

## Use Case 02a: Geological model for planning

### Purpose

A conceptual geological model is used for tunnel route selection and environment assessments. The model is based on existing geological data like regional geological maps and existing models, drilling data and geological/geotechnical data (e.g. from reference projects). The exchange of geological and geotechnical factual data is described in Use Case 1b. The required performance of the model is revealing regional topography, geology, hydrogeology, geochemistry, and geological risk (like landslides, faults) in the tunnel route selection. At least, the topographical and geological features and geotechnical aspects which affect route selection have to be transported in IFC format. Expected exchange scenario is a model data exchange from GIS and geological modelling software into road and rail design software.

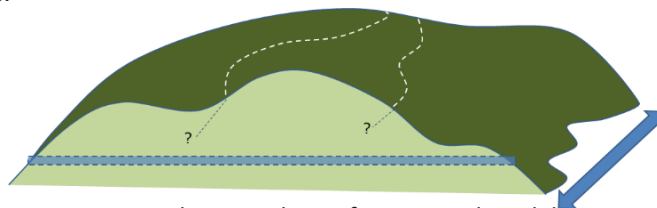


Fig. UC2a-1: A schematic draw of conceptual model covering wide area for tunnel route selection. The model is created based on existing data (geological map, borehole log, etc.) and geological

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;

- Topography
- Geology (including tectonics, seismicity, weathering, ...)
- Geophysical properties
- Hydrogeology
- Geotechnical aspects (e.g., ground behaviour for foundations and excavations)

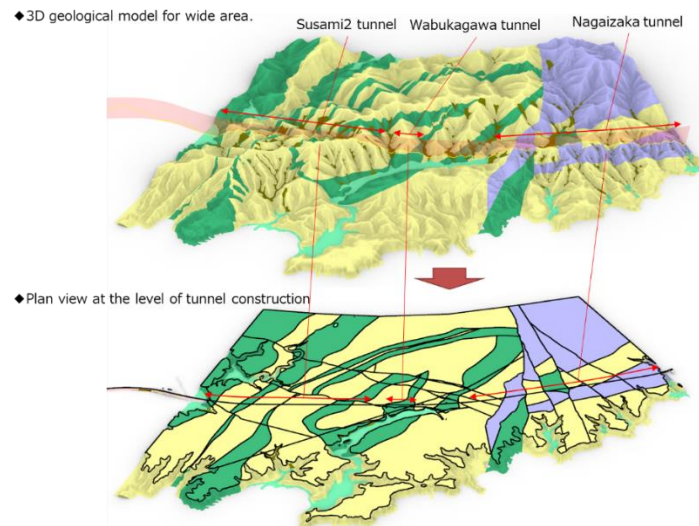


Fig.UC2a-2: An Example of 3D geological model for planning (3D Model was developed by OYO using the data, proprietary to the Ministry of Land, Infrastructure, Transport and Tourism.)

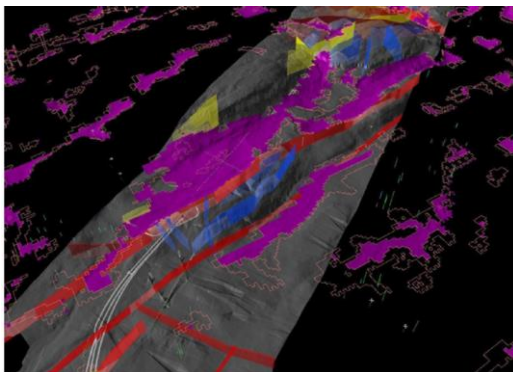


Fig.UC2a-3: An example of geotechnical feature that should be exchanged by IFC- Weathering condition (cited from Fig1.1.1: Deep weathering maps for tunnelling from the project FRE16 (Digitalisation in Norwegian tunnelling, Publication Np.28, Norwegian Tunnelling Society 2019, p.20 )

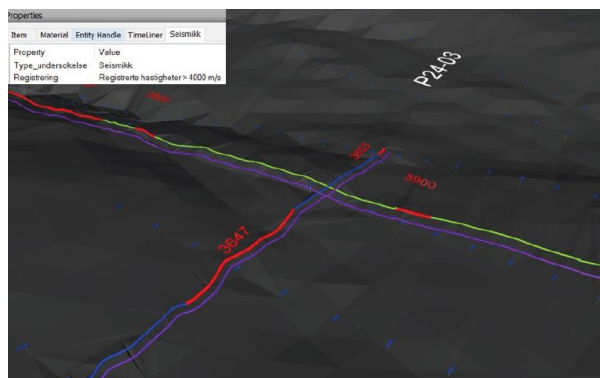


Fig.UC2a-4: An example of geotechnical feature that should be exchanged by IFC- Seismic wave velocity distribution (cited from Fig1.1.4: Seismic survey in geological model FRE16 (Digitalisation in Norwegian tunnelling, Publication Np.28, Norwegian Tunnelling Society 2019, p.23 )

Linkage is needed;

- Factual data used for modelling (drilling log, groundwater wells, geological maps, etc.), refer to Use Case 1b for details
- Risks determined by the model

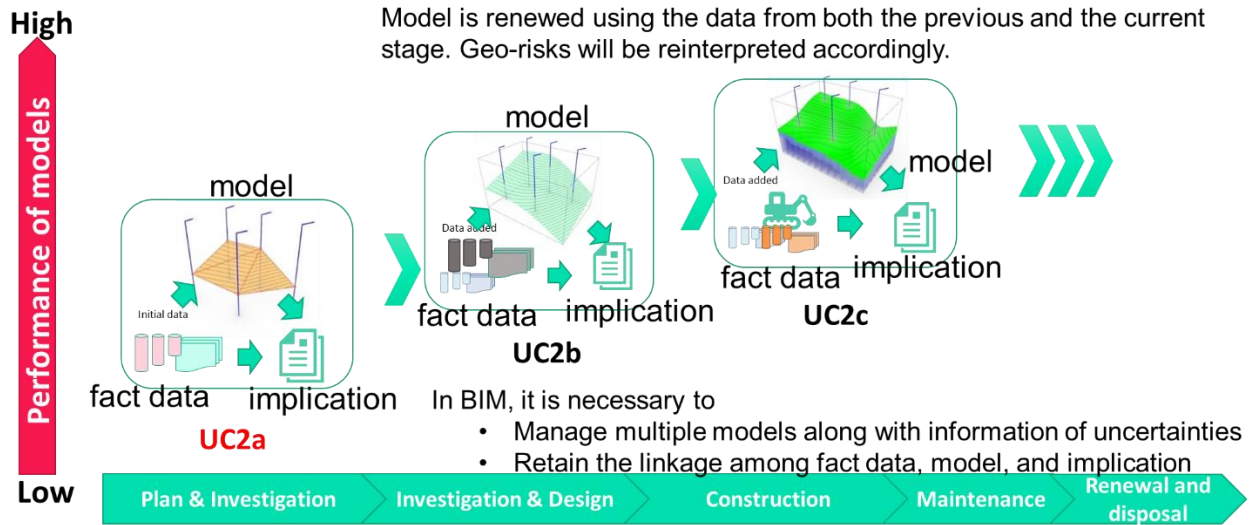


Fig. UC2a-5: Positioning of UC2a in UC2 series. UC2a covers model's geometry-semantic and also data linkage among fact data, model, implication.

Required attribute for uncertainty evaluation;

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

### Geometry:

Topography can be described by GIS data or surface models. Geological boundaries can be described by GIS data, surface models, and solid models.

Note: 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.).