An aerial photograph of Geneva, Switzerland, with a large green circular overlay. The word 'Geneva' is written in white text on the left side of the circle. To the right, the words 'Future' and 'Circular' are written in a larger, semi-transparent white font. At the bottom of the circle, the text '100 km' is visible. A grey rectangular box is superimposed over the center of the map, containing white text.

# Contract management of underground works using combined GIS, 3D geological and BIM mode

Digitalisation in underground works

# Overview



Underground structures

# CONTEXT

# The increased role of information

- Interdisciplinary
- Team delocalisation
- Project tempo



# Information acquisition and understanding

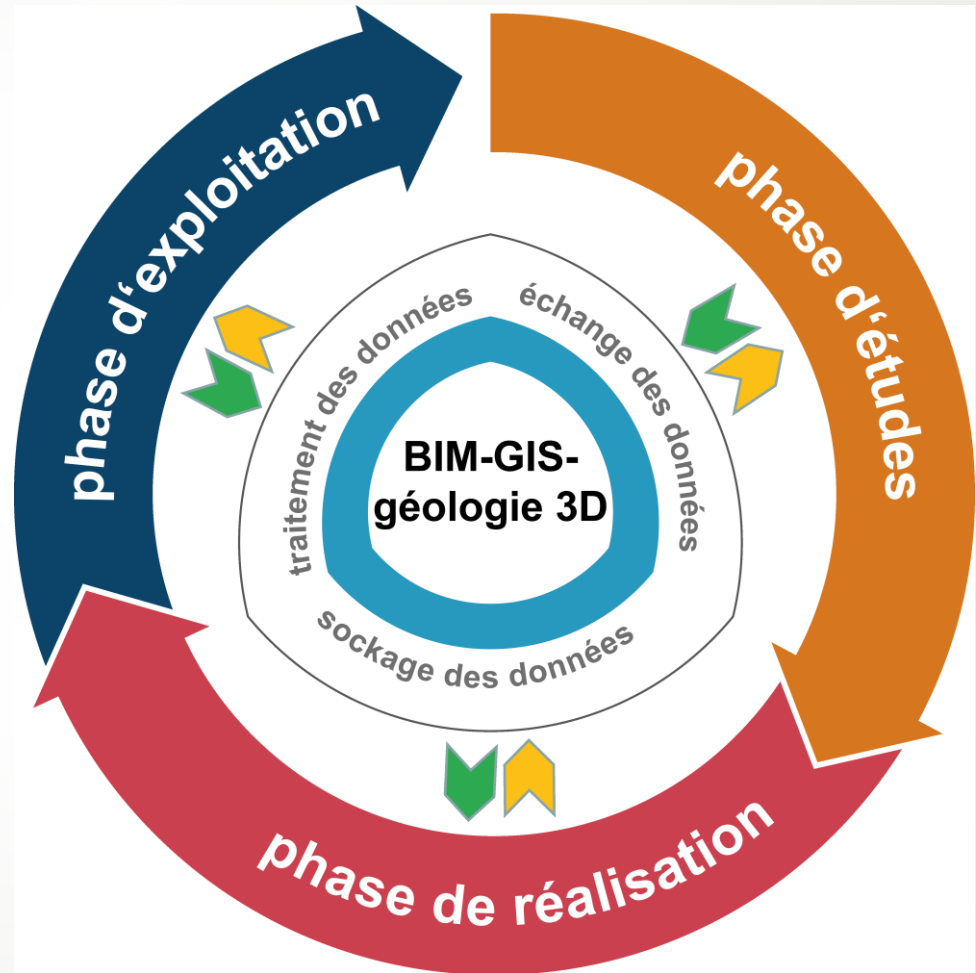
- Design dependencies
- Interpretation
- Quantity of Information
- Dynamic interpretation



# ARCHITECTURE

# Project life cycle

Understanding the interrelationships



# Flexibilité dans le choix d'outils



ArcGIS Online



RhinoCeros



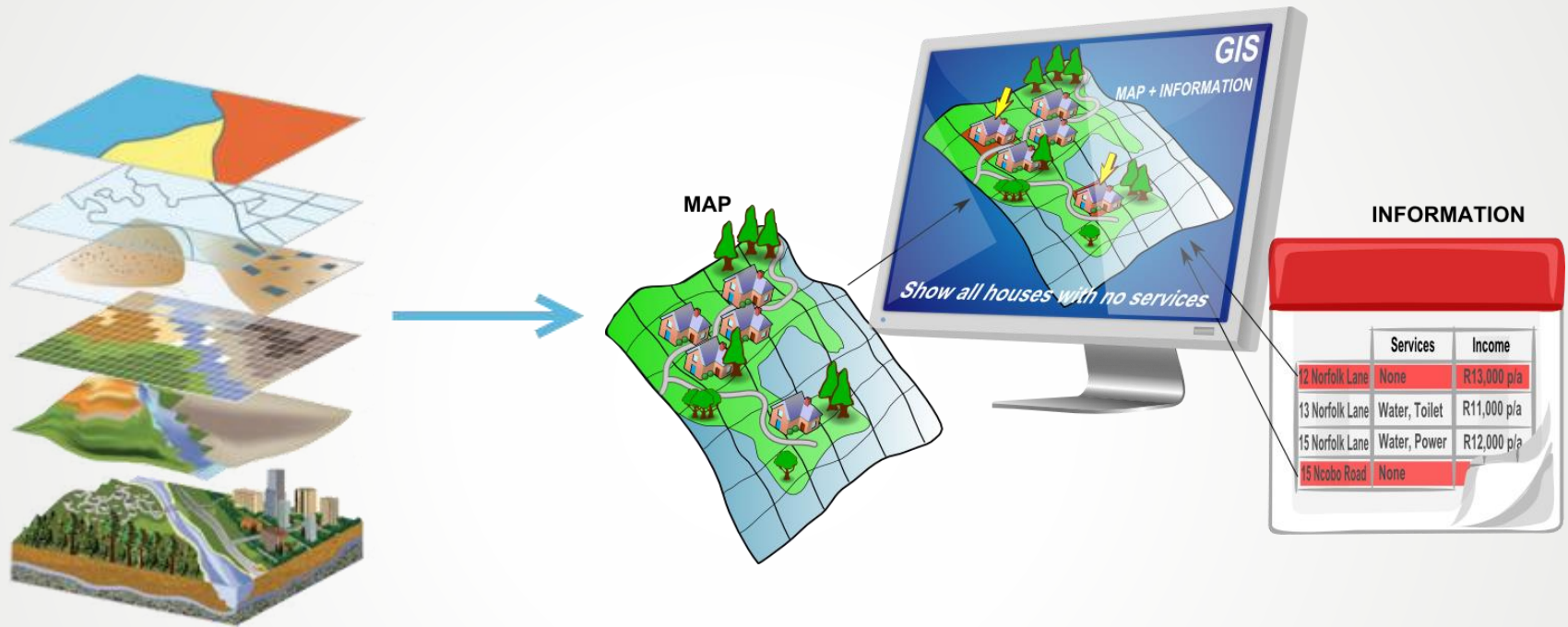


# BIM and GIS Numerical twins

- Conflict check
- Cross referencing information
- New tools (terrains/Google Earth)



# GIS is the foundation for any BIM approach



# Combining

The image displays two screenshots of the CATIA 3DEXPERIENCE software interface, illustrating the combination of different data sources for a tunnel project.

**Top Screenshot: Terrain Preparation**  
The interface shows the '3DEXPERIENCE | CATIA Terrain Preparation' environment. The title bar includes 'PN1206\_1\_LIGNE 16\_LOT' and 'Plateforme Configuration Tests'. The left-hand tree structure lists the following components:

- PN1206\_1\_LIGNE 16\_LOT 3\_GARE DE CHELLES A.1
  - TER\_PN1206 A.1
    - Skeleton Representation0001839 A.1
    - Knowledge Engineering Specification Physical000024
    - OSM Representation A.1
  - Substructure A.1
  - CHL\_07\_PN1206 A.1 (CHL\_07\_PN1206.1)
  - PN1206\_Converted\_Piping A.1 (PN1206\_Converted\_Pipi)
  - Publications
    - Tunnel\_Hull\_Inner\_Diameter
  - Engineering Connections

The main 3D view shows a top-down perspective of a city map with a series of blue tunnel structures and black piping components overlaid on the terrain.

**Bottom Screenshot: Building and Civil Assemblies**  
The interface shows the '3DEXPERIENCE | CATIA Building and Civil Assemblies' environment. The title bar includes 'Viewing Mohamed Ali El Hani...' and 'AMB ENG'. The left-hand tree structure lists the following components:

- PN1206\_1\_LIGNE 16\_LOT 3\_GARE DE CHELLES A.1
  - TER\_PN1206 A.1
  - Substructure A.1
  - CHL\_07\_PN1206 A.1 (CHL\_07\_PN1206.1)
  - PN1206\_Converted\_Piping A.1 (PN1206\_Converted\_Piping.1)
  - Publications
  - Engineering Connections

The main 3D view shows a perspective view of the same tunnel structures and piping components, now overlaid on a brown and green terrain model. A coordinate system (X, Y, Z) is visible in the bottom right corner.

# GIS

# Mapping BIM and GIS and Geology

Exemple du tunnel de base du Ceneri

Pop-up window showing metadata for 'Formazione\_geologica\_853 - OGC':

- OBJECTID: 22
- Id: 0
- Formazione: OGC
- Shape\_Length: 101.210497
- Shape\_Area: 546.420223

GIS software interface showing a drawing order, a map, and a data table.

**Drawing Order:**

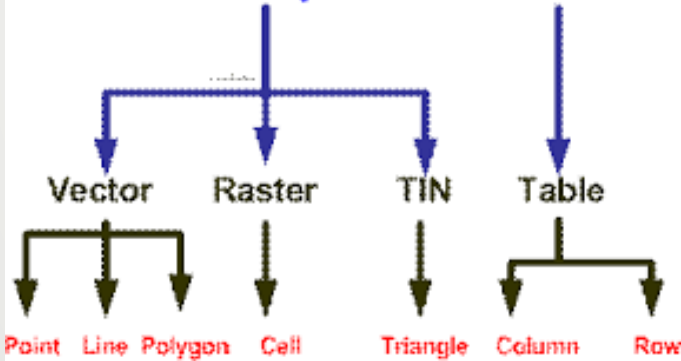
- Planimetria
  - Autostrada\_ExportCAD1
  - L853\_Annotazione
  - Autostrada
- Interpretazione\_ZD\_853
- Idrogeologia
- Geotecnica
- Sondaggi
- Discontinuità
- Formazione geologica
  - Limite\_quater\_853
  - Formazione\_geologica\_853
    - Rilevato autostradale (R)
    - Paragneiss del Ceneri (PGC): gneiss/s
    - Paragneiss del Ceneri (PGC): anfibolit
    - Paragneiss del Ceneri (PGC): gneiss /s
    - Ortogneiss del Ceneri (OGC): ortogne
    - Gneiss cataclastici/molto intensamen
    - Faglia cataclastica kakiritica
    - Faglia kakiritica

**Map:** Shows a geological map with various colored polygons representing different geological formations. A blue arrow points from the pop-up window to a specific polygon on the map.

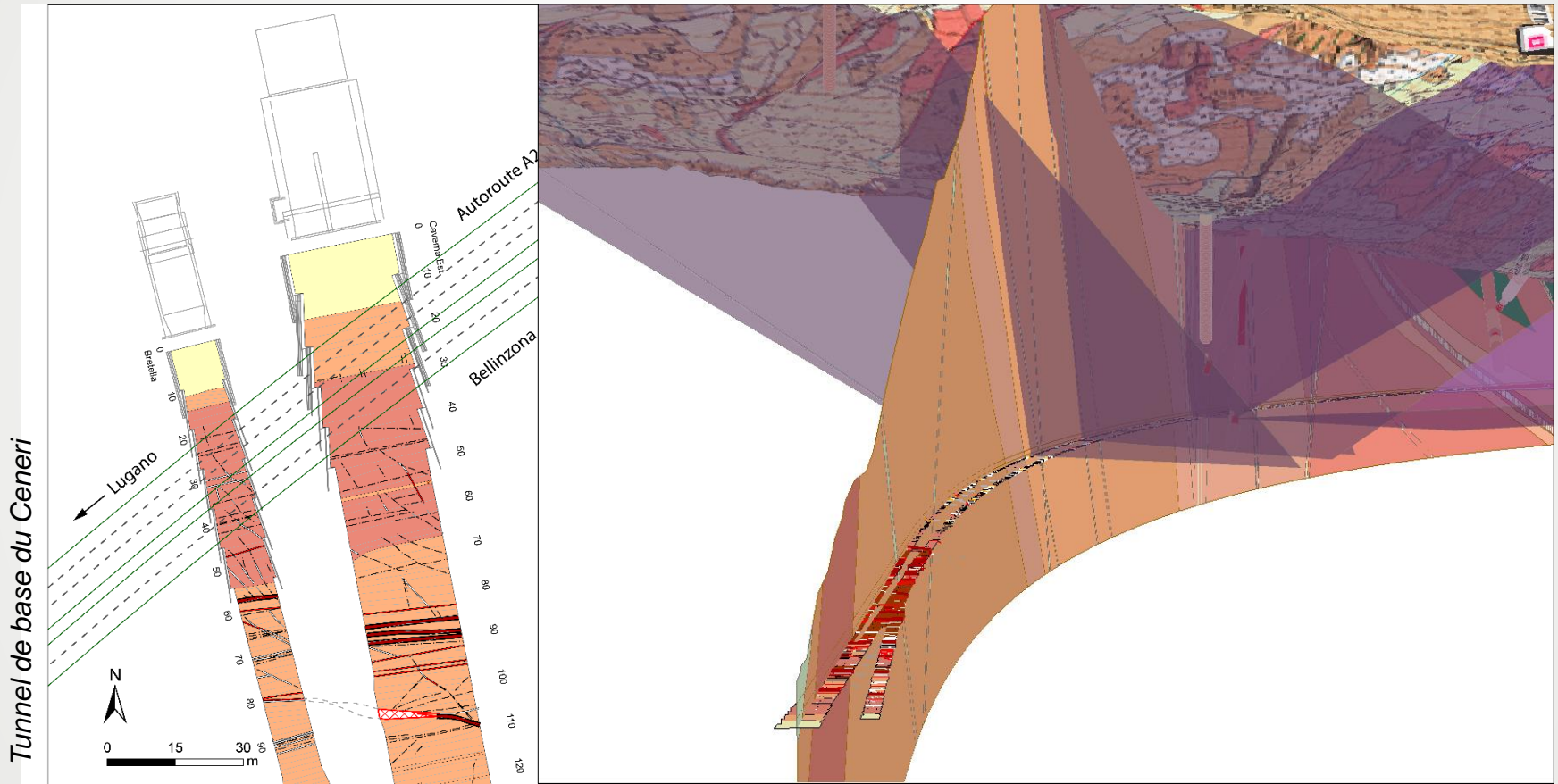
**Data Table:**

OBJECTID	Shape	Id	Formazione	Shape_Length	Shape_Area
14	Polygon	0	PGC	173.783949	245.221588
15	Polygon	0	PGC	72.990625	62.909507
16	Polygon	0	PGC, B	148.158219	576.248723
17	Polygon	0	PGC, B	1113.4961	6397.607386
18	Polygon	0	Cataclastica kakiritica	23.078734	18.365638
19	Polygon	0	Cataclastica kakiritica	31.388896	22.359561
20	Polygon	0	Cataclastica kakiritica	54.895667	44.148973
21	Polygon	0	Cataclastica kakiritica	27.165363	10.645328
22	Polygon	0	OGC	101.210497	546.420223
23	Polygon	0	Cataclastica kakiritica	20.607901	2.550131
24	Polygon	0	Cataclastica kakiritica	25.724117	3.927716
25	Polygon	0	Breccia	47.229733	90.574622

GIS = Map + Database

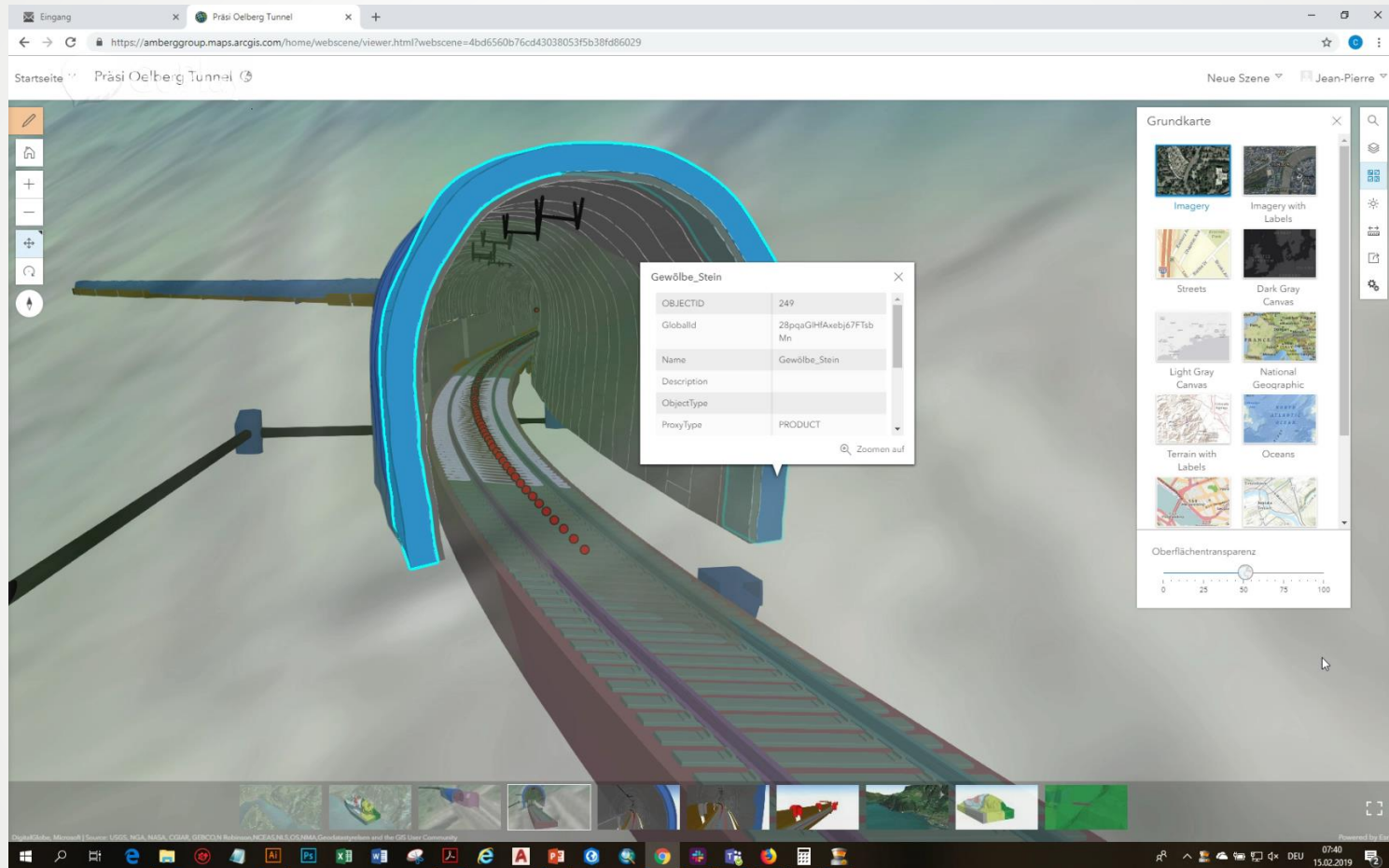


# Implementation



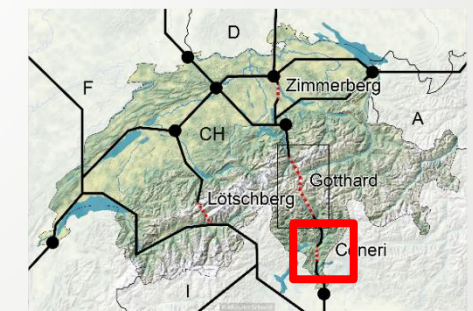
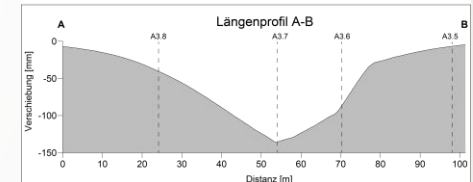
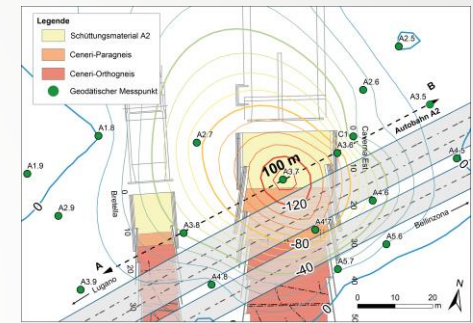
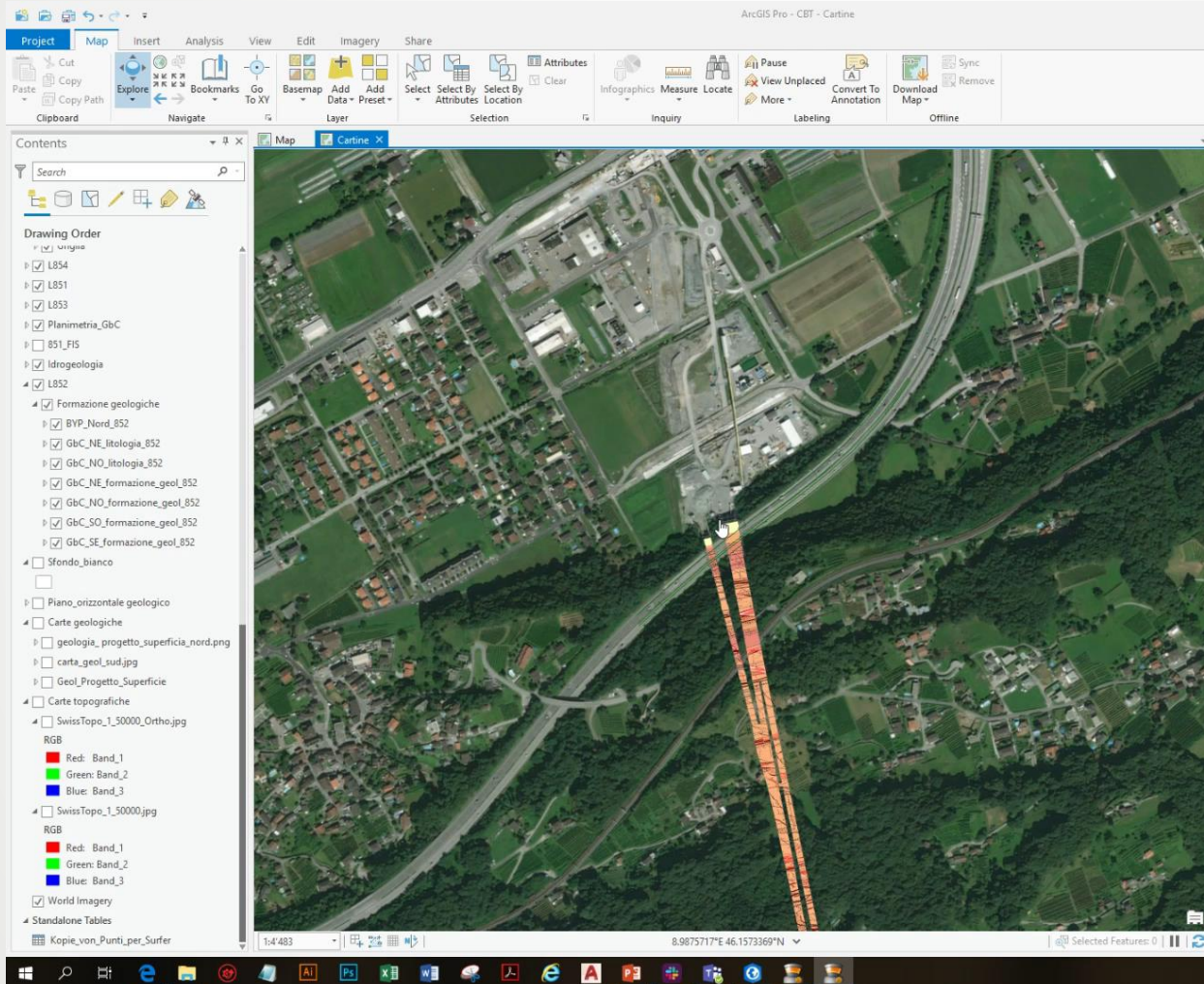
Geology, hydrology and geotechnical data 2D longitudinal cat with ArcMap et ArcScene

# GIS and 4D BIM



Visualisation interactive des données BIM-GIS en ligne (ArcGis online)

# Monte-Ceneri





# Realtime tracking

← → https://geovis.amberg.ch/workbench/show

Amberg Technologies AG: ...

Konvertieren Auswählen

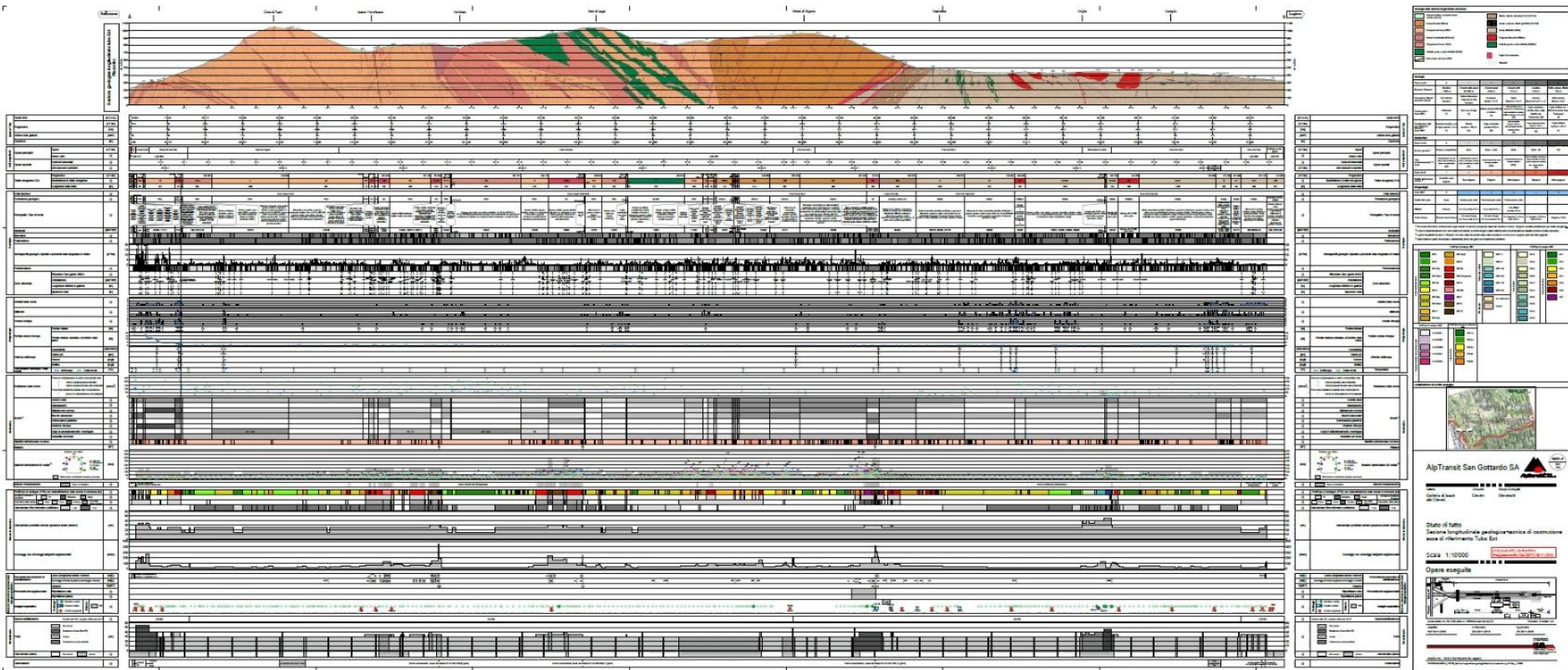
**AMBERG TECHNOLOGIES** | **GEOvis**

User: Rudigier Cu

**Listing projects**

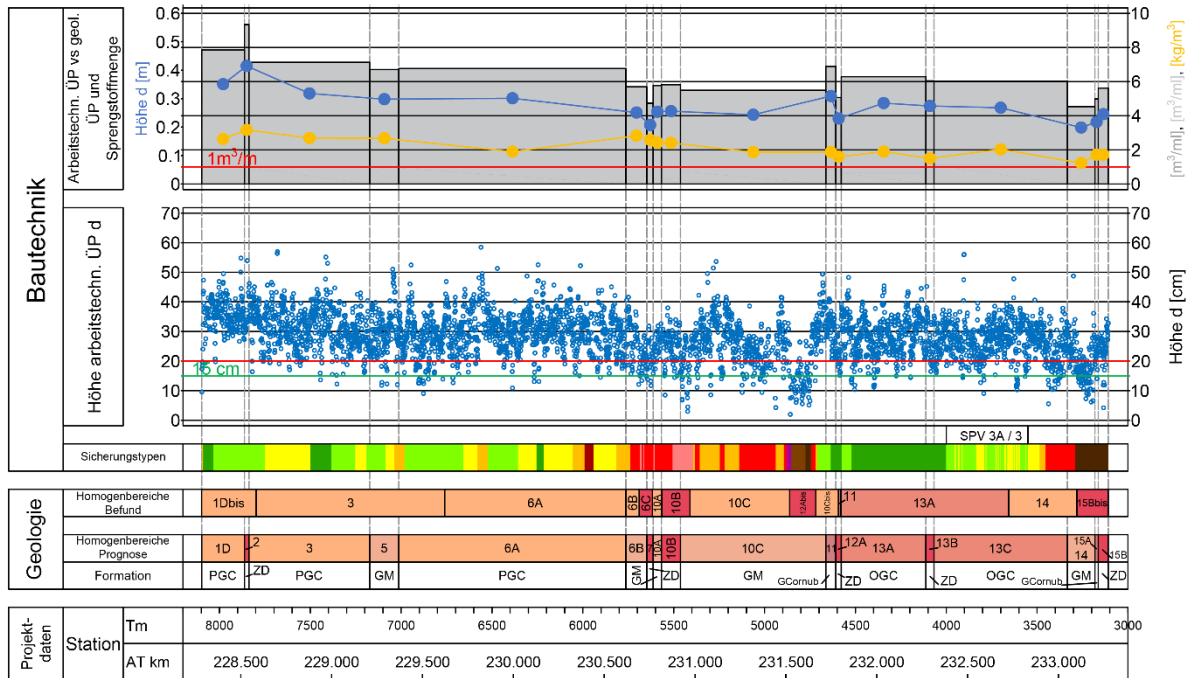
- [GbC Lotto704 - Vigana A2](#)
- [GbC Lotto814 - Monitoraggio geodetico](#)
- [GbC Lotto814 - Monitoraggio geodetico nastro](#)
- [GbC Lotto852](#)
- [GbC Lotto853 - MATRO SUD](#)
- [GbC Lotto854 - Portale Sud Vezia](#)

# Consolidation



# Claim review

Tunnel de base du Ceneri



Plan de gestion basé sur les données GIS.

## Legende

Geologie	Geotechnik	Bautechnik	Sicherungstypen
Mischgneis	Prognose	Vergleich arbeitstechn. ÜP vs geol. ÜP und verwendete Sprengmittel	ST-SPV 1
Ceneri Paragneis	Befund günstiger als Prognose <sup>1)</sup>	arbeitstechn. Überprofil [m³/m]	ST-SPV 2
Ceneri Orthogneis	Befund entspricht der Prognose <sup>1)</sup>	Höhe d [m]	ST-SPV 3
Hornfels	Befund ungünstiger als Prognose <sup>1)</sup>	Sprengstoff [kg/m³]	ST-SPV 4
Störzone	Prozentwert äquivalent der Differenz, um die obere Grenze der Prognose zu erreichen		ST-SPV 5
			ST-SPV 6
			ST-SPV 7
			ST-SPV 8
			ST-SPV 9
			ST-SPV 10

<sup>1)</sup> Anteil der Strecke in Prozent berechnet für den Zeitraum ab 1.1.2013

## Summary

Combining SIG – BIM and Geology requires

- Centralisation of data
- Georeferenced data

The platform approach demonstrates:

- Facilitates interdisciplinary studies
- Provides a global overview
- Single source of truth