

and semantically appropriate identifier to convey the information whether only a translation or a translation and transformation of coordinates into the projected coordinate system is to be applied. In order to achieve this, three options are available:

- a renaming of the flag or identifier of the operation (*ProjectionOperation*)
- instead of one identifier, the addition of two (*Translation, Projection*)
- an enumeration to cover the three specific cases that can occur (TRANSLATION, TRANSLATION_PROJECTION, PROJECTION)

Entity change:

ENTITY IfcMapConversion

SUBTYPE OF (IfcCoordinateOperation);

Eastings : IfcLengthMeasure;

Northings : IfcLengthMeasure;

OrthogonalHeight : IfcLengthMeasure;

XAxisAbscissa : OPTIONAL IfcReal;

XAxisOrdinate : OPTIONAL IfcReal;

Scale : OPTIONAL IfcReal;

ScaleY : OPTIONAL IfcReal;

ScaleZ : OPTIONAL IfcReal;

OperationType : IfcCoordinationOperationTypeEnum;

END_ENTITY;

TYPE IfcCoordinationOperationTypeEnum = ENUMERATION OF

(TRANSLATION,

TRANSLATION_PROJECTION,

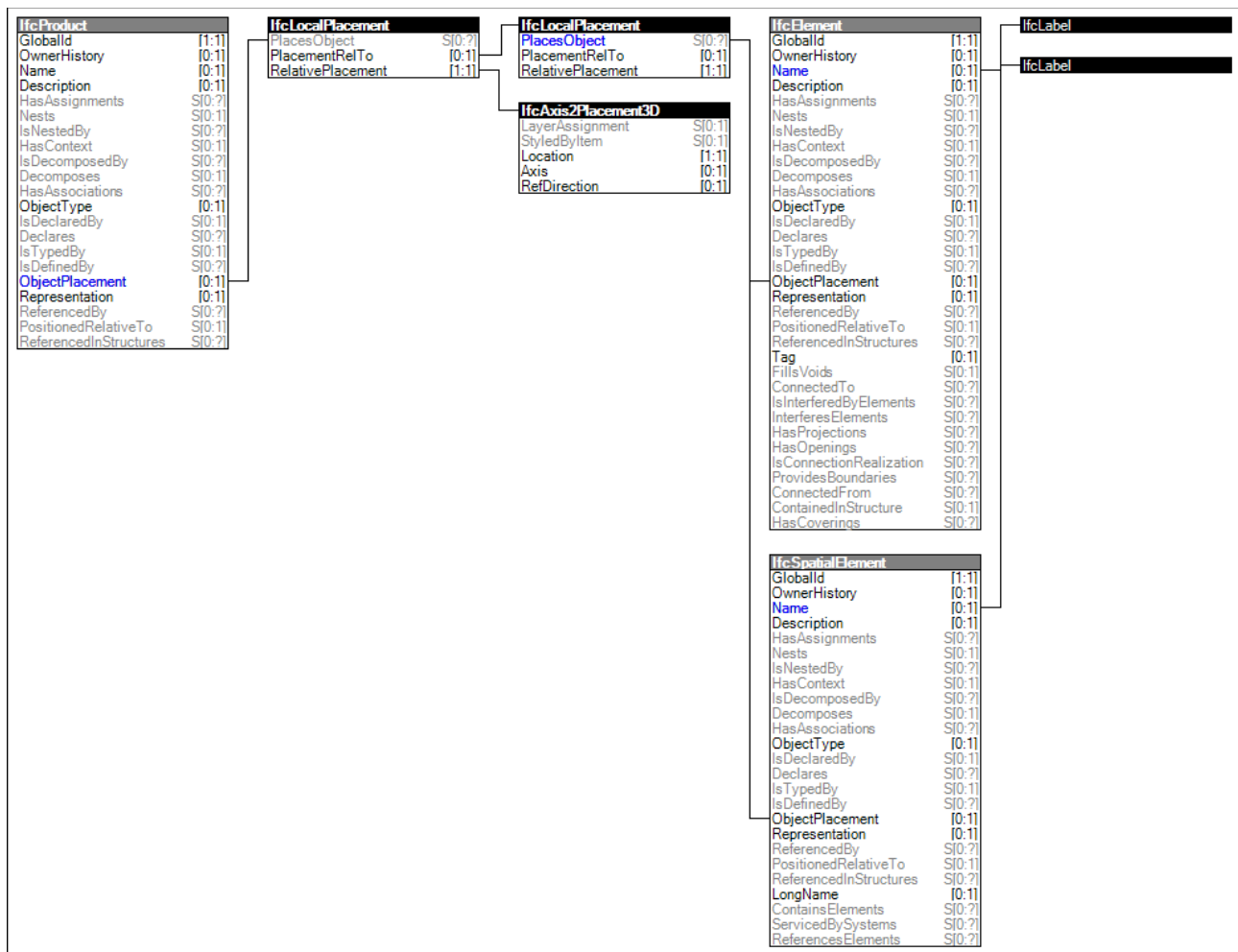
PROJECTION);

END_TYPE;

Additional requirements

In order to cover various contexts inside one *IfcProject*, a proposal for the amendment of the template *Project Global Positioning* shall be discussed. As there is no limitation on the amount of *IfcGeometricRepresentationContext* in one *IfcProject* scenarios where (prefabricated) product coordinates might be in use for a particular element can be imagined. For such elements, the addition of the aforementioned modifications of *IfcMapConversion* would allow various contexts and various base coordinate systems to coexist in an *IfcProject*.

Another requirement that should be discussed is the need for *Product (Local and Linear) Placement* to have direct access to *IfcGeometricRepresentationContext*.



The current IFC schema allows for *IfcProduct* to have more than one *IfcShapeRepresentation* in *IfcProductDefinitionShape*. Each of these *IfcShapeRepresentations* can reside in its own *IfcGeometricRepresentationContext*. The issue with this is that the placement for all representations has to be the same which is not always desirable. There might be a requirement where an *IfcProduct* is placed in the context of the building but would also require a placement on the transportation vehicle. In this case, various contexts for various purposes are required.

The final requirement is a direct reference to a geographic coordinate system in case there is no map projection available. In general, this requirement should be covered with just a reference to the translation. There are a couple of alternatives on how to deal with this:

1. option:

- a new type for referencing a geographic coordinate system with the parent type *IfcCoordinateOperation* that would not project but just translate the origin (such a translation could also model map translations),
- a new sub type of *IfcCoordinateReferenceSystem* *IfcGeographicCRS*.
- addressing Well Known Text (WKT) with a dedicated datastructure

2. option:

- using the existing `IfcMapConversion` and `IfcProjectedCRS` where the attributes dealing with projection do not have values.

The proposal would not require a modification to `IfcMapConversion` with the predefined type and a more generic approach, also covering geographic coordinate systems, would be possible.

Existing entities:

```
ENTITY IfcCoordinateOperation
  ABSTRACT SUPERTYPE OF (ONEOF
    (IfcMapConversion));
    SourceCRS : IfcCoordinateReferenceSystemSelect;
    TargetCRS : IfcCoordinateReferenceSystem;
END_ENTITY;
```

```
ENTITY IfcMapConversion
  SUBTYPE OF (IfcCoordinateOperation);
    Eastings : IfcLengthMeasure;
    Northings : IfcLengthMeasure;
    OrthogonalHeight : IfcLengthMeasure;
    XAxisAbscissa : OPTIONAL IfcReal;
    XAxisOrdinate : OPTIONAL IfcReal;
    Scale : OPTIONAL IfcReal;
    ScaleY : OPTIONAL IfcReal;
    ScaleZ : OPTIONAL IfcReal;
END_ENTITY;
```

The proposed entities:

A translation operation specifies an offset in the coordinate reference system. The rotation is covered in `IfcGeometricRepresentationContext.WorldCoordinateSystem`. A projection is covered by `IfcMapConversion`.

```
ENTITY IfcTranslationOperation
  SUBTYPE OF (IfcCoordinateOperation);
    Eastings : IfcLengthMeasure; // IfcPlaneAngleMeasure
    Northings : IfcLengthMeasure;
```

OrthogonalHeight : OPTIONAL IfcLengthMeasure;

Scale : OPTIONAL IfcReal;

ScaleY : OPTIONAL IfcReal;

END_ENTITY;

Well known text is a standardized (ISO 19182) text based format to describe coordinate reference systems.

ENTITY IfcWellKnownTextCRS

SUBTYPE OF (IfcCoordinateOperation);

WKT : IfcText;

END_ENTITY;

Geographic CRS typically requires two angles and a height (can be derived) to specify a location on a body such as ellipsoid, geoid etc.

ENTITY IfcGeographicCRS

SUBTYPE OF (IfcCoordinateReferenceSystem);

//Identifier : OPTIONAL IfcIdentifier;

GeodeticDatum : OPTIONAL IfcIdentifier;

Unit : OPTIONAL IfcNamedUnit;

END_ENTITY;

Conclusion

The above described issues have to be resolved in IFC4x3 in order to support exchange scenarios in the Infra domain. Tunnel use cases rely on the resolution and addition of proposed types into the EXPRESS schema and General Usage specification i.e. the IFC schema. In order to accommodate the resolution, a dedicated expert panel is proposed. Compliance with OGC should be addressed by appointing a liaison to collaborate and review the alternatives.