

Use Case 15b: Geological documentation during construction progress

Purpose

A common conceptual geological model should be updated throughout the whole cycle life of the project and especially during the excavation phase.

The aim of this use case is to record and transfer all geological/hydrogeological information and documentation inside tunnel during construction phase and the exchange of the produced data. This use case covers both excavation methods: conventional (D&B) as well as mechanized (TBM).

Conventional method:

Conventional method of excavation includes a range of excavation and support systems to cover the anticipated spectrum of geological conditions along the tunnel. With selection of the applicable system in each case relying on the encountered geology at the tunnel face, experience on system behaviour at previously excavated sections under similar conditions and, on accurate deformation measurements, i.e., by applying the so-called “observational method”.



Frontage survey/face log
Source: Toulon tunnel (France)

A typical result/report from these surveys requires specific representations: It typically includes the frontage surveys (face logs, geological face mapping), or a synthetic development of this face survey for a defined section of the structure on which all the information gathered concerning the geological and hydrogeological conditions is recorded (depending on applied methods, regional standards, ...). This allows updating the longitudinal section or equivalent model (relation with UC 2b and UC12c) as the work progresses to obtain the longitudinal section / model encountered in the tunnel. These surveys make it possible to reconstitute the geological context encountered and to keep the memory of the terrain.

This method ensures adequate safety and, at the same time, an economical construction. It is equally important to ensure proper recording of monitoring data (survey of displacements) in order to verify the design assumptions and take immediate action in case of any adverse situation.

For the geological monitoring, different types of tools are used: as frontage images (face logs), sketches, tunnel scans, photos, water leakage data, drilling records and other documents.

Mechanized method:

For TBM, parameters of the machine can be registered too, as well as forward probing results, forward drilling survey, advance rate and contact pressures etc.

The IFC exchange scenario has to take into account:

- Surveying application to visualisation application
- Documented geological/hydrogeological situations to geological model
- Documented geological/hydrogeological situations to geotechnical model

Requirements for IFC-Tunnel:

- Tunnel itself
- Terrain
- Geology and hydrogeology

Linkage is needed to:

- Link to original database or documents (existing reports, maps etc.)
- Factual data used for modelling (link with UC1a);
- Link to geotechnical design model (UC 2b)
- Link to geotechnical model for tender, time and cost estimation (UC 12b)
- Link to geotechnical model for construction and maintenance (UC2c)
- Risks determined by the model

Details on the hereby described data exchange from documentation to further analysis and the following update (especially of UC 12b) need to be defined project specific in the BEP and modelling guidelines.

Geometry:

It should be emphasized that the geology registered inside the tunnel is different from the geology registrations done by terrain surface inspections/investigation. The geology registrations inside the tunnel is much more detailed, the key parameters extracted from the investigations are often different (Q-value etc..). Geological documentation could be described by IFC, GIS data, surface models, solid models or block models.

Semantics:

All existing entities must be described with appropriate semantics. It's expected that the existing geological standards (GEOSciML, ISO etc.) should be leveraged.