

Use Case 02b: Geological and geotechnical model for design

Purpose

Detailed geological/geotechnical models are used for structural design and definition of support and ground improvement measures (rock bolts, anchors, fore poling, grouting, water seals, freezing, injections, etc.). The models are based on geological survey data, drilling data, geophysical exploration data, various in-situ and laboratory tests, etc., around the tunnel route (as described in UC 1b). The required performance of the models is revealing geology, permeability, geochemistry, geophysical properties, crack distribution, mechanical properties, and geological / geotechnical risks concerning design. That information has to be transported in IFC format. The model needs to be developed together and be consistent with the geotechnical model for tender, time and cost analysis (UC 12b). Expected exchange scenario is a model data exchange from geological/geotechnical modelling software into road and rail design software and numerical analysis software.

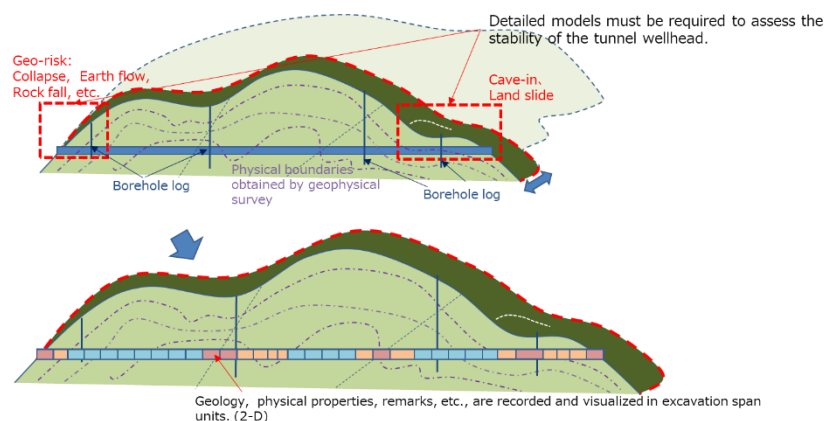


Fig. UC2b-1: A schematic draw of geological or geotechnical model around the tunnel route design. Uncertainty in model is less than that of previous stage.

The model needs to be consistent with geotechnical units described in geotechnical design reports, including the associated geotechnical design parameters.

The relation to other Use Cases and exchange scenarios are displayed in the detail-process map for geotechnical applications.

Requirements for IFC-Tunnel:

Required geometric- semantic:

- Geology, Hydrogeology
- Geotechnical parameters
- Geophysical parameters

Required parameters as attribute:

- Geological formation, age, etc.
- Ground classification
- Geotechnical parameters for ground types and discontinuities
- Geophysical parameters for ground types and discontinuities

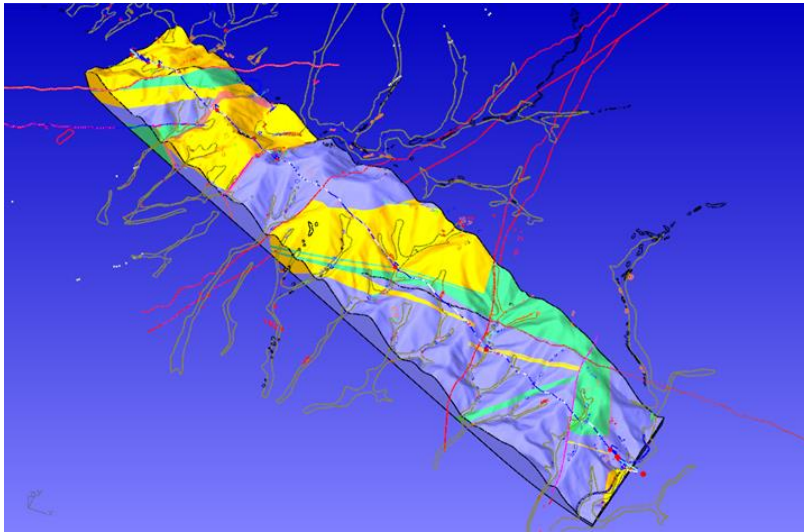


Fig. UC2b-2: An Example of 3D geological model for design (the Nagaizaka tunnel). The solid model is accompanied with the geometry of factual data. (3D Model was developed by OYO using the data, proprietary to the Ministry of Land, Infrastructure, Transport and Tourism).

Linkage is needed:

- Factual data used for modelling (UC 1b)
- Risks determined by the model

Required attribute for uncertainty evaluation:

- Uncertainty in factual data
- Spatial distribution of knowledge (factual data)
- Complexity of geological conditions
- Modelling parameter (Spatial interpolation algorithm, reference area for calculation, etc.)

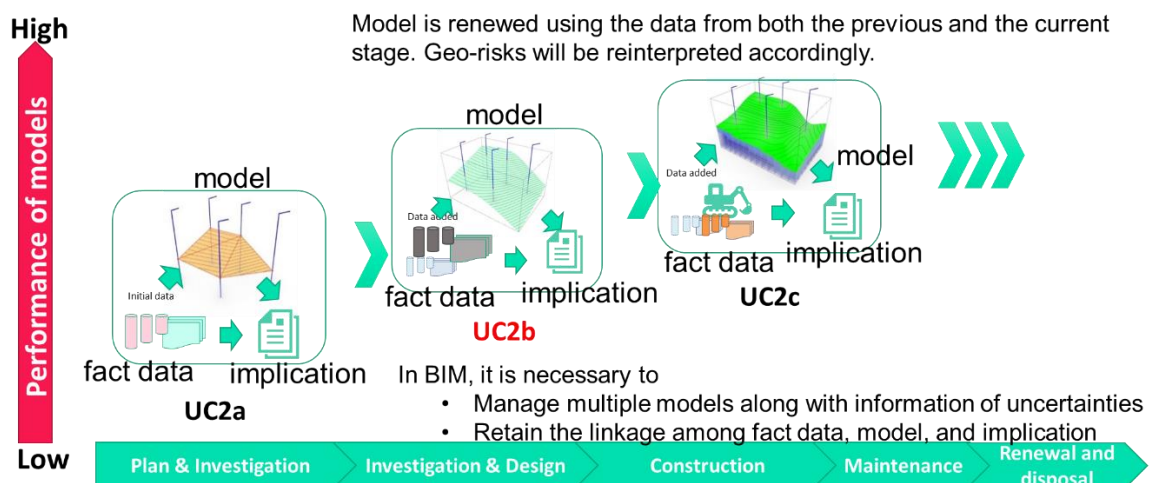


Fig. UC2b-3: Positioning of UC2b in UC2 series. UC2b covers model's geometry-semantic and also data linkage among fact data, model, implication.

Geometry:

The terrain model is expressed as a surface model. Geological and geotechnical models are depicted as cross-sections, surface models, and solid models.

To demonstrate the uncertainty of geological models, geometry of factual data must be represented.

Semantics:

All entities must be consistent with the existing geological and geotechnical engineering standards (GEOSciML, ISO etc.).