bSI UML Model Report

UML Model Report for Geoscience taxonomy and IFC mapping

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IFC Tunnel

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1 Introduction

The IFC Tunnel project extends the IFC data model into the domain of tunnels by describing the semantics and geometry for tunnels. The conceptual model documentation for IFC Tunnel is divided in these parts:

- IR-TUN_ConceptualModelReport - Excavation, support and lining_v1.1. Describes the domain taxonomy concepts specified within the excavation, support and lining domain and their mapping to existing, modified or proposed entities, predefined types or property sets in the IFC specification
- **IR-TUN_ConceptualModelReport - Geotechnics_v1.1 (this document)**. Describes the domain taxonomy concepts in the geological and geotechnical domain and their mapping to existing, modified or proposed entities, predefined types or property sets in the IFC specification
- IR-TUN_ConceptualModelReport - Systems_v1.1. Describes the domain taxonomy concepts in the systems domain and their mapping to existing, modified or proposed entities, predefined types or property sets in the IFC specification
- IR-TUN_ConceptualModelReport – IFC Extension_v1.1. Describes the proposed extensions to the IFC schema based on the requirements from the three above documents.
- IR-TUN_ConceptualModelReport – Annex I – Reading guide_v1.0. Describes the UML notation used in the above documents.

The IFC Tunnel project has based the definition of tunnel concepts in taxonomies specified by the three domain expert teams and on the previously distributed requirements analysis report (IR-TUN_Requirement-Analysis-Report_v1.0).

2 Package: Geotechnics

A package containing the geoscience taxonomy concepts and their mappings towards existing or new IFC elements.

All classes stereotyped <<VirtualEntity>> represent the domain taxonomy concepts. The mappings towards IFC is made through UML Realization relationships. The IFC Entities are represented by classes with no stereotype. Property sets and Predefined types are represented by UML classes stereotyped as <<PropertySet>> and <<PredefinedType>>.

The GeoScience taxonomy is essentially divided into 3 main packages:

- Book A dealing with concepts for factual data such as borehole observations, laboratory test results and mwd data
- Book B dealing with concepts for interpreted data based on Book A, describing the foreseen features of the subsoil, their uncertainties and properties

- Book C dealing with concepts for dealing with the implications of Book B in terms of excavation and support methods

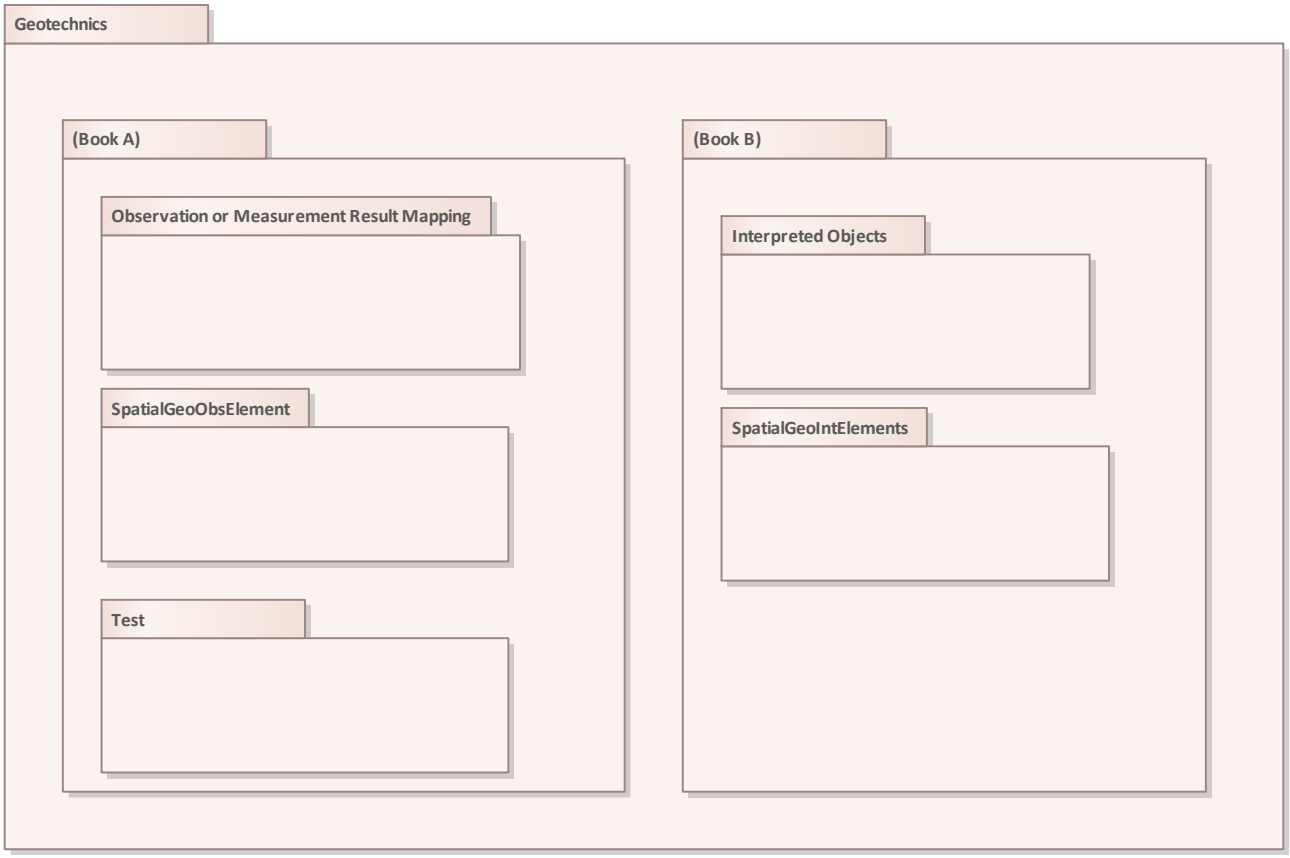

Figure 1: Geotechnics -

2.1 Virtual Entity: GroundModel

<<ToDo: definition>>

Entity Properties	
Realizing Parent	
Notes	

2.2 Package: (Book A)

This is the package representing the taxonomy for geoscience elements Book A and their mappings to IFC.

Book A essentially consists of three parts:

- SpatialGeoObsElement: Serves as containers for geoscience observations and tests
- Observation or measurement result mapping: Results from measurements belonging to a container
- TestResult: Results from tests belonging to a container

2.2.1 Package: Observation or Measurement Result Mapping

This is the package representing the taxonomy for geoscience elements concerning observation or measurement result mappings and their mappings to IFC.

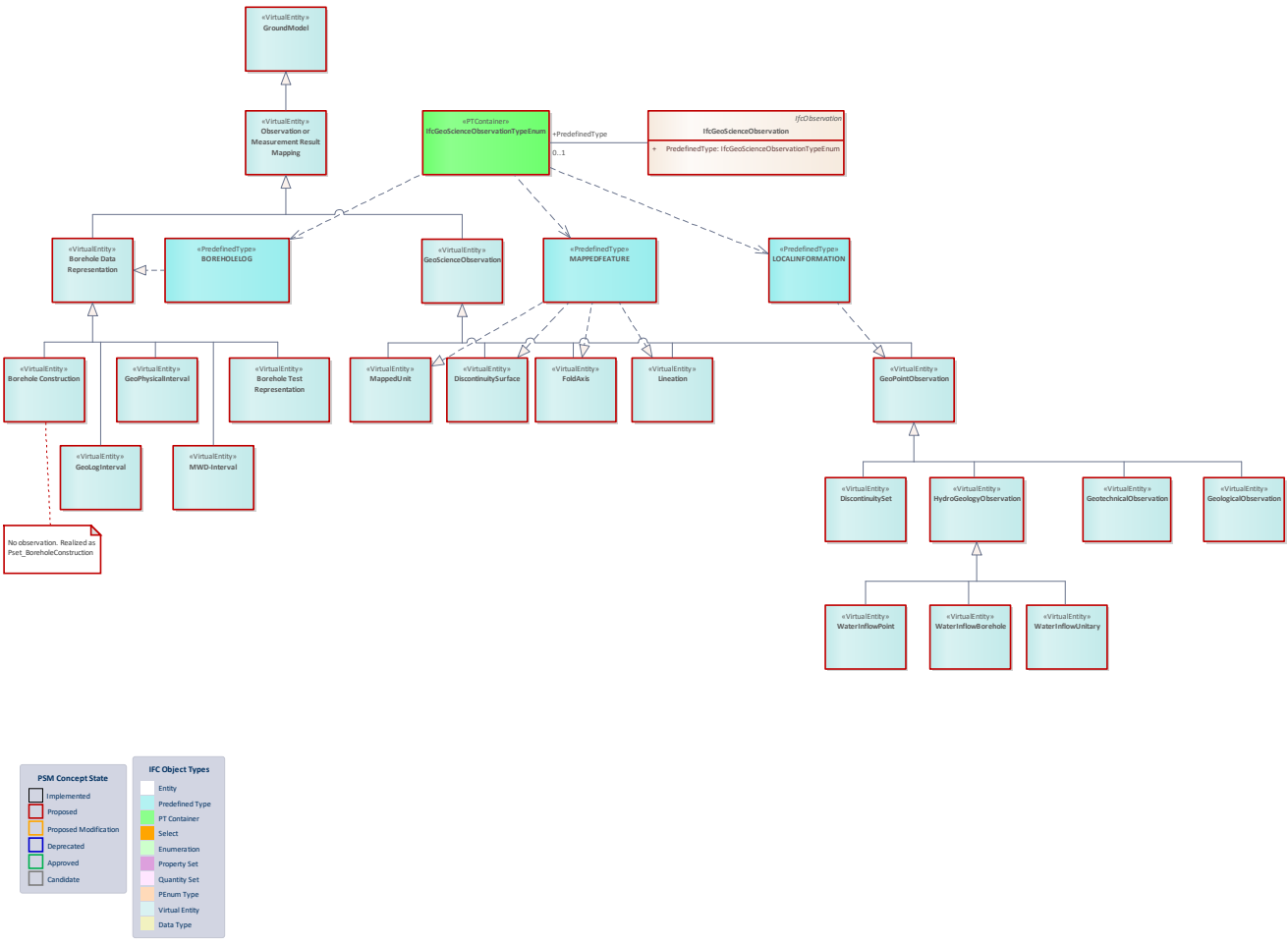

Figure 2: Observation or Measurement Result Mapping taxonomy -

2.2.1.1 Virtual Entity: GroundModel

<<ToDo: definition>>

Entity Properties	
Realizing Parent	
Notes	

2.2.1.2 Predefined Type: BOREHOLELOG

Full Identifier: **IfcGeoScienceObservationTypeEnum.BOREHOLELOG**

Any kind of observation or measurement result related to intervals or points on the borehole axis

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceObservationTypeEnum	**Parent Entity**	IfcGeoScienceObservation
Stereotype	«PredefinedType»		
Property sets			

2.2.1.3 Class: IfcGeoScienceObservation

Detailed collected information, including measured parameters, descriptions etc related to geoscientific observations. that can be assigned to physical or spatial elements using _IfcRelAssignsToProduct_.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcObservation	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcGeoScienceObservationTypeEnum		Identifies the predefined type of a geoscience observation element. This type may associate additional specific property sets.

2.2.1.4 PDT Container: IfcGeoScienceObservationTypeEnum

This enumeration defines the range of different types of geoscience observations that can further specify an _IfcGeoScienceObservation_.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Container Properties			
Parent Entity	IfcGeoScienceObservation	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
		IfcGeoScienceObservationTypeEnum.MAPPEDFEATURE IfcGeoScienceObservationTypeEnum.LOCALINFORMATION IfcGeoScienceObservationTypeEnum.GEOPHYSICALSURVEYRESULT IfcGeoScienceObservationTypeEnum.INSITUTESTRESULT IfcGeoScienceObservationTypeEnum.LABTESTRESULT IfcGeoScienceObservationTypeEnum.BOREHOLELOG	

2.2.1.5 Predefined Type: LOCALINFORMATION

Full Identifier: **IfcGeoScienceObservationTypeEnum.LOCALINFORMATION**

Other observations made locally (e.g. at a point) such as discontinuities, water inflow, weathering, rockburst etc.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceObservationTypeEnum	**Parent Entity**	IfcGeoScienceObservation
Stereotype	«PredefinedType»		
Property sets			

2.2.1.6 Predefined Type: MAPPEDFEATURE

Full Identifier: **IfcGeoScienceObservationTypeEnum.MAPPEDFEATURE**

Distinctly mapped structures that have been observed on MappedZones such as lineation, fold axis, discontinuity surfaces etc.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceObservationTypeEnum	**Parent Entity**	IfcGeoScienceObservation
Stereotype	«PredefinedType»		
Property sets			

2.2.1.7 Virtual Entity: Borehole Construction

Installed casing, material, filter segments, different casing and drilling diameters,...

Entity Properties	
Realizing Parent	
Notes	No observation. Realized as Pset_BoreholeConstruction

2.2.1.8 Virtual Entity: Borehole Data Representation

Any kind of information related to intervals or points on the borehole axis

Entity Properties	
Realizing Parent	IfcGeoScienceObservationTypeEnum.BOREHOLELOG
Notes	

2.2.1.9 Virtual Entity: Borehole Test Representation

Interval or point representing the geometry /location of the test results

Entity Properties	
Realizing Parent	
Notes	

2.2.1.10 Virtual Entity: DiscontinuitySet

Entity Properties	
Realizing Parent	
Notes	

2.2.1.11 Virtual Entity: DiscontinuitySurface

shape of a structure like a contact or tectonic fault mapped as a planar feature or trace line

Entity Properties	
Realizing Parent	IfcGeoScienceObservationTypeEnum.MAPPEDFEATURE
Notes	Part of a set?

2.2.1.12 Virtual Entity: FoldAxis

Linear structure that defines the geometry of a fold structure

Entity Properties

Realizing Parent	IfcGeoScienceObservationTypeEnum.MAPPEDFEATURE
Notes	

2.2.1.13 Virtual Entity: GeologicalObservation

Any kind of observation regarding geological conditions that is represented in the model

Entity Properties	
Realizing Parent	
Notes	

2.2.1.14 Virtual Entity: GeoLogInterval

Typical geological information contained an a logging sheet like lithology, eathering, RQD, core recovery,...

Entity Properties	
Realizing Parent	
Notes	

2.2.1.15 Virtual Entity: GeoPhysicalInterval

Typical information collected in continuous geophysical logs, e.g. Pwave velocity, Resistivity, Density, Caliper, Acoustic and optic scan,...

Entity Properties	
Realizing Parent	
Notes	

2.2.1.16 Virtual Entity: GeoPointObservation

Proposal: Observation at a point regarding geological or geotechnical phenomenon such as discontinuities, groundwater, weathering, rockbursts etc.

Entity Properties	
Realizing Parent	IfcGeoScienceObservationTypeEnum.LOCALINFORMATION

Notes	

2.2.1.17 Virtual Entity: GeoScienceObservation

Distinctly mapped structures that have been observed on "MappedZones"

Entity Properties	
Realizing Parent	
Notes	

2.2.1.18 Virtual Entity: GeotechnicalObservation

Any kind of observation regarding geotechnical conditions that is represented in the model

Entity Properties	
Realizing Parent	
Notes	

2.2.1.19 Virtual Entity: HydroGeologyObservation

Any kind of observation regarding groundwater conditions that is represented in the model

Entity Properties	
Realizing Parent	
Notes	

2.2.1.20 Virtual Entity: Lineation

Linear elements / measurements of e.g. striae on a fault surface, mineral lineations,...

Entity Properties	
Realizing Parent	IfcGeoScienceObservationTypeEnum.MAPPEDFEATURE
Notes	

2.2.1.21 Virtual Entity: MappedUnit

Part of a MappedZone which was assigned to distinct category of "Book B" models, e.g. a GeologicalUnit, GeotechnicalUnit or fault zone, including detailed observations like weathering, lithologies, discontinuity spacing etc.

Entity Properties	
Realizing Parent	IfcGeoScienceObservationTypeEnum.MAPPEDFEATURE
Notes	

2.2.1.22 Virtual Entity: MWD-Interval

"Measure While Drilling" data are collected during destructive drilling in short intervals and conatin information like water flow, advance rates, drilling resistence,...

For exchanged in IFC, interpreted MWD-data or key-attributes are expected

Entity Properties	
Realizing Parent	
Notes	

2.2.1.23 Virtual Entity: Observation or Measurement Result Mapping

Detailed collected information, including measured parameters, descriptions etc. that are referencing to the SpatialGeoObsElements.

These elements are understood as objects with a discrete geometry, that enables spatial queries and visualization

Entity Properties	
Realizing Parent	
Notes	

2.2.1.24 Virtual Entity: WaterInflowBorehole

Groundwaterflow measured from a borehole

Entity Properties	
Realizing Parent	
Notes	

2.2.1.25 Virtual Entity: WaterInflowPoint

Groundwaterflow to the excavation measured on a specific point

Entity Properties	
Realizing Parent	
Notes	

2.2.1.26 Virtual Entity: WaterInflowUnitary

Groundwaterflow to the tunnel measured for a defined stretch or chainage of the tunnel

Entity Properties	
Realizing Parent	
Notes	

2.2.2 Package: SpatialGeoObsElement

Package for the containers of Book A information.

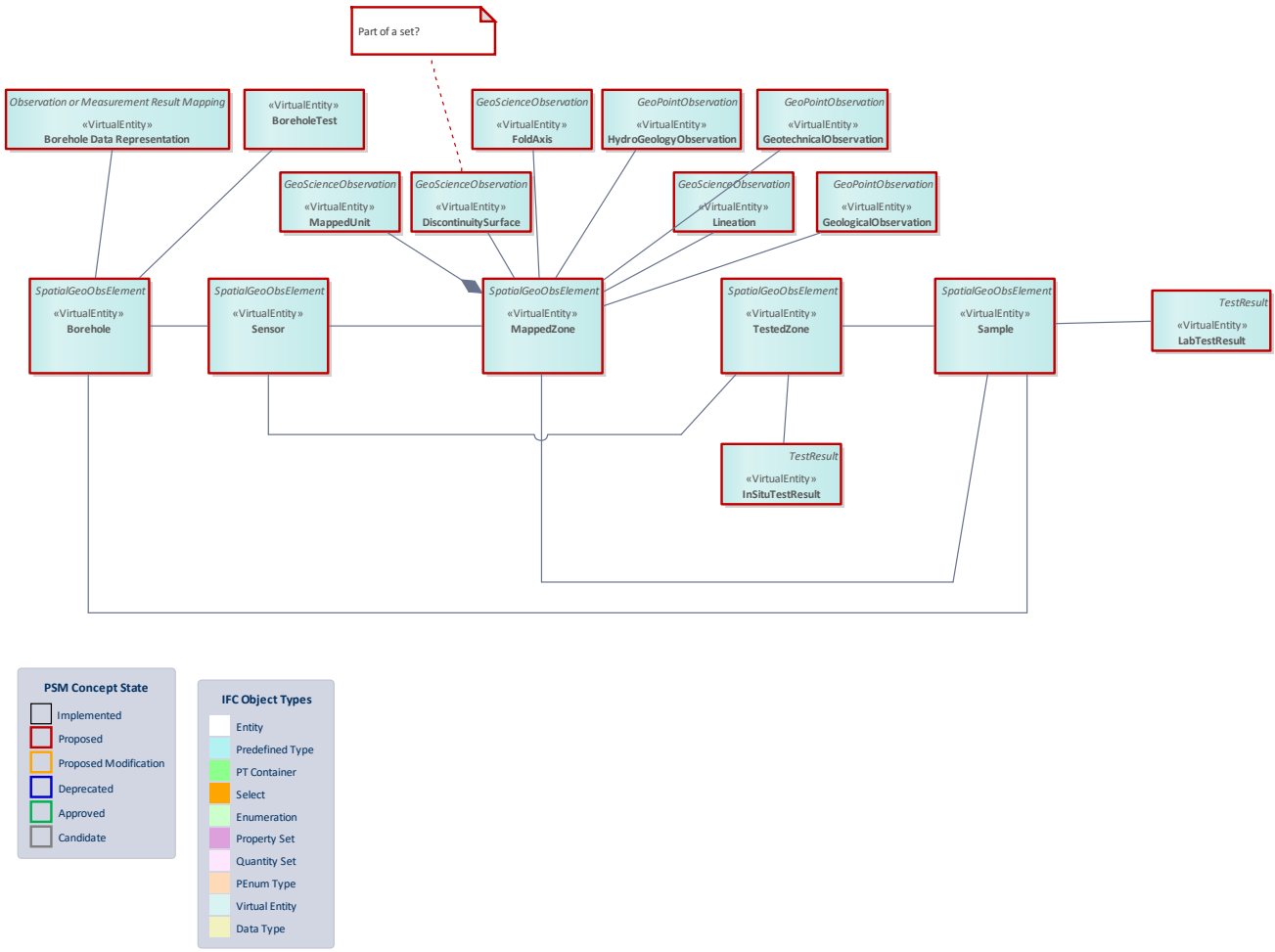

Figure 3: SpatialGeoObsElement relationships -

2.2.2.1 Virtual Entity: Borehole Data Representation

Any kind of information related to intervals or points on the borehole axis

Entity Properties	
Realizing Parent	IfcGeoScienceObservationTypeEnum.BOREHOLELOG
Notes	

2.2.2.2 Virtual Entity: DiscontinuitySurface

shape of a structure like a contact or tectonic fault mapped as a planar feature or trace line

Entity Properties

Realizing Parent	IfcGeoScienceObservationTypeEnum.MAPPEDFEATURE
Notes	Part of a set?

2.2.2.3 Virtual Entity: FoldAxis

Linear structure that defines the geometry of a fold structure

Entity Properties	
Realizing Parent	IfcGeoScienceObservationTypeEnum.MAPPEDFEATURE
Notes	

2.2.2.4 Virtual Entity: GeologicalObservation

Any kind of observation regarding geological conditions that is represented in the model

Entity Properties	
Realizing Parent	
Notes	

2.2.2.5 Virtual Entity: GeotechnicalObservation

Any kind of observation regarding geotechnical conditions that is represented in the model

Entity Properties	
Realizing Parent	
Notes	

2.2.2.6 Virtual Entity: HydroGeologyObservation

Any kind of observation regarding groundwater conditions that is represented in the model

Entity Properties	
Realizing Parent	
Notes	

2.2.2.7 Virtual Entity: Lineation

Linear elements / measurements of e.g. striae on a fault surface, mineral lineations,...

Entity Properties	
Realizing Parent	IfcGeoScienceObservationTypeEnum.MAPPEDFEATURE
Notes	

2.2.2.8 Virtual Entity: MappedUnit

Part of a MappedZone which was assigned to distinct category of "Book B" models, e.g. a GeologicalUnit, GeotechnicalUnit or fault zone, including detailed observations like weathering, lithologies, discontinuity spacing etc.

Entity Properties	
Realizing Parent	IfcGeoScienceObservationTypeEnum.MAPPEDFEATURE
Notes	

2.2.2.9 Virtual Entity: BoreholeTest

A test carried out inside the borehole, during or after drilling, including various types of sonding

Entity Properties	
Realizing Parent	
Notes	Pset connected to IfcGeoScienceObservation/INSITUTEST

2.2.2.10 Virtual Entity: InSituTestResult

A test carried out on site directly in place, e.g. in a borehole, a gallery or from the surface.

Distinguished from geophysical surveys which are more complex, see separate description.

Entity Properties

Realizing Parent	IfcGeoScienceObservationTypeEnum.INSITUTESTRESULT
Notes	

2.2.2.11 Virtual Entity: LabTestResult

A test on a soli (geologic) or fluid specimen carried out in a laboratory

Entity Properties	
Realizing Parent	IfcGeoScienceObservationTypeEnum.LABTESTRESULT
Notes	

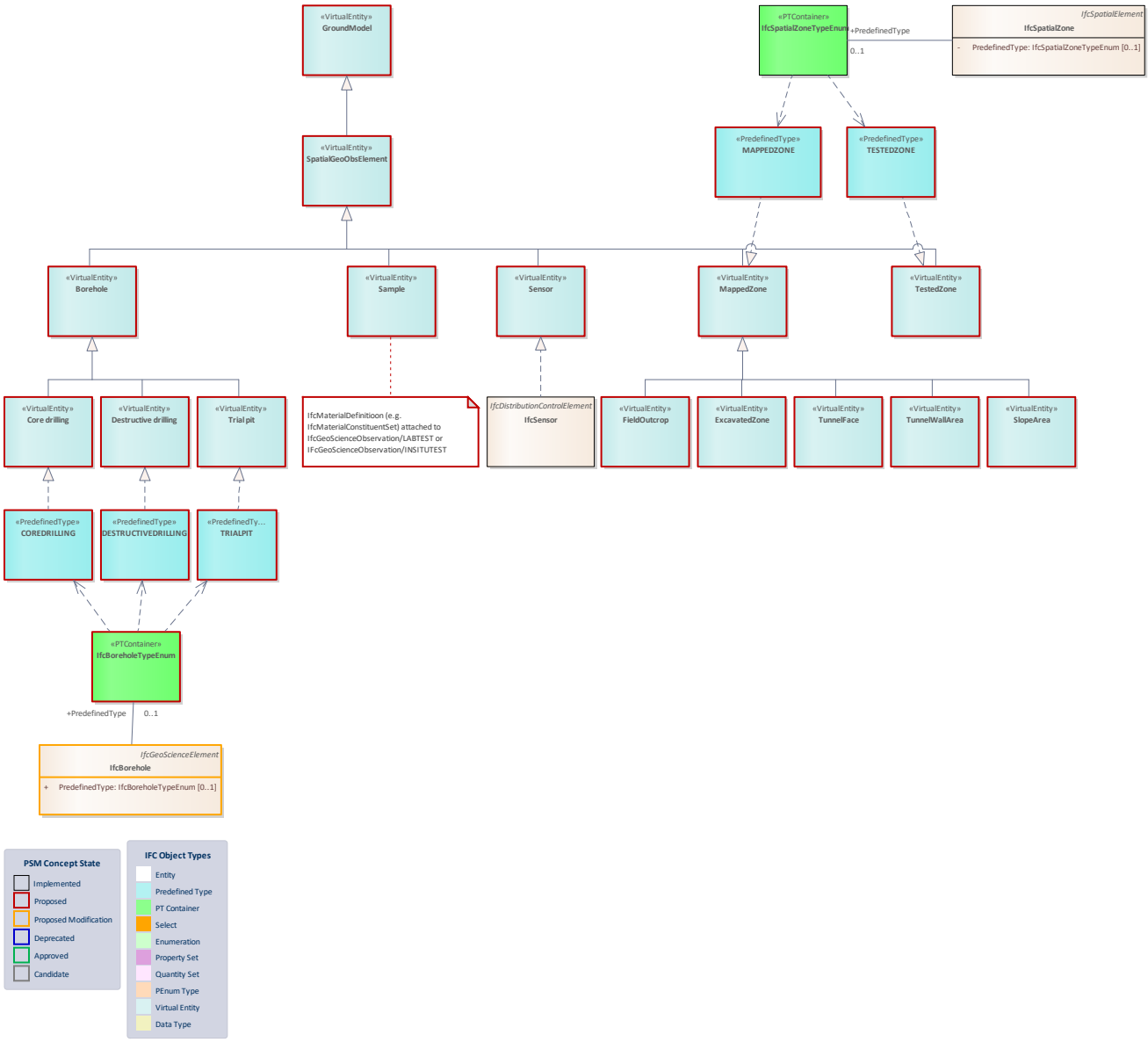

Figure 4: SpatialGeoObsElement taxonomy -

2.2.2.12 Class: IfcBorehole

Representation of the concept of a linear geological and geotechnical model, usually an interpretation but sometimes created direct from ground penetrating measurement

The assembly may contain one of more strata and other elements such as capping and lining. The contained subtypes of IfcGeotechnicalStratum will have shape representations made from straight or bent tubes reflecting the bore diameter, or discs if a 'Yabuki' top surface model is being used.

Status: **ProposedModification**

Package: **IfcSharedInfrastructureElements**

Class Properties			
Status	ProposedModification	**Is Abstract**	
Property sets	Pset_BoreholeCommon		

Inheritance Statement		
Subtype Of	IfcGeoScienceElement	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcBoreholeTypeEnum	[0..1]	Identifies the predefined type of a borehole. This type may associate additional specific property sets.

2.2.2.13 Virtual Entity: GroundModel

<<ToDo: definition>>

Entity Properties	
Realizing Parent	
Notes	

2.2.2.14 PDT Container: IfcBoreholeTypeEnum

This enumeration defines the range of different types of boreholes that can further specify an _IfcBorehole_.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Container Properties			
Parent Entity	IfcBorehole	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
		IfcBoreholeTypeEnum.COREDRILLING	

		IfcBoreholeTypeEnum.DESTRUCTIVEDRILLING IfcBoreholeTypeEnum.TRIALPIT

2.2.2.15 Predefined Type: COREDRILLING

Full Identifier: **IfcBoreholeTypeEnum.COREDRILLING**

A drilling process in which borehole is performed by cutting out cylindrical rock or soil samples in the field, using a core barrel.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcBoreholeTypeEnum	**Parent Entity**	IfcBorehole
Stereotype	«PredefinedType»		
Property sets			

2.2.2.16 Predefined Type: DESTRUCTIVEDRILLING

Full Identifier: **IfcBoreholeTypeEnum.DESTRUCTIVEDRILLING**

A drilling process in which the boring is performed using destructive tools

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcBoreholeTypeEnum	**Parent Entity**	IfcBorehole
Stereotype	«PredefinedType»		
Property sets			

2.2.2.17 Predefined Type: TRIALPIT

Full Identifier: **IfcBoreholeTypeEnum.TRIALPIT**

An excavation made for the purpose of observing shallow subsurface conditions, performing field tests and obtaining soil samples.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcBoreholeTypeEnum	**Parent Entity**	IfcBorehole
Stereotype	«PredefinedType»		
Property sets			

2.2.2.18 Predefined Type: MAPPEDZONE

Full Identifier: **IfcSpatialZoneTypeEnum.MAPPEDZONE**

A spatial zone used for collecting and recording observations of different kinds.

Status: **Proposed**

Package: **Spatial zones**

Predefined Type Properties			
Predefined Type Container	IfcSpatialZoneTypeEnum	**Parent Entity**	IfcSpatialZoneType IfcSpatialZone
Stereotype	«PredefinedType»		
Property sets			

2.2.2.19 Predefined Type: TESTEDZONE

Full Identifier: **IfcSpatialZoneTypeEnum.TESTEDZONE**

A limited zone subjected to in situ tests. Space to carry the related information on test results, methodology and other metadata. Used similar to sample, but for In-situ test

Status: **Proposed**

Package: **Spatial zones**

Predefined Type Properties			
Predefined Type Container	IfcSpatialZoneTypeEnum	**Parent Entity**	IfcSpatialZoneType IfcSpatialZone
Stereotype	«PredefinedType»		
Property sets			

2.2.2.20 Virtual Entity: Borehole

OGC GeoSciML.Borehole : A Borehole is the generalized term for any narrow shaft drilled in the ground, either vertically, horizontally, or inclined.

Entity Properties	
Realizing Parent	
Notes	

2.2.2.21 Virtual Entity: Core drilling

A drilling process in which borehole is performed by cutting out cylindrical rock or soil samples in the field, using a core barrel.

Entity Properties	
Realizing Parent	IfcBoreholeTypeEnum.COREDRILLING
Notes	

2.2.2.22 Virtual Entity: Destructive drilling

A drilling process in which the boring is performed using destructive tools

Entity Properties	
Realizing Parent	IfcBoreholeTypeEnum.DESTRUCTIVEDRILLING
Notes	

2.2.2.23 Virtual Entity: ExcavatedZone

Entity Properties	
Realizing Parent	
Notes	

2.2.2.24 Virtual Entity: FieldOutcrop

A limited zone where the natural ground conditions are exposed, and soil or rock can be mapped

Entity Properties	
Realizing Parent	
Notes	

2.2.2.25 Virtual Entity: MappedZone

A limited zone subject to observation

Entity Properties	
Realizing Parent	IfcSpatialZoneTypeEnum.MAPPEDZONE
Notes	

2.2.2.26 Virtual Entity: Sample

OGC GeoSciML.Specimen : A Specimen is a physical sample, obtained for observation(s) carried out ex situ, sometimes in a laboratory.

Entity Properties	
Realizing Parent	
Notes	IfcMaterialDefinitioon (e.g. IfcMaterialConstituentSet) attached to IfcGeoScienceObservation/LABTEST or IFcGeoScienceObservation/INSITUTEST

2.2.2.27 Virtual Entity: Sensor

INSPIRE EnvironmentalMonitoringFacilities.EnvironmentalMonitoringFacility : A georeferenced object directly collecting or processing data about objects whose properties (e.g. physical, chemical, biological or other aspects of environmental conditions) are repeatedly observed or measured.

Entity Properties	
Realizing Parent	IfcSensor
Notes	

2.2.2.28 Virtual Entity: SlopeArea

A segment of an artificial cut slope where the natural ground conditions are exposed, and soil or rock can be mapped during construction

Entity Properties	
Realizing Parent	
Notes	

2.2.2.29 Virtual Entity: SpatialGeoObsElement

A container for geoscience observations.

Entity Properties	
Realizing Parent	
Notes	

2.2.2.30 Virtual Entity: TestedZone

A limited zone subjected to in situ tests. "Container-geometry" to carry the information on test results, methodology and other metadata

Entity Properties	
Realizing Parent	IfcSpatialZoneTypeEnum.TESTEDZONE
Notes	

2.2.2.31 Virtual Entity: Trial pit

An excavation made for the purpose of observing shallow subsurface conditions, performing field tests and obtaining soil samples.

Entity Properties

Realizing Parent	IfcBoreholeTypeEnum.TRIALPIT
Notes	

2.2.2.32 Virtual Entity: TunnelFace

The excavated tunnel heading where the natural ground conditions are exposed, and soil or rock can be mapped (can be excavated partially as well)

Entity Properties	
Realizing Parent	
Notes	

2.2.2.33 Virtual Entity: TunnelWallArea

A segment of the tunnel wall where the natural ground conditions are exposed, and soil or rock can be mapped

Entity Properties	
Realizing Parent	
Notes	

2.2.3 Package: Test

Package containing the taxonomy and mapping for Book A tests.

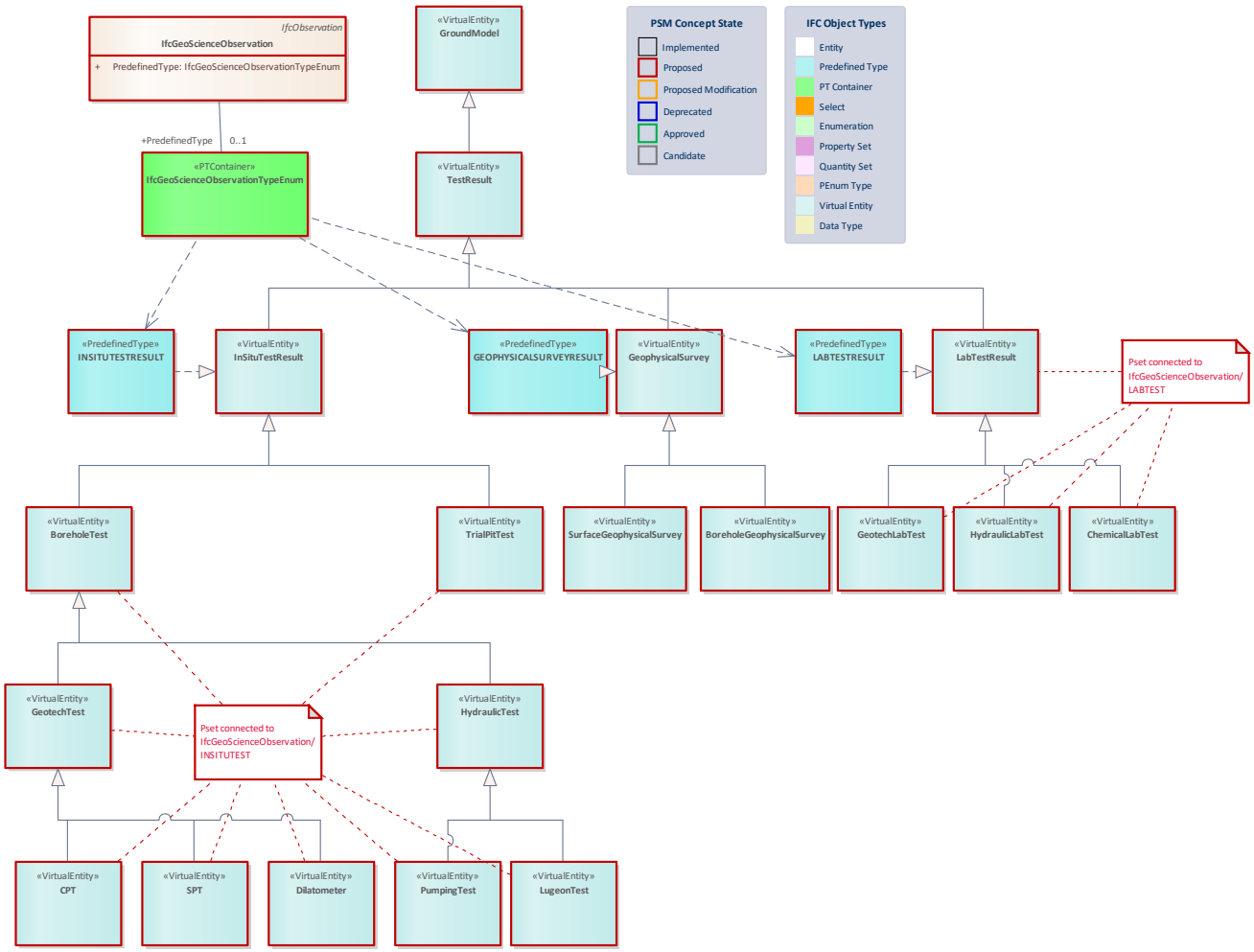

Figure 5: Test -

2.2.3.1 Virtual Entity: GroundModel

<<ToDo: definition>>

Entity Properties	
Realizing Parent	
Notes	

2.2.3.2 Class: IfcGeoScienceObservation

Detailed collected information, including measured parameters, descriptions etc related to geoscientific observations. that can be assigned to physical or spatial elements using _IfcRelAssignsToProduct_.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcObservation	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcGeoScienceObservationTypeEnum		Identifies the predefined type of a geoscience observation element. This type may associate additional specific property sets.

2.2.3.3 PDT Container: IfcGeoScienceObservationTypeEnum

This enumeration defines the range of different types of geoscience observations that can further specify an _IfcGeoScienceObservation_.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Container Properties			
Parent Entity	IfcGeoScienceObservation	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
		IfcGeoScienceObservationTypeEnum.MAPPEDFEATURE IfcGeoScienceObservationTypeEnum.LOCALINFORMATION IfcGeoScienceObservationTypeEnum.GEOPHYSICALSURVEYRESULT IfcGeoScienceObservationTypeEnum.INSITUTESTRESULT IfcGeoScienceObservationTypeEnum.LABTESTRESULT	

		IfcGeoScienceObservationTypeEnum.BOREHOLELOG

2.2.3.4 Predefined Type: GEOPHYSICALSURVEYRESULT

Full Identifier: **IfcGeoScienceObservationTypeEnum.GEOPHYSICALSURVEYRESULT**

A systematic collection of geophysical data that was gathered either at or near the ground surface or by using boreholes and measuring the whole volume in between (crosshole).

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceObservationTypeEnum	**Parent Entity**	IfcGeoScienceObservation
Stereotype	«PredefinedType»		
Property sets			

2.2.3.5 Predefined Type: INSITUTESTRESULT

Full Identifier: **IfcGeoScienceObservationTypeEnum.INSITUTESTRESULT**

Result from a test carried out on site directly in place, e.g. in a borehole, a gallery or from the surface.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceObservationTypeEnum	**Parent Entity**	IfcGeoScienceObservation
Stereotype	«PredefinedType»		
Property sets			

2.2.3.6 Predefined Type: LABTESTRESULT

Full Identifier: **IfcGeoScienceObservationTypeEnum.LABTESTRESULT**

Result from a test on a rock/soil (geologic) or fluid specimen carried out in a laboratory

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceObservationTypeEnum	**Parent Entity**	IfcGeoScienceObservation
Stereotype	«PredefinedType»		
Property sets			

2.2.3.7 Virtual Entity: BoreholeGeophysicalSurvey

Larger scale geophysical test performed from inside a borehole, distinguished from detailed geophysical log because the ground in greater distance around the boreholes is beeing investigated.

Distinguished from logging of the borehole wall with geophysical methods, e.g. sonic or gamma log.

Entity Properties	
Realizing Parent	
Notes	

2.2.3.8 Virtual Entity: BoreholeTest

A test carried out inside the borehole, during or after drilling, including various types of sonding

Entity Properties	
Realizing Parent	
Notes	Pset connected to IfcGeoScienceObservation/INSITUTEST

2.2.3.9 Virtual Entity: ChemicalLabTest

<<ToDo: definition>>

Entity Properties	
Realizing Parent	
Notes	Pset connected to IfcGeoScienceObservation/LABTEST

2.2.3.10 Virtual Entity: CPT

<<ToDo: definition>>

Entity Properties	
Realizing Parent	
Notes	Pset connected to IfcGeoScienceObservation/INSITUTEST

2.2.3.11 Virtual Entity: Dilatometer

<<ToDo: definition>>

Entity Properties	
Realizing Parent	
Notes	Pset connected to IfcGeoScienceObservation/INSITUTEST

2.2.3.12 Virtual Entity: GeophysicalSurvey

<<ToDo: definition>>

Entity Properties	
Realizing Parent	IfcGeoScienceObservationTypeEnum.GEOPHYSICALSURVEYRESULT
Notes	

2.2.3.13 Virtual Entity: GeotechLabTest

<<ToDo: definition>>

Entity Properties

Realizing Parent	
Notes	Pset connected to IfcGeoScienceObservation/LABTEST

2.2.3.14 Virtual Entity: GeotechTest

Geotechnical test performed inside a borehole

Entity Properties	
Realizing Parent	
Notes	Pset connected to IfcGeoScienceObservation/INSITUTEST

2.2.3.15 Virtual Entity: HydraulicLabTest

<<ToDo: definition>>

Entity Properties	
Realizing Parent	
Notes	Pset connected to IfcGeoScienceObservation/LABTEST

2.2.3.16 Virtual Entity: HydraulicTest

Hydraulic test performed inside a borehole

Entity Properties	
Realizing Parent	
Notes	Pset connected to IfcGeoScienceObservation/INSITUTEST

2.2.3.17 Virtual Entity: InSituTestResult

A test carried out on site directly in place, e.g. in a borehole, a gallery or from the surface.

Distinguished from geophysical surveys which are more complex, see separate description.

Entity Properties

Realizing Parent	IfcGeoScienceObservationTypeEnum.INSITUTESTRESULT
Notes	

2.2.3.18 Virtual Entity: LabTestResult

A test on a soli (geologic) or fluid specimen carried out in a laboratory

Entity Properties	
Realizing Parent	IfcGeoScienceObservationTypeEnum.LABTESTRESULT
Notes	

2.2.3.19 Virtual Entity: LugeonTest

<<ToDo: definition>>

Entity Properties	
Realizing Parent	
Notes	Pset connected to IfcGeoScienceObservation/INSITUTEST

2.2.3.20 Virtual Entity: PumpingTest

<<ToDo: definition>>

Entity Properties	
Realizing Parent	
Notes	Pset connected to IfcGeoScienceObservation/INSITUTEST

2.2.3.21 Virtual Entity: SPT

<<ToDo: definition>>

Entity Properties	
Realizing Parent	

Notes	Pset connected to IfcGeoScienceObservation/INSITUTEST

2.2.3.22 Virtual Entity: SurfaceGeophysicalSurvey

Geophysical surveys conducted at or near the ground surface

Entity Properties	
Realizing Parent	
Notes	

2.2.3.23 Virtual Entity: TestResult

<<ToDo: definition>>

Entity Properties	
Realizing Parent	
Notes	

2.2.3.24 Virtual Entity: TrialPitTest

A test carried out during the exectuion of a trial pit

Entity Properties	
Realizing Parent	
Notes	Pset connected to IfcGeoScienceObservation/INSITUTEST

2.3 Package: (Book B)

This is the package representing the taxonomy for geoscience elements Book B and their mappings to IFC.

Book B essentially consists of two parts:

- SpatialGeoIntElement: Serves as containers for interpreted geoscience features
- Interpreted objects: Serves as representations for interpreted geoscience features

2.3.1 Package: Interpreted Objects

Package representing the taxonomy for geoscience interpreted objects Book B and their mappings to IFC.

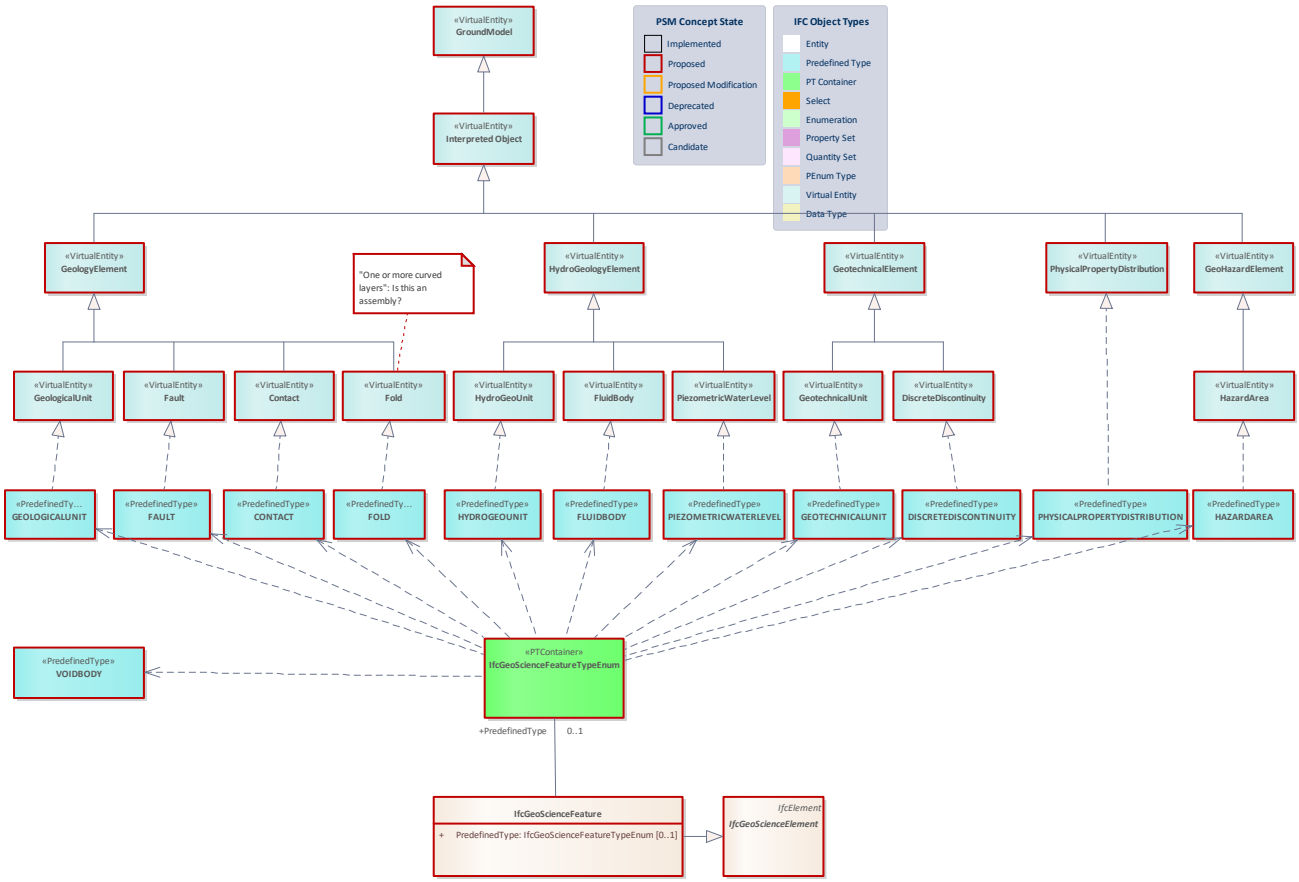

Figure 6: Interpreted Objects taxonomy -

2.3.1.1 Virtual Entity: GroundModel

<<ToDo: definition>>

Entity Properties	
Realizing Parent	
Notes	

2.3.1.2 Predefined Type: PHYSICALPROPERTYDISTRIBUTION

Full Identifier: **IfcGeoScienceFeatureTypeEnum.PHYSICALPROPERTYDISTRIBUTION**

Additional option (alternative to discrete models) to describe a +/- continuous spatial distribution of any physical parameter (geotechnical key-parameters, permeabilty, likelyhood of. e.g. a fault or any other uncertainty-related information)

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		
Property sets			

2.3.1.3 Class: IfcGeoScienceElement

An abstract entity for geotechnical and geological concepts.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Class Properties			
Status	Proposed	**Is Abstract**	Abstract
Property sets			

Inheritance Statement		
Subtype Of	IfcElement	
Subtypes	**EXISTING**	**PROPOSED**
		IfcGeoScienceFeature IfcGeoScienceModel

2.3.1.4 Class: IfcGeoScienceFeature

Represents a geological or geotechnical feature as an interpretation of factual data such as observations, measurements and tests.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcGeoScienceElement	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcGeoScienceFeatureTypeEnum	[0..1]	Identifies the predefined type of a geoscience feature. This type may associate additional specific property sets.

2.3.1.5 PDT Container: IfcGeoScienceFeatureTypeEnum

This enumeration defines the range of different types of geoscience features that can further specify an _IfcGeoScienceFeatureTypeEnum_.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Container Properties			
Parent Entity	IfcGeoScienceFeature	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
		IfcGeoScienceFeatureTypeEnum.HAZARDAREA IfcGeoScienceFeatureTypeEnum.HYDROGEOUNIT IfcGeoScienceFeatureTypeEnum.GEOLOGICALUNIT IfcGeoScienceFeatureTypeEnum.FAULT IfcGeoScienceFeatureTypeEnum.GEOTECHNICALUNIT IfcGeoScienceFeatureTypeEnum.FOLD IfcGeoScienceFeatureTypeEnum.FLUIDBODY IfcGeoScienceFeatureTypeEnum.CONTACT	

		IfcGeoScienceFeatureTypeEnum.PIEZOMETRICWATERLEVEL IfcGeoScienceFeatureTypeEnum.DISCRETEDISCONTINUITY IfcGeoScienceFeatureTypeEnum.VOIDBODY IfcGeoScienceFeatureTypeEnum.PHYSICALPROPERTYDISTRIBUTION

2.3.1.6 Predefined Type: CONTACT

Full Identifier: **IfcGeoScienceFeatureTypeEnum.CONTACT**

OGC GeoSciML.Contact : A contact is a general concept representing any kind of surface separating two geologic units, including primary boundaries such as depositional contacts, all kinds of unconformities, intrusive contacts, and gradational contacts, as well as faults that separate geologic units.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		
Property sets			

2.3.1.7 Predefined Type: DISCRETEDISCONTINUITY

Full Identifier: **IfcGeoScienceFeatureTypeEnum.DISCRETEDISCONTINUITY**

AFTES.GT1R1A1. Any interuption of the continuity in the rock material with its attendant mechanical, hydraulic and thermal properties.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties

Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		
Property sets			

2.3.1.8 Predefined Type: FAULT

Full Identifier: **IfcGeoScienceFeatureTypeEnum.FAULT**

OGC GeoSciML.ShearDisplacementStructure : A shear displacement structure includes all brittle to ductile style structures along which displacement has occurred, from a simple, single 'planar' brittle or ductile surface to a fault system comprised of tens of strands of both brittle and ductile nature. This structure may have some significant thickness (a deformation zone) and have an associated body of deformed rock that may be considered a deformation unit (which geologicUnitType is 'DeformationUnit') which can be associated to the ShearDisplacementStructure using GeologicFeatureRelation from the GeoSciML Extension package

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		
Property sets			

2.3.1.9 Predefined Type: FLUIDBODY

Full Identifier: **IfcGeoScienceFeatureTypeEnum.FLUIDBODY**

OGC GroundWaterML2.FluidBody : A distinct body of some fluid (liquid, gas) that fills the voids of a container such as an aquifer, system of aquifers, water well, etc. In hydrogeology this body is usually constituted by groundwater, but the model allows for other types of fillers e.g. petroleum.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties

Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		
Property sets			

2.3.1.10 Predefined Type: FOLD

Full Identifier: **IfcGeoScienceFeatureTypeEnum.FOLD**

OGC GeoSciML.Fold : A fold is formed by one or more systematically curved layers, surfaces, or lines in a rock body. A fold denotes a structure formed by the deformation of a geologic structure, such as a contact which the original undeformed geometry is presumed, to form a structure that may be described by the translation of an abstract line (the fold axis) parallel to itself along some curvilinear path (the fold profile). Folds have a hinge zone (zone of maximum curvature along the surface) and limbs (parts of the deformed surface not in the hinge zone). Folds are described by an axial surface, hinge line, profile geometry, the solid angle between the limbs, and the relationships between adjacent folded surfaces if the folded structure is a Layering fabric.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		
Property sets			

2.3.1.11 Predefined Type: GEOLOGICALUNIT

Full Identifier: **IfcGeoScienceFeatureTypeEnum.GEOLOGICALUNIT**

OGC GeoSciML.GeologicUnit : Conceptually, a GeologicUnit may represent a body of material in the Earth whose complete and precise extent is inferred to exist (e.g., North American Data Model GeologicUnit, Stratigraphic unit in the sense of NACSN, or International Stratigraphic Code), or a classifier used to characterize parts of the Earth (e.g. lithologic map unit like 'granitic rock' or 'alluvial deposit', surficial units like 'till' or 'old alluvium'). It includes both formal units (i.e. formally adopted and named in an official lexicon) and informal units (i.e. named but not promoted to a lexicon) and unnamed units (i.e., recognizable, described and delineable in the field but not otherwise formalised). In simpler terms, a geologic unit is a package of earth material (generally rock or soil).

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		
Property sets			

2.3.1.12 Predefined Type: GEOTECHNICALUNIT

Full Identifier: **IfcGeoScienceFeatureTypeEnum.GEOTECHNICALUNIT**

A surface or a volume in which the mechanical behaviour and other design-relevant characteristics are characterized using the same geotechnical parameters values. Several alternative classifications (=GeotechModels) can be required in a project for different design tasks.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		
Property sets			

2.3.1.13 Predefined Type: HAZARDAREA

Full Identifier: **IfcGeoScienceFeatureTypeEnum.HAZARDAREA**

INSPIRE NaturalRiskZones.HazardArea : Discrete spatial objects representing a natural hazard.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties

Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		
Property sets			

2.3.1.14 Predefined Type: HYDROGEOUNIT

Full Identifier: **IfcGeoScienceFeatureTypeEnum.HYDROGEOUNIT**

OGC GroundWaterML2.HydroGeoUnit : Any soil or rock unit or zone that by virtue of its hydraulic properties has a distinct influence on the storage or movement of groundwater (after ANS, 1980).

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		
Property sets			

2.3.1.15 Predefined Type: PIEZOMETRICWATERLEVEL

Full Identifier: **IfcGeoScienceFeatureTypeEnum.PIEZOMETRICWATERLEVEL**

OGC GroundWaterML2.FluidBodySurface : A surface on a fluid body within a local or regional area, e.g. piezometric, potentiometric, water table, salt wedge, etc.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		
Property sets			

2.3.1.16 Predefined Type: VOIDBODY

Full Identifier: **IfcGeoScienceFeatureTypeEnum.VOIDBODY**

a discrete air filled geological feature, including caves and other voids

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceFeatureTypeEnum	**Parent Entity**	IfcGeoScienceFeature
Stereotype	«PredefinedType»		
Property sets			

2.3.1.17 Virtual Entity: Contact

OGC GeoSciML.Contact : A contact is a general concept representing any kind of surface separating two geologic units, including primary boundaries such as depositional contacts, all kinds of unconformities, intrusive contacts, and gradational contacts, as well as faults that separate geologic units.

Entity Properties	
Realizing Parent	IfcGeoScienceFeatureTypeEnum.CONTACT
Notes	

2.3.1.18 Virtual Entity: DiscreteDiscontinuity

AFTES.GT1R1A1. Any interuption of the continuity in the rock material with its attendant mechanical, hydraulic and thermal properties.

Entity Properties	
Realizing Parent	IfcGeoScienceFeatureTypeEnum.DISCRETEDISCONTINUITY
Notes	

2.3.1.19 Virtual Entity: Fault

"OGC GeoSciML.ShearDisplacementStructure : A shear displacement structure includes all brittle to ductile style structures along which displacement has occurred, from a simple, single 'planar' brittle or ductile surface to a fault system comprised of tens of strands of both brittle and ductile nature. This structure may have some significant thickness (a deformation zone) and have an associated body of deformed rock that may be considered a deformation unit (which geologicUnitType is 'DeformationUnit') which can be associated to the ShearDisplacementStructure using GeologicFeatureRelation from the GeoSciML Extension package

"

Entity Properties	
Realizing Parent	IfcGeoScienceFeatureTypeEnum.FAULT
Notes	

2.3.1.20 Virtual Entity: FluidBody

OGC GroundWaterML2.FluidBody : A distinct body of some fluid (liquid, gas) that fills the voids of a container such as an aquifer, system of aquifers, water well, etc. In hydrogeology this body is usually constituted by groundwater, but the model allows for other types of fillers e.g. petroleum.

Entity Properties	
Realizing Parent	IfcGeoScienceFeatureTypeEnum.FLUIDBODY
Notes	

2.3.1.21 Virtual Entity: Fold

OGC GeoSciML.Fold : A fold is formed by one or more systematically curved layers, surfaces, or lines in a rock body. A fold denotes a structure formed by the deformation of a geologic structure, such as a contact which the original undeformed geometry is presumed, to form a structure that may be described by the translation of an abstract line (the fold axis) parallel to itself along some curvilinear path (the fold profile). Folds have a hinge zone (zone of maximum curvature along the surface) and limbs (parts of the deformed surface not in the hinge zone). Folds are described by an axial surface, hinge line, profile geometry, the solid angle between the limbs, and the relationships between adjacent folded surfaces if the folded structure is a Layering fabric.

Entity Properties	
Realizing Parent	IfcGeoScienceFeatureTypeEnum.FOLD
Notes	"One or more curved layers": Is this an assembly?

2.3.1.22 Virtual Entity: GeoHazardElement

<<ToDo: definition>>

Entity Properties	
Realizing Parent	
Notes	

2.3.1.23 Virtual Entity: GeologicalUnit

OGC GeoSciML.GeologicUnit : Conceptually, a GeologicUnit may represent a body of material in the Earth whose complete and precise extent is inferred to exist (e.g., North American Data Model GeologicUnit, Stratigraphic unit in the sense of NACSN, or International Stratigraphic Code), or a classifier used to characterize parts of the Earth (e.g. lithologic map unit like 'granitic rock' or 'alluvial deposit', surficial units like 'till' or 'old alluvium'). It includes both formal units (i.e. formally adopted and named in an official lexicon) and informal units (i.e. named but not promoted to a lexicon) and unnamed units (i.e., recognizable, described and delineable in the field but not otherwise formalised). In simpler terms, a geologic unit is a package of earth material (generally rock or soil).

Entity Properties	
Realizing Parent	IfcGeoScienceFeatureTypeEnum.GEOLOGICALUNIT
Notes	

2.3.1.24 Virtual Entity: GeologyElement

<<ToDo: definition>>

Entity Properties	
Realizing Parent	
Notes	

2.3.1.25 Virtual Entity: GeotechnicalElement

<<ToDo: definition>>

Entity Properties

Realizing Parent	
Notes	

2.3.1.26 Virtual Entity: GeotechnicalUnit

A surface or a volume in which the mechanical behaviour and other design-relevant characteristics are characterized using the same geotechnical parameters values. Several alternative classifications (=GeotechModels) can be required in a project for different design tasks.

Entity Properties	
Realizing Parent	IfcGeoScienceFeatureTypeEnum.GEOTECHNICALUNIT
Notes	

2.3.1.27 Virtual Entity: HazardArea

INSPIRE NaturalRiskZones.HazardArea : Discrete spatial objects representing a natural hazard.

Entity Properties	
Realizing Parent	IfcGeoScienceFeatureTypeEnum.HAZARDAREA
Notes	

2.3.1.28 Virtual Entity: HydroGeologyElement

<<ToDo: definition>>

Entity Properties	
Realizing Parent	
Notes	

2.3.1.29 Virtual Entity: HydroGeoUnit

OGC GroundWaterML2.HydroGeoUnit : Any soil or rock unit or zone that by virtue of its hydraulic properties has a distinct influence on the storage or movement of groundwater (after ANS, 1980).

Entity Properties

Realizing Parent	IfcGeoScienceFeatureTypeEnum.HYDROGEOUNIT
Notes	

2.3.1.30 Virtual Entity: Interpreted Object

<<ToDo: definition>>

Entity Properties	
Realizing Parent	
Notes	

2.3.1.31 Virtual Entity: PhysicalPropertyDistribution

Additional option (alternative to discrete models) to describe a +/- continuous spatial distribution of any physical parameter (geotechnical key-parameters, permeabilty, likelyhood of. e.g. a fault or any other uncertainty-related information)

Entity Properties	
Realizing Parent	IfcGeoScienceFeatureTypeEnum.PHYSICALPROPERTYDISTRIBUTION
Notes	

2.3.1.32 Virtual Entity: PiezometricWaterLevel

"OGC GroundWaterML2.FluidBodySurface : A surface on a fluid body within a local or regional area, e.g. piezometric, potentiometric, water table, salt wedge, etc.

"

Entity Properties	
Realizing Parent	IfcGeoScienceFeatureTypeEnum.PIEZOMETRICWATERLEVEL
Notes	

2.3.2 Package: SpatialGeoIntElements

Package for containers of interpreted geoscience objects.

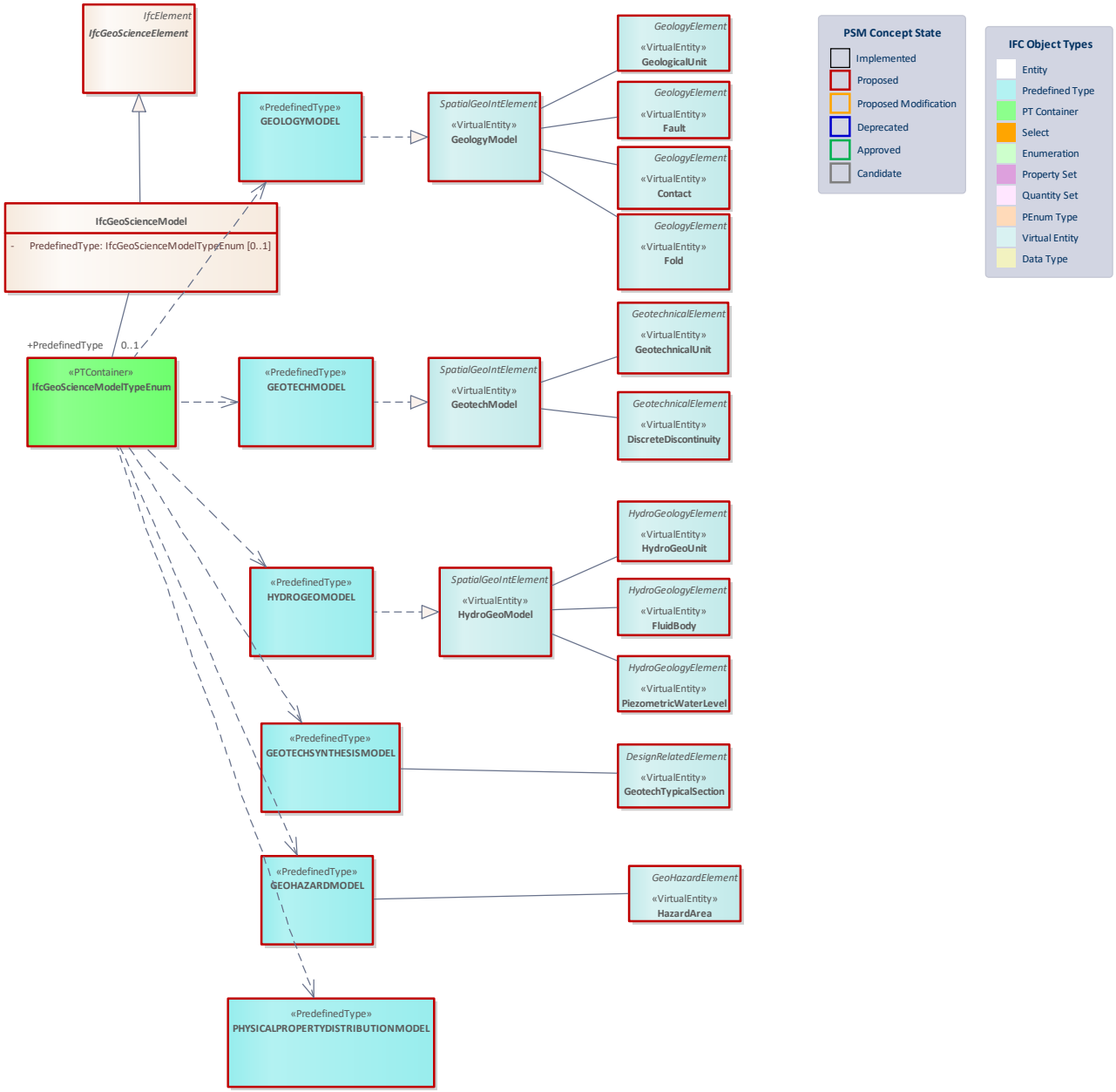

Figure 7: SpatialGeoIntElements relationships -

2.3.2.1 Virtual Entity: Contact

OGC GeoSciML.Contact : A contact is a general concept representing any kind of surface separating two geologic units, including primary boundaries such as depositional contacts, all kinds of unconformities, intrusive contacts, and gradational contacts, as well as faults that separate geologic units.

Entity Properties

Realizing Parent	IfcGeoScienceFeatureTypeEnum.CONTACT
Notes	

2.3.2.2 Virtual Entity: DiscreteDiscontinuity

AFTES.GT1R1A1. Any interuption of the continuity in the rock material with its attendant mechanical, hydraulic and thermal properties.

Entity Properties	
Realizing Parent	IfcGeoScienceFeatureTypeEnum.DISCRETEDISCONTINUITY
Notes	

2.3.2.3 Virtual Entity: Fault

"OGC GeoSciML.ShearDisplacementStructure : A shear displacement structure includes all brittle to ductile style structures along which displacement has occurred, from a simple, single 'planar' brittle or ductile surface to a fault system comprised of tens of strands of both brittle and ductile nature. This structure may have some significant thickness (a deformation zone) and have an associated body of deformed rock that may be considered a deformation unit (which geologicUnitType is 'DeformationUnit') which can be associated to the ShearDisplacementStructure using GeologicFeatureRelation from the GeoSciML Extension package

"

Entity Properties	
Realizing Parent	IfcGeoScienceFeatureTypeEnum.FAULT
Notes	

2.3.2.4 Virtual Entity: FluidBody

OGC GroundWaterML2.FluidBody : A distinct body of some fluid (liquid, gas) that fills the voids of a container such as an aquifer, system of aquifers, water well, etc. In hydrogeology this body is usually constituted by groundwater, but the model allows for other types of fillers e.g. petroleum.

Entity Properties	
Realizing Parent	IfcGeoScienceFeatureTypeEnum.FLUIDBODY

Notes	

2.3.2.5 Virtual Entity: Fold

OGC GeoSciML.Fold : A fold is formed by one or more systematically curved layers, surfaces, or lines in a rock body. A fold denotes a structure formed by the deformation of a geologic structure, such as a contact which the original undeformed geometry is presumed, to form a structure that may be described by the translation of an abstract line (the fold axis) parallel to itself along some curvilinear path (the fold profile). Folds have a hinge zone (zone of maximum curvature along the surface) and limbs (parts of the deformed surface not in the hinge zone). Folds are described by an axial surface, hinge line, profile geometry, the solid angle between the limbs, and the relationships between adjacent folded surfaces if the folded structure is a Layering fabric.

Entity Properties	
Realizing Parent	IfcGeoScienceFeatureTypeEnum.FOLD
Notes	"One or more curved layers": Is this an assembly?

2.3.2.6 Virtual Entity: GeologicalUnit

OGC GeoSciML.GeologicUnit : Conceptually, a GeologicUnit may represent a body of material in the Earth whose complete and precise extent is inferred to exist (e.g., North American Data Model GeologicUnit, Stratigraphic unit in the sense of NACSN, or International Stratigraphic Code), or a classifier used to characterize parts of the Earth (e.g. lithologic map unit like 'granitic rock' or 'alluvial deposit', surficial units like 'till' or 'old alluvium'). It includes both formal units (i.e. formally adopted and named in an official lexicon) and informal units (i.e. named but not promoted to a lexicon) and unnamed units (i.e., recognizable, described and delineable in the field but not otherwise formalised). In simpler terms, a geologic unit is a package of earth material (generally rock or soil).

Entity Properties	
Realizing Parent	IfcGeoScienceFeatureTypeEnum.GEOLOGICALUNIT
Notes	

2.3.2.7 Virtual Entity: GeotechnicalUnit

A surface or a volume in which the mechanical behaviour and other design-relevant characteristics are characterized using the same geotechnical parameters values. Several alternative classifications (=GeotechModels) can be required in a project for different design tasks.

Entity Properties	
Realizing Parent	IfcGeoScienceFeatureTypeEnum.GEOTECHNICALUNIT
Notes	

2.3.2.8 Virtual Entity: HazardArea

INSPIRE NaturalRiskZones.HazardArea : Discrete spatial objects representing a natural hazard.

Entity Properties	
Realizing Parent	IfcGeoScienceFeatureTypeEnum.HAZARDAREA
Notes	

2.3.2.9 Virtual Entity: HydroGeoUnit

OGC GroundWaterML2.HydroGeoUnit : Any soil or rock unit or zone that by virtue of its hydraulic properties has a distinct influence on the storage or movement of groundwater (after ANS, 1980).

Entity Properties	
Realizing Parent	IfcGeoScienceFeatureTypeEnum.HYDROGEOUNIT
Notes	

2.3.2.10 Virtual Entity: PiezometricWaterLevel

"OGC GroundWaterML2.FluidBodySurface : A surface on a fluid body within a local or regional area, e.g. piezometric, potentiometric, water table, salt wedge, etc.

"

Entity Properties	
Realizing Parent	IfcGeoScienceFeatureTypeEnum.PIEZOMETRICWATERLEVEL
Notes	

2.3.2.11 Predefined Type: GEOHAZARDMODEL

Full Identifier: **IfcGeoScienceModelTypeEnum.GEOHAZARDMODEL**

Model of natural ("geogenic") hazards like rock fall, avalanches, seismicity,...

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceModelTypeEnum	**Parent Entity**	IfcGeoScienceModel
Stereotype	«PredefinedType»		
Property sets			

2.3.2.12 Predefined Type: GEOTECHSYNTHESISMODEL

Full Identifier: **IfcGeoScienceModelTypeEnum.GEOTECHSYNTHESISMODEL**

Link between the design and modelled geology and geotechnical conditions:

summarized interpretation with regard to building, construction method,… in relation to a section of the alignment or building structure.

Typical definition of "baseline conditions" as usually included in a geotech. longitudinal section

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceModelTypeEnum	**Parent Entity**	IfcGeoScienceModel
Stereotype	«PredefinedType»		
Property sets			

2.3.2.13 Predefined Type: PHYSICALPROPERTYDISTRIBUTIONMODEL

Full Identifier: **IfcGeoScienceModelTypeEnum.PHYSICALPROPERTYDISTRIBUTIONMODEL**

Additional option (alternative to discrete models) to describe a +/- continuous spatial distribution of any physical properties (geotechnical key-parameters, permeabilty, likelyhood of. e.g. a fault or any other uncertainty-related information)

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceModelTypeEnum	**Parent Entity**	IfcGeoScienceModel
Stereotype	«PredefinedType»		
Property sets			

2.3.2.14 Class: IfcGeoScienceElement

An abstract entity for geotechnical and geological concepts.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Class Properties			
Status	Proposed	**Is Abstract**	Abstract
Property sets			

Inheritance Statement		
Subtype Of	IfcElement	
Subtypes	**EXISTING**	**PROPOSED**
		IfcGeoScienceFeature IfcGeoScienceModel

2.3.2.15 Class: IfcGeoScienceModel

Model of geological structured as considered relevant for the project, as a base for the definition of building- and design-related geotechnical models, hydrogeological models and GeoHazardModel

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcGeoScienceElement	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcGeoScienceModelTypeEnum	[0..1]	Identifies the predefined type of a geoscience model. This type may associate additional specific property sets.

2.3.2.16 PDT Container: IfcGeoScienceModelTypeEnum

This enumeration defines the range of different types of geoscience models that can further specify an _IfcGeoScienceModel_.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Container Properties			
Parent Entity	IfcGeoScienceModel	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
		IfcGeoScienceModelTypeEnum.PHYSICALPROPERTYDISTRIBUTIONMODEL IfcGeoScienceModelTypeEnum.HYDROGEOMODEL IfcGeoScienceModelTypeEnum.GEOLOGYMODEL IfcGeoScienceModelTypeEnum.GEOTECHMODEL IfcGeoScienceModelTypeEnum.GEOTECHSYNTHESISMODEL IfcGeoScienceModelTypeEnum.GEOHAZARDMODEL	

2.3.2.17 Predefined Type: GEOLOGYMODEL

Full Identifier: **IfcGeoScienceModelTypeEnum.GEOLOGYMODEL**

Model of geological structured as considered relevant for the project, as a base for the definition of building- and design-related geotechnical models, hydrogeological models and GeoHazardModel

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceModelTypeEnum	**Parent Entity**	IfcGeoScienceModel
Stereotype	«PredefinedType»		
Property sets			

2.3.2.18 Predefined Type: GEOTECHMODEL

Full Identifier: **IfcGeoScienceModelTypeEnum.GEOTECHMODEL**

Model with project and design-task specific geotechnical classification (e.g. material with similar characteristics regarding geomechanical properties or excavation)

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceModelTypeEnum	**Parent Entity**	IfcGeoScienceModel
Stereotype	«PredefinedType»		
Property sets			

2.3.2.19 Predefined Type: HYDROGEOMODEL

Full Identifier: **IfcGeoScienceModelTypeEnum.HYDROGEOMODEL**

Model of hydrogeological conditions with parameters like permeability and definition of boundary conditions for hydrogeological modelling

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceModelTypeEnum	**Parent Entity**	IfcGeoScienceModel
Stereotype	«PredefinedType»		
Property sets			

2.3.2.20 Virtual Entity: GeotechTypicalSection

Interval along the tunnel axis with similar ground conditions, as part of the GeotechSynthesis model that represents the connection between the ground model and the building. Includes key-properties like expected sidtribution of ground types (reference to GeotechUnits) and baseline-definition of expected ground conditions and potential hazards, and may also include key-information on design like excavation measures, distribution of support types etc.

Entity Properties	
Realizing Parent	IfcGeotechTypicalSection
Notes	

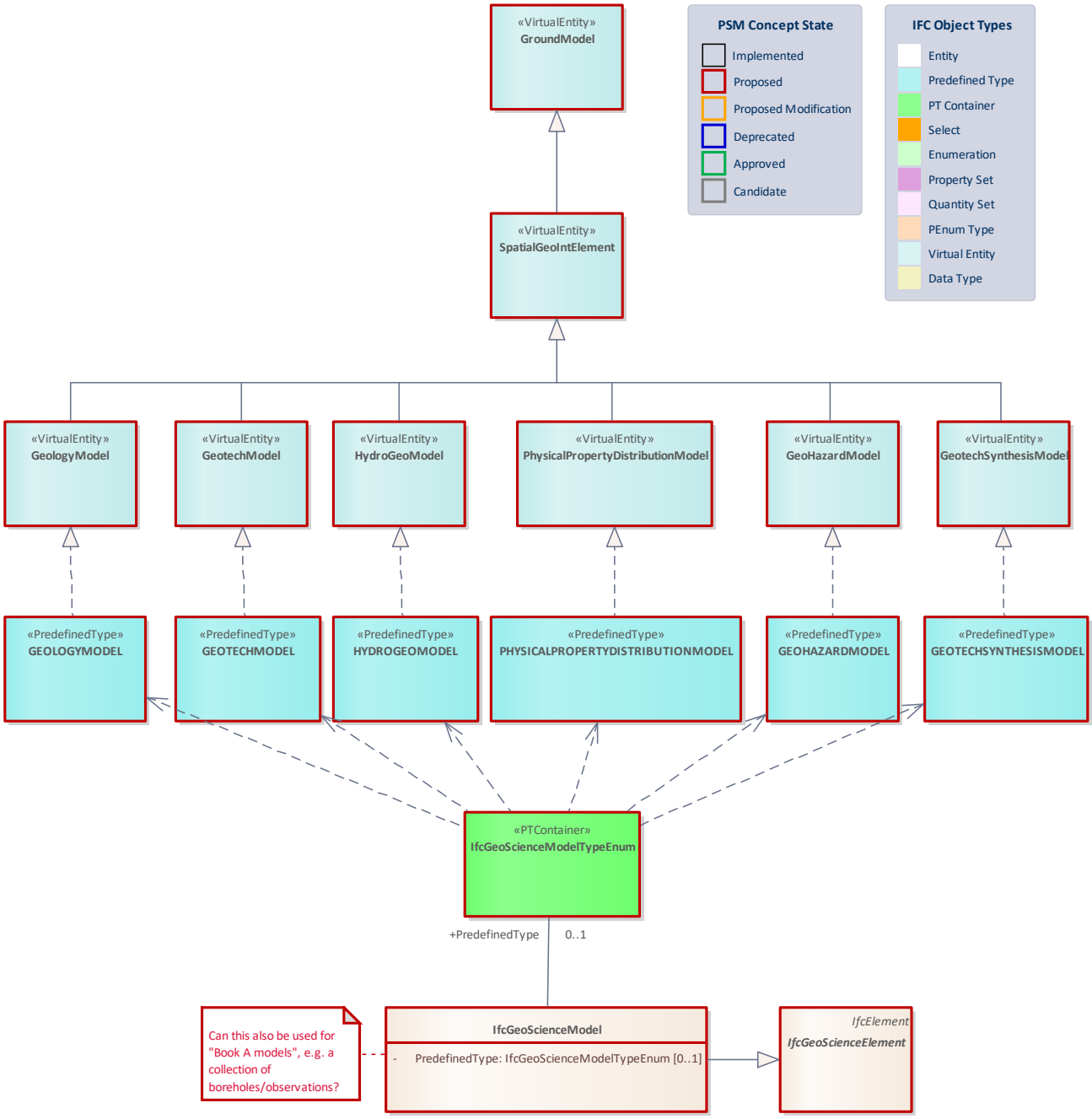

Figure 8: SpatialGeoIntElements taxonomy -

2.3.2.21 Virtual Entity: GroundModel

<<ToDo: definition>>

Entity Properties	
Realizing Parent	

Notes	

2.3.2.22 Predefined Type: GEOHAZARDMODEL

Full Identifier: **IfcGeoScienceModelTypeEnum.GEOHAZARDMODEL**

Model of natural ("geogenic") hazards like rock fall, avalanches, seismicity,...

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceModelTypeEnum	**Parent Entity**	IfcGeoScienceModel
Stereotype	«PredefinedType»		
Property sets			

2.3.2.23 Predefined Type: GEOTECHSYNTHESISMODEL

Full Identifier: **IfcGeoScienceModelTypeEnum.GEOTECHSYNTHESISMODEL**

Link between the design and modelled geology and geotechnical conditions:

summarized interpretation with regard to building, construction method,… in relation to a section of the alignment or building structure.

Typical definition of "baseline conditions" as usually included in a geotech. longitudinal section

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceModelTypeEnum	**Parent Entity**	IfcGeoScienceModel
Stereotype	«PredefinedType»		
Property sets			

2.3.2.24 Predefined Type: PHYSICALPROPERTYDISTRIBUTIONMODEL

Full Identifier: **IfcGeoScienceModelTypeEnum.PHYSICALPROPERTYDISTRIBUTIONMODEL**

Additional option (alternative to discrete models) to describe a +/- continuous spatial distribution of any physical properties (geotechnical key-parameters, permeabilty, likelyhood of. e.g. a fault or any other uncertainty-related information)

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceModelTypeEnum	**Parent Entity**	IfcGeoScienceModel
Stereotype	«PredefinedType»		
Property sets			

2.3.2.25 Class: IfcGeoScienceElement

An abstract entity for geotechnical and geological concepts.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Class Properties			
Status	Proposed	**Is Abstract**	Abstract
Property sets			

Inheritance Statement		
Subtype Of	IfcElement	
Subtypes	**EXISTING**	**PROPOSED**
		IfcGeoScienceFeature IfcGeoScienceModel

2.3.2.26 Class: IfcGeoScienceModel

Model of geological structured as considered relevant for the project, as a base for the definition of building- and design-related geotechnical models, hydrogeological models and GeoHazardModel

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcGeoScienceElement	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcGeoScienceModelTypeEnum	[0..1]	Identifies the predefined type of a geoscience model. This type may associate additional specific property sets.

2.3.2.27 PDT Container: IfcGeoScienceModelTypeEnum

This enumeration defines the range of different types of geoscience models that can further specify an _IfcGeoScienceModel_.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Container Properties			
Parent Entity	IfcGeoScienceModel	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	
		IfcGeoScienceModelTypeEnum.PHYSICALPROPERTYDISTRIBUTIONMODEL IfcGeoScienceModelTypeEnum.HYDROGEOMODEL IfcGeoScienceModelTypeEnum.GEOLOGYMODEL IfcGeoScienceModelTypeEnum.GEOTECHMODEL	

		IfcGeoScienceModelTypeEnum.GEOTECHSYNTHESISMODEL IfcGeoScienceModelTypeEnum.GEOHAZARDMODEL

2.3.2.28 Predefined Type: GEOLOGYMODEL

Full Identifier: **IfcGeoScienceModelTypeEnum.GEOLOGYMODEL**

Model of geological structured as considered relevant for the project, as a base for the definition of building- and design-related geotechnical models, hydrogeological models and GeoHazardModel

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceModelTypeEnum	**Parent Entity**	IfcGeoScienceModel
Stereotype	«PredefinedType»		
Property sets			

2.3.2.29 Predefined Type: GEOTECHMODEL

Full Identifier: **IfcGeoScienceModelTypeEnum.GEOTECHMODEL**

Model with project and design-task specific geotechnical classification (e.g. material with similar characteristics regarding geomechanical properties or excavation)

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceModelTypeEnum	**Parent Entity**	IfcGeoScienceModel
Stereotype	«PredefinedType»		
Property sets			

2.3.2.30 Predefined Type: HYDROGEOMODEL

Full Identifier: **IfcGeoScienceModelTypeEnum.HYDROGEOMODEL**

Model of hydrogeological conditions with parameters like permeability and definition of boundary conditions for hydrogeological modelling

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Predefined Type Properties			
Predefined Type Container	IfcGeoScienceModelTypeEnum	**Parent Entity**	IfcGeoScienceModel
Stereotype	«PredefinedType»		
Property sets			

2.3.2.31 Virtual Entity: GeoHazardModel

Model of natural ("geogenic") hazards like rock fall, avalanches, seismicity,...

Entity Properties	
Realizing Parent	IfcGeoScienceModelTypeEnum.GEOHAZARDMODEL
Notes	

2.3.2.32 Virtual Entity: GeologyModel

Model of geological structured as considered relevant for the project, as a base for the definition of building- and design-related geotechnical models, hydrogeological models and GeoHazardModel

Entity Properties	
Realizing Parent	IfcGeoScienceModelTypeEnum.GEOLOGYMODEL
Notes	

2.3.2.33 Virtual Entity: GeotechModel

Model with project and design-task specific geotechnical classification (e.g. material with similar characteristics regarding geomechanical properties or excavation)

Entity Properties	
Realizing Parent	IfcGeoScienceModelTypeEnum.GEOTECHMODEL
Notes	

2.3.2.34 Virtual Entity: GeotechSynthesisModel

Link between the design and modelled geology and geotechnical conditions:

summarized interpretation with regard to building, construction method,… in relation to a section of the alignment or building structure.

Typical definition of "baseline conditions" as usually included in a geotech. longitudinal section

Entity Properties	
Realizing Parent	IfcGeoScienceModelTypeEnum.GEOTECHSYNTHESISMODEL
Notes	

2.3.2.35 Virtual Entity: HydroGeoModel

Model of hydrogeological conditions with parameters like permeability and definition of boundary conditions for hydrogeological modelling

Entity Properties	
Realizing Parent	IfcGeoScienceModelTypeEnum.HYDROGEOMODEL
Notes	

2.3.2.36 Virtual Entity: PhysicalPropertyDistributionModel

Additional option (alternative to discrete models) to describe a +/- continuous spatial distribution of any physical properties (geotechnical key-parameters, permeabilty, likelyhood of. e.g. a fault or any other uncertainty-related information)

Entity Properties	
Realizing Parent	IfcGeoScienceModelTypeEnum.PHYSICALPROPERTYDISTRIBUTIONMODEL
Notes	

2.3.2.37 Virtual Entity: SpatialGeoIntElement

Container for interpreted objects

Entity Properties	
Realizing Parent	
Notes	

2.4 Package: (Book C)

Package for design related elements.

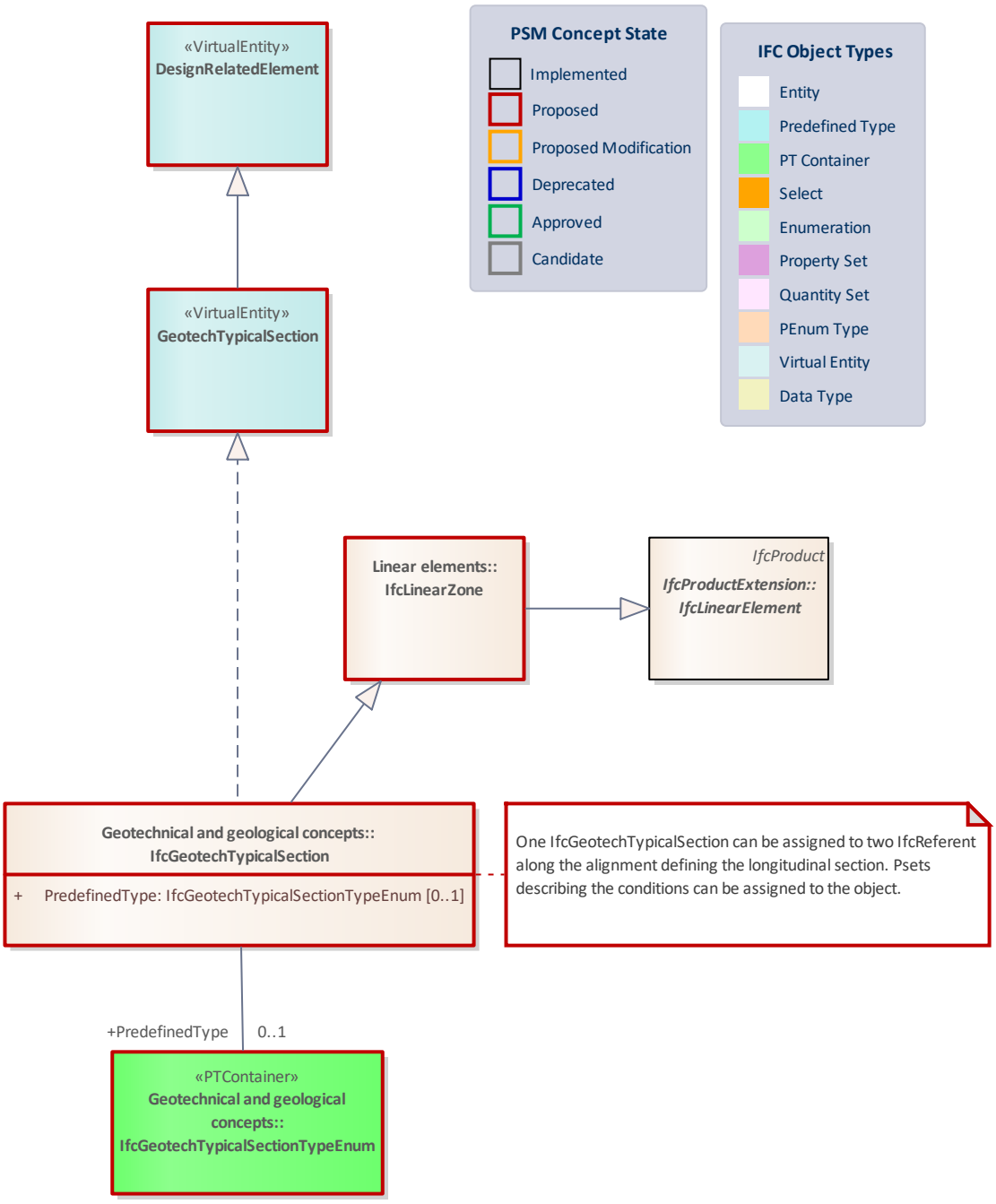

Figure 9: Book C taxonomy and mapping -

2.4.1 Class: IfcGeotechTypicalSection

Interval along the tunnel axis with similar ground conditions, as part of the GeotechSynthesis model that represents the connection between the ground model and the building. Includes key-properties like expected

sidtribution of ground types (reference to GeotechUnits) and baseline-definition of expected ground conditions and potential hazards, and may also include key-information on design like excavation measures, distribution of support types etc.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcLinearZone	
Subtypes	**EXISTING**	**PROPOSED**

Class Attributes

Name	Type	Multiplicity	Definition
PredefinedType	IfcGeotechTypicalSectionTypeEnum	[0..1]	Identifies the predefined type of a geostech typical section. This type may associate additional specific property sets.

2.4.2 PDT Container: IfcGeotechTypicalSectionTypeEnum

This enumeration defines the range of different types of geotech typical sections that can further specify an _IfcGeotechTypicalSection_.

Status: **Proposed**

Package: **Geotechnical and geological concepts**

Container Properties			
Parent Entity	IfcGeotechTypicalSection	**Stereotype**	«PTContainer»
Contains	**EXISTING**	**PROPOSED**	

2.4.3 Class: IfcLinearZone

A linear zone is the generalization of all linear elements that may be used to define linear zones where the linear elements of the same types may overlap linearly. Typical examples are longitudinal zones along an alignment where each zone represents some information such as interpretations of the terrain or underground conditions or design parameters for e.g. a road-, railway- or tunnel section.

Status: **Proposed**

Package: **Linear elements**

Class Properties			
Status	Proposed	**Is Abstract**	
Property sets			

Inheritance Statement		
Subtype Of	IfcLinearElement	
Subtypes	**EXISTING**	**PROPOSED**
		IfcGeotechTypicalSection

2.4.4 Virtual Entity: DesignRelatedElement

<<ToDo: definition>>

Entity Properties	
Realizing Parent	
Notes	

2.4.5 Virtual Entity: GeotechTypicalSection

Interval along the tunnel axis with similar ground conditions, as part of the GeotechSynthesis model that represents the connection between the ground model and the building. Includes key-properties like expected sidtribution of ground types (reference to GeotechUnits) and baseline-definition of expected ground conditions and potential hazards, and may also include key-information on design like excavation measures, distribution of support types etc.

Entity Properties	
Realizing Parent	IfcGeotechTypicalSection

Notes	


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