societies / national bodies and around 20,000 individual members
- 37 Technical Commitees: 7 about Fundamentals (TC1xx), 21 about Applications (TC2xx), 9 about Impact on Society (TC3xx)
- TC222 : BIM & Digital Twins for Geotechnics

More info: https://www.issmge.org/

TC222 Council

Chair

Magnus Rømoen

-

NGI

Vice-chair

Mickaël Beaufils

-

BRGM

Secretary

Mats Kahlström

-

NGI

Core members

Jelena Ninic

-

University of Birmingham

Core members

Raymond Koo

-

Hong-Kong City

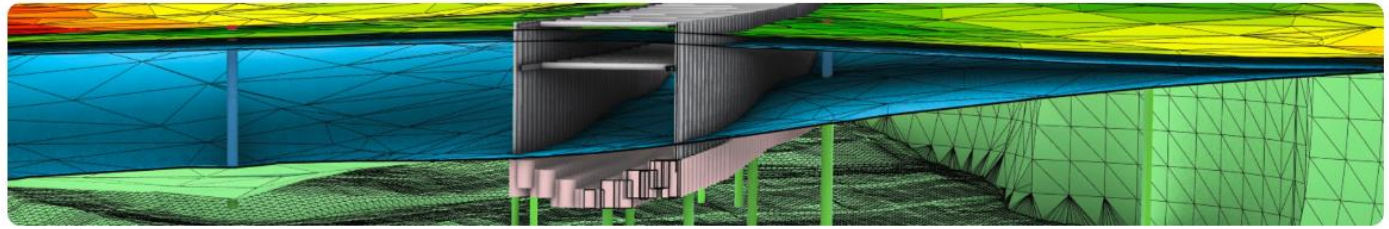
Follow us

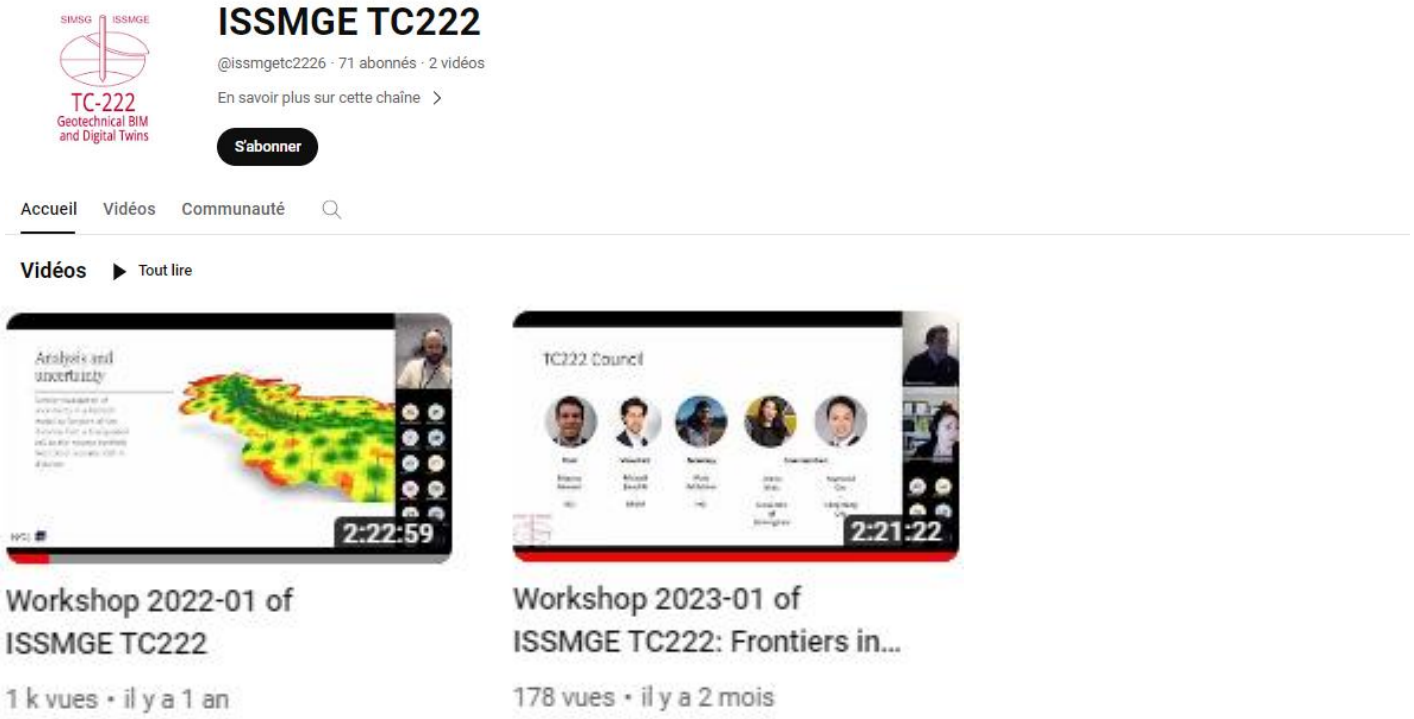
- On our website:
  - https://www.issmge.org/committees/technical-committees/applications/geotechnical-bim-and-dt

- On LinkedIn:
  - https://www.linkedin.com/company/issmge-tc-222/

- On Youtube:
  - https://www.youtube.com/channel/UC7eMKzvagK7DN3MnIvK7yCQ

Previous workshops recordings are available!





YouTube

- https://www.youtube.com/channel/UC7eMKzvagK7DN3MnIvK7yCQ

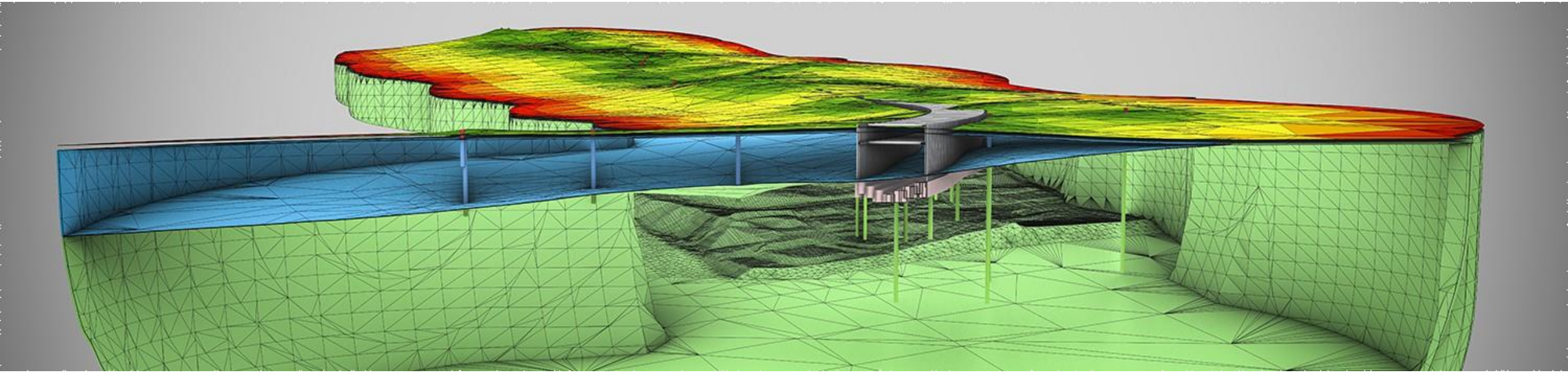
3rd ISSMGE TC222 online Workshop

- **Agenda**
  - 14h00: Welcome
  - 14h05: Introduction about ISSMGE TC222 (5min)
  - **14h10: Introduction about digital standards for geotech (10min)**
  - 14h20: AGS presentation – Neil Chadwick (20min + 5 for Q&A)
  - 14h45: DIGGS presentation – Dan Ponti (20min + 5 for Q&A)
  - 15h10: bSI presentation – Jonas Weil (20min + 5 for Q&A)
  - 15h35: OGC presentation – Mickaël Beaufils (10min + 5 for Q&A)
  - 15h50: Wrap-up (5min)

- **For Q&A**

https://app.sli.do/event/rdUsCqYqe4vbqRGiYu6tXX/live/questions

Or go to https://www.slido.com/
Code: #4158 443



SIMSG ISSMGE

Digital standards for geotech

Mickaël Beaufils

ISSMGE TC222 & Digital Standards

- TC222 is one of the most "digital oriented" TC from ISSMGE
- Standards are necessary to achieve BIM and Digital Twins
- Terms of reference:
  - Objective 2 : Guidelines & Recommendations
    - *TC222 will be a link between the ISSMGE member geotechnical societies and the ongoing standardization work for BIM and Digital Twins in practice. This means **collaboration and development together** with buildingSmart International (bSI), the Open Geospatial Consortium (OGC) and potentially the AGS and DIGGS communities. This important work, including cross-discipline standardization, is an essential element for the success of future geotechnical BIM projects.*
    - *The TC will also, where necessary, establish **guidelines and technical recommendations** for the implementation of BIM and Digital twins in geotechnics, looking at both research and practice.*

See: https://www.issmge.org/committees/technical-committees/applications/geotechnical-bim-and-dt

ISSMGE & Digital Standards

International data standards for geotechnical engineering

Les normes internationales de données pour l'ingénierie géotechnique

D.G. Toll

School of Engineering, Durham University, Durham, UK Email: d.g.toll@durham.ac.uk

ABSTRACT

The World Wide Web has revolutionised data access for all aspects of our daily lives. However, to allow full use of geo-engineering data from the web, as part of our professional activities, it is necessary for the data to be available in a structured and standardised form. This will allow the World Wide Web to become an international repository for geotechnical information, available to the whole community. A further advantage of developing data standards is to allow transfer of data between computer systems providing a data exchange format between different organisations or an interchange format for linking different software packages. The development of data standards for geo-engineering is now an important activity for the three international societies (ISSMGE, IAEG and ISRM) through Joint Technical Committee, JTC2 (http://www.dur.ac.uk/geo-engineering/jtc2). JTC2's role is to oversee the development of internationally agreed forms of representation of geo-engineering data. The paper discusses standardised XML schemes that are in development for geo-engineering and presents examples for borehole records and slopes. The DIGGS data format (Data Interchange for Geotechnical and Geo-environmental Specialists) is discussed and comparisons are drawn with data standards in the geosciences (eg GeoSciML). The paper also considers how web-based data could be used, such as the use of a case-based reasoning system for slope design using a global database of slope case histories.

RÉSUMÉ

Le World Wide Web a révolutionné l'accès aux données sur tous les aspects de notre vie quotidienne. Toutefois, pour permettre la complète utilisation des données de la géo-ingénierie sur le web, dans le cadre de nos activités professionnelles, il est nécessaire que les données soient disponibles sous une forme structurée et normalisée. Cela permettra au World Wide Web à devenir un référentiel pour l'information géotechnique, à la disposition de l'ensemble de la communauté. Un autre avantage de l'élaboration de normes de données est de permettre le transfert de données entre des systèmes informatiques offrant un format pour l'échange de données entre les différentes organisations ou d'un format permettant de relier différents logiciels. Le développement de normes de données pour la géo-ingénierie est désormais une activité importante pour les trois sociétés internationales (ISSMGE, IAEG et ISRM) par le Joint Technical Committee, JTC2 (http://www.dur.ac.uk/geo-engineering/jtc2). JTC2 a le rôle de superviser le développement international des formes de représentation des données de géo-ingénierie. Cet article traite les schémas standardisé XML qui sont en cours de développement pour la géo-ingénierie et présente des exemples de forages et les pentes. Le format des données DIGGS (Data Interchange for Geotechnical and Geo-environmental Specialists) est examiné et des comparaisons avec les données sont tirées des normes employées dans les géosciences (par exemple GeoSciML). Le document examine également comment les données sur le Web pourrait être utilisé, comme l'utilisation d'un raisonnement par cas (Case Based Reasoning) pour le système de la pente, en utilisant une base de données globale de cas de la pente.

Keywords : data standards, world wide web, XML, borehole, slope

1 INTRODUCTION

The World Wide Web provides us with easy access to a huge amount of information. However, at present, the data we can access exists in many formats. To allow routine use of geo-engineering data from the web, as part of our professional activities, it is necessary for the data to be stored in a structured and standardised form. The way to achieve this is by adopting XML (eXtensible Markup Language) and developing internationally agreed data standards for geo-engineering.

XML is a simple and highly extensible way to represent data, which is sufficiently flexible to allow data standards to continue to evolve to meet the needs of geo-engineering professionals. The concept of creating a geotechnical version of XML was first proposed by Mete Oner and the World Wide Web of Geotechnical Engineers (http://www.cige.com/GmL/) in 1998. There are now a number of initiatives to develop representation schemes, both for geo-engineering and for geo-science data. The three international geo-engineering societies (ISSMGE, IAEG and ISRM) have a Joint Technical Committee, JTC2 (http://www.dur.ac.uk/geo-engineering/jtc2) to oversee the development of internationally agreed forms of representation of geo-engineering data. The data standards developed can be used to store such data on the World Wide Web and will ensure that geo-engineering data is stored in the same format anywhere on the web.

The major advantage of having data standards for web-based data is that it will make it possible to search all geotechnical data available on the web using structured search options (XQuery). For instance, it would be possible to locate XML files that contain projects within a particular geographical location or having particular soil/rock types or where a particular type of test has been performed. In this way the World Wide Web will become an international repository for geotechnical information, available to the whole community. This avoids the necessity to establish national or international geotechnical databases; each data owner can make their data directly available on their own web server.

A further advantage of developing data standards is to allow transfer of data between computer systems. XML uses very simple text files that can be easily accessed and read. Therefore, it can be used as a data exchange format between different

doi:10.3233/978-1-60750-031-5-2690

- *Toll, D. (2009). **International Data Standards for Geotechnical Engineering**. In M. Hamza, M. Shahien, & Y. El-Mossallamy (Eds.), Proc. 17th International Conference on Soil Mechanics and Geotechnical Engineering, Alexandria, Egypt. https://www.issmge.org/uploads/publications/1/21/STAL9781607500315-2690.pdf*

- *The three international geo-engineering societies (ISSMGE, IAEG and ISRM) have a **Joint Technical Committee**, JTC2 to oversee the development of internationally agreed forms of representation of geo-engineering data.*

➢ *Standardization shall be addressed together.*

- *Greenwood (1988) and Threadgold and Hutchison (1992) identified the need to have **a standard interchange format that was independent of particular software packages**. This led to the development of the Association of Geotechnical and Geoenvironmental Specialists (**AGS**) data format in the UK in 1992.*

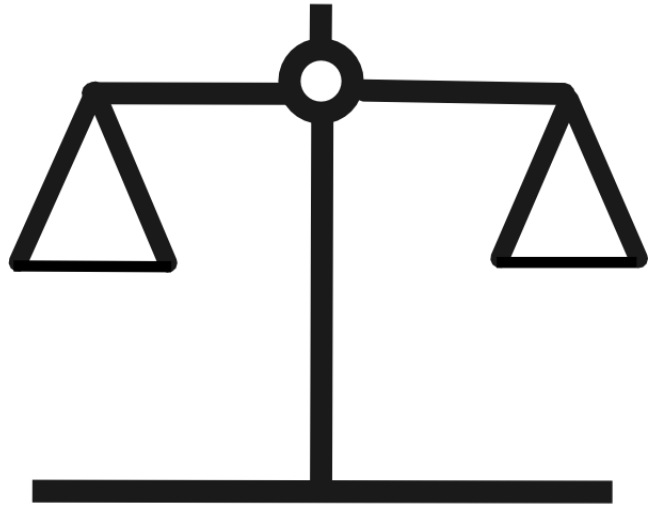
- *The […] **DIGGS** project (Data Interchange for Geotechnical and Geo-environmental Specialists) […] is discussed in more detail later in the paper.*

- ***GeoSciML** […] aims to **represent geoscience information associated with geologic maps and observations**, as well as being extensible in the long-term to other geoscience data.*

➢ *Identification of three key players in 2009: AGS, DIGGS, GeoSciML communities.*

Key challenges for standardization

- Semantics alignment
  - Different cultures / domains / practices
- Level of sophistication
  - Human readable vs Machine readable
  - Small boxes vs big(ger) containers
- Dependence of technologies
  - CSV, XML, JSON



➢ Different choices = Different capacities and results

Geotech Interoperability Experiment

January 2019

buildingSMART International

Open Geospatial Consortium

GT1-5 Geotechnics

TC222
BIM & Digital Twin for Geotechnics

AGS

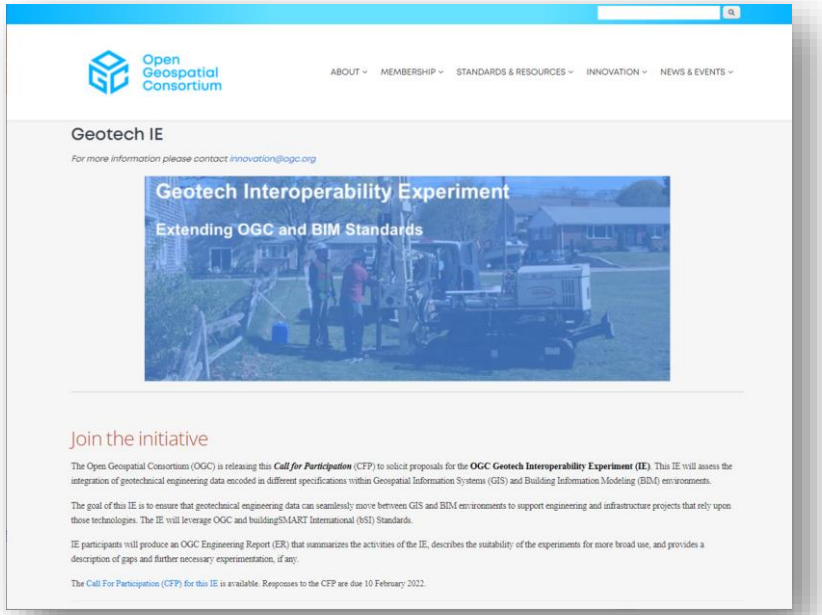
DIGGS

CGI

and many more...

- Common semantics
- Common tools / APIs
- Guidance

February 2022 > December 2023



ATLAS by AFNeT

MINnD Modélisation des INformations INteropérables pour les INfrastructures Durables

GeotechIE Workplan

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

Work packages:

- #1: Common conceptual model
- #4: Technical paper
- #5: Implementation Guide for Software Vendors

Technical oriented goals

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

Work packages:

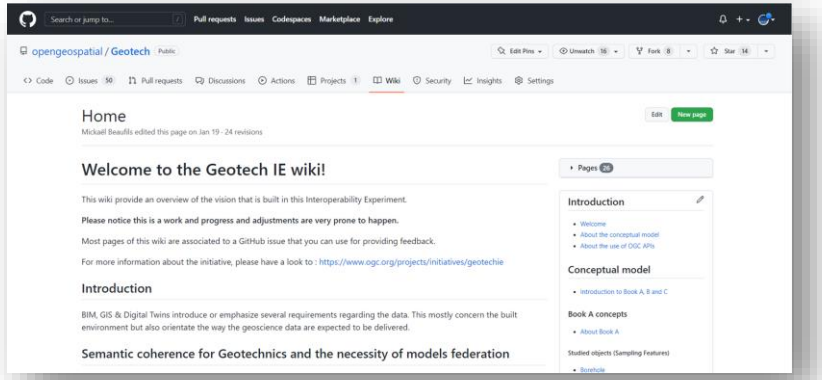
- #2: Extension of OGC Geoscience standards,
- #3: Technical documentation on the use of OGC APIs
- #3bis: Implementation forum

Deliverables

#4a: White paper

https://github.com/opengeospatial/Geotech/blob/master/Geotech_IE/white_paper/Digital%20continuity%20for%20Geotechnics%20at%20the%20BIM%20era%20v1.pdf

#4b: Technical paper



https://github.com/opengeospatial/Geotech/wiki

- #1 : Common conceptual model
- #2: Extension proposal of OGC Geoscience standards
- #3: Technical documentation on the use of OGC APIs
- #3bis: Implementation forum
- #5: Implementation Guide for Software Vendors

Chapter 1: Geotech Concepts and mapping

Geotech investigations

Book A concepts

- About Book A

Hole in the ground

- Borehole
- TrialPit

For the activity of observation and its results

- Observations
- Geotech Procedures (codelist)
- Geotech Observable Properties (codelist)

For the activity of sampling and preparation

- MaterialSample
- Sampling and Preparation

Subsurface and hazard modeling

Book B concepts

- About Book B
- Geomodel

For Geological Modeling

- GeologicUnit
- Fault
- Contact
- Fold

For Hydrogeological Modeling

- HydrogeoUnit
- FluidBody
- FluidBodySurface

For Geotechnical Modeling

- GeotechUnit
- DiscreteDiscontinuity
- Void

For Hazard Modeling

- HazardArea
- SurroundingConstruction

Infrastructure dimensioning and risks assessment

Book C concepts

- About Book C
- GeotechSynthesisModel
- Alignment
- GeotechTypicalSection
- RiskZone

https://github.com/opengeospatial/Geotech/wiki

Chapter 2: OGC+ standards extensions proposals

General considerations

- About the Borehole IE and Sampling Boreholes
- Geometry considerations
- Features properties vs observations

ISO19148 and ISO19156

- A brief introduction to ISO 19148 and ISO 19156
- Enabling linear referencing based observations
- Conceptual Borehole Model

SensorThingsAPI datamodel

- A brief introduction to the SensorThingsAPI data model
- STA Borehole Model

GeoSciML

- A brief introduction to GeoSciML
- Extending gsml:GeologicUnit
- Extending gsml:ShearStructureDisplacement
- Extending gsml:Fold
- Extending gsml:Contact
- Adding gsml:GeotechUnit
- Extending gsml:Joint

GroundWaterML2

- A brief introduction to GroundWaterML2
- Extending gwml2:HydroGeoUnit
- Extending gwml2:FluidBody
- Extending gwml2:FluidBodySurface
- Extending gwml2:HydroGeoVoid

EPOS WP15

- A brief introduction to the EPOS TCS GIM
- Extending eposl:Modelview

LandInfra & InfraGML

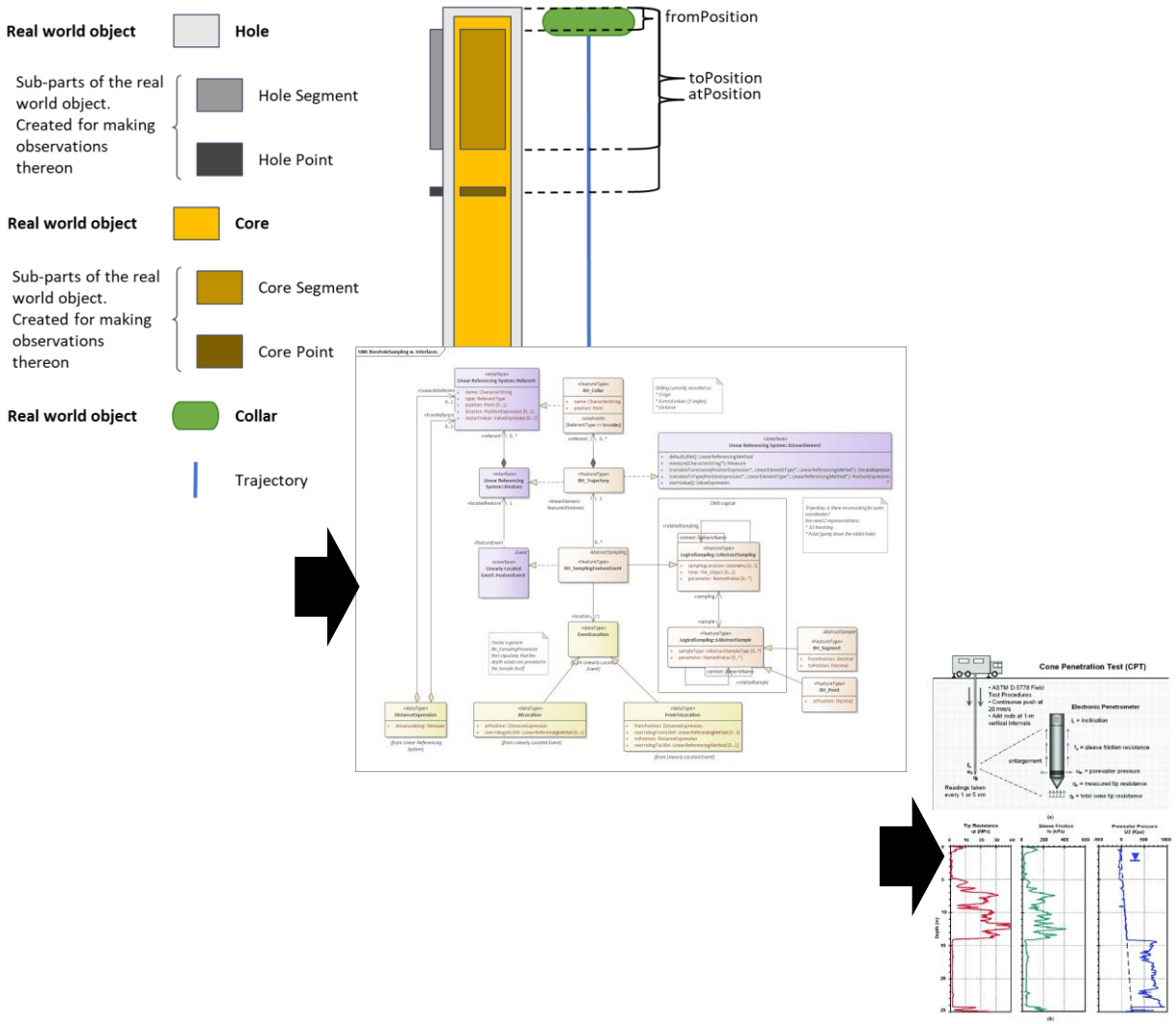
- A brief introduction to LandInfra and InfraGML
- Reusing InfraGML:Alignment
- Extending InfraGML:Facility and FacilityPart

INSPIRE Theme III: Natural Risk Zone

- A brief introduction to INSPIRE NZ
- Extending NZ:HazardArea
- Extending NZ:RiskZone

https://github.com/opengeospatial/Geotech/wiki

Chapter 3: An (OGC) API for Geotech investigations – implementation and guidance



Implementation guide, resources and examples

- About implementation
- About OGC APIs
- About FROST
- FROST plugin for Geotech

Exposing geotech investigation data with OGC SensorThings API

- Approach for Borehole logs
- Approach for CPT
- Approach for SPT
- Approach for Pressuremeter
- Approach for Atterberg limits
- Mappings from AGS and DIGGS
- EndPoints
- Relevant queries to FROST for Geotech

Vocabulary and codelist for geotech

- Geotech vocabularies and codelists

https://github.com/opengeospatial/Geotech/wiki

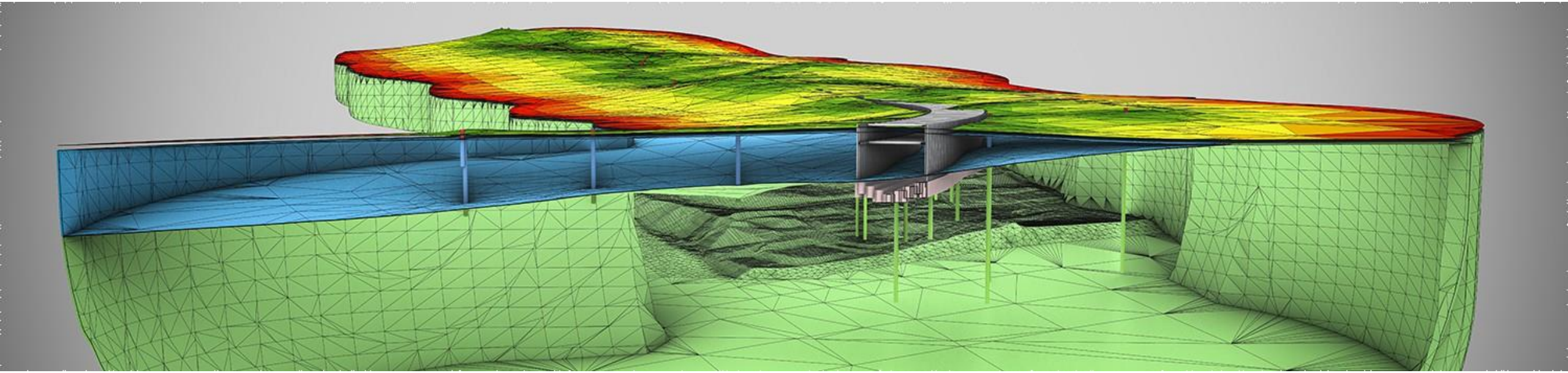
3rd ISSMGE TC222 online Workshop

- **Agenda**
  - 14h00: Welcome
  - 14h05: Introduction about ISSMGE TC222 (5min)
  - 14h10: Introduction about digital standards for geotech (10min)
  - **14h20: AGS presentation – Neil Chadwick (20min + 5 for Q&A)**
  - 14h45: DIGGS presentation – Dan Ponti (20min + 5 for Q&A)
  - 15h10: bSI presentation – Jonas Weil (20min + 5 for Q&A)
  - 15h35: OGC presentation – Mickaël Beaufils (10min + 5 for Q&A)
  - 15h50: Wrap-up (5min)

- **For Q&A**

https://app.sli.do/event/rdUsCqYqe4vbqRGiYu6tXX/live/questions

Or go to https://www.slido.com/
Code: #4158 443



SIMSG ISSMGE

Wrap-up

Magnus Rømoen (Chair, NGI) & Mickaël Beaufils (Vice-Chair, BRGM)

Conclusion & perspectives

- Digital standards for geotech data is not a new topic

- BIM and Digital Twins
  - Relaunch the interest and need for (geotech) standards
  - Offer new perspectives

- Role of ISSMGE TC222
  - Guidelines and recommandations about standards
    - Continue the collaboration set during Geotech IE with bSI, OGC, AGS and DIGGS
  - A place to discuss things (that should be) in common
    - Vocabularies (eg. Lists of geotech procedures, list of observed properties, …)
    - APIs?

Next event(s)

- ISSMGE TC222 4th Online Workshop

- Date (tentative):
  - Last week of May (May 27th – May 31th)

- Topics:
  - National geotechnical database and assets registers
  - Links with AI / Machine Learning

- Would like to propose you / someone as speaker?
  - Contact us at https://www.issmge.org/committees/technical-committees/applications/geotechnical-bim-and-dt

Next event(s)

- ISSMGE TC222 4th Online Workshop

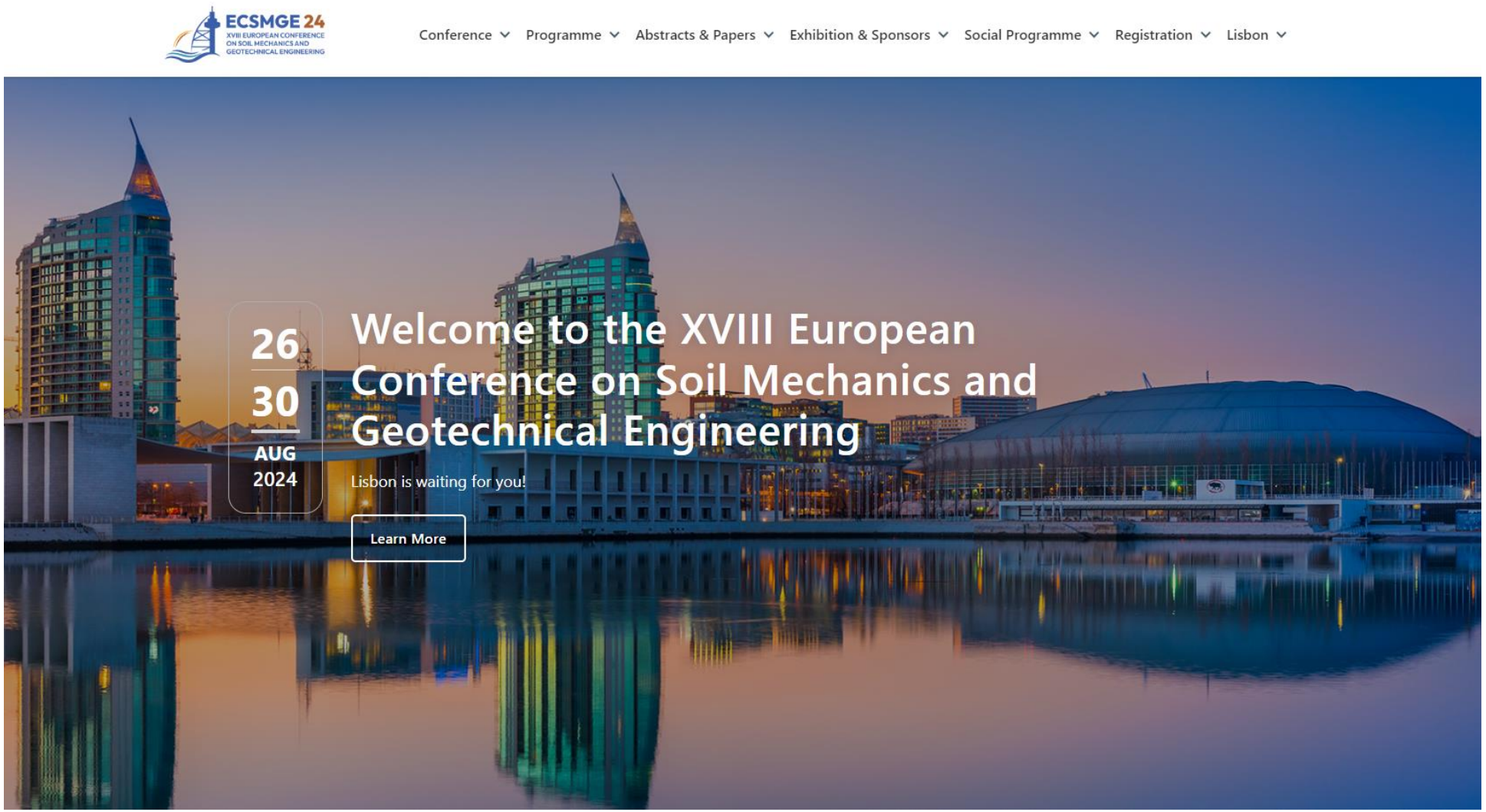
- Date (tentative):
  - Thursday 30th of May
  - Tuesday 25th of June

- Candidates:
  - Contact from Raymond: Professor Song,
  - Contacts from Jelena: BGS, NUAR, Australia
  - Contacts from Mickaël: UGEG, IUGS-CGI
  - Contacts from Mats : NGU, SGU

- Topics:
  - National geotechnical database and assets registers

ECSMGE 2024

About: https://www.ecsmge-2024.com/



Follow us

- On our website:
  - https://www.issmge.org/committees/technical-committees/applications/geotechnical-bim-and-dt

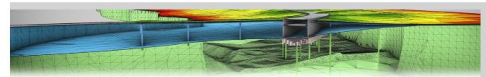
- On LinkedIn:
  - https://www.linkedin.com/company/issmge-tc-222/

- On Youtube:
  - https://www.youtube.com/channel/UC7eMKzvagK7DN3MnIvK7yCQ

Become an ISSMGE TC222 member

- Please get in touch with your national society

- https://www.issmge.org/the-society/member-societies



ISSMGE TC222 Geotechnical BIM and Digital Twins

Online Workshop

Digital standards for geotechnical data

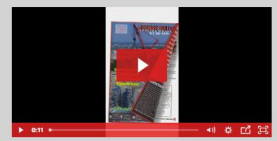
Thursday April 4th |14:00 (Paris) | 8:00 (New York) | 20:00 (Hong-Kong)

Duration : 2 hours

with talks from:

Neil Chadwick (AGS Data Management WG), Dan Ponti (DIGGS Steering Commitee), Jonas Weil (bSI IFC Tunnel GeoSubgroup) and Mickaël Beaufils (OGC GeoScience DWG)

3rd ISSMGE TC222 digital workshop recording published



ISSMGE welcomes you to the new look of **ISSMGE Bulletin!** The new bulletin is a flip book, e-magazine style, with zooming capability, hotlinks and pop-ups when it flashes white, embedded videos, and more... We hope you enjoy it! A new issue will be published every 3 months.

Read the new Bulletin!

Highlighted Resources

ISSMGE Library

Access 18921 publications and conference proceedings

ISSMGE Bulletin

Read ISSMGE Bulletin

ISSMGE Virtual University

Watch all the available Courses and Webinars

Lexicon

Review Geotechnical terms in 14 languages

Thanks for your attention!

Magnus Rømoen

Mickaël Beaufils

Mats Kahlström

Neil Chadwick

Dan Ponti

Jonas Weil