Data format specification of the Official 3D Building Model of Germany in Level of Detail 1 and 2 (LoD1-DE + LoD2-DE)

For the data distribution from the data stock of the Central Office for House Coordinates and Building Polygons (ZSHH)

Version 2.2   **Updated: 30.01.2023**

1. Description of the data format

The distribution format for the 3D building models is the CityGML format in accordance with the AdV-CityGML[1] profile. The CityGML-LoD-DE example instances are obtained from the annex to the "Product standard for 3D building models"[2]. The description of the OGC standard is obtained from the OGC specification "CityGML[3], version 1.0.0, OpenGIS® City Geography Markup Language (CityGML) Encoding Standard 08-007r1".

2. Data contents of the 3D buildings

The 3D building model is an extension of the dataset of the building polygons including the third dimension.

A 3D building model is a digital, numerical surface model of the earth's surface reduced to the object fields of buildings and structures defined in ALKIS (definition according to ALKIS-OK in the GeoInfoDok[4]). Underground buildings are not included.

For the data stock of the 3D building models all objects modelled as areas from the following object groups are used:

- AX_Gebaeude
- AX_Turm
- AX_BauwerkOderAnlageFuerIndustrieUndGewerbe
- AX_VorratsbehaelterSpeicherbauwerk
- AX_BauwerkOderAnlageFuerSportFreizeitUndErholung
- AX_SonstigesBauwerkOderSonstigeEinrichtung
- AX_HistorischesBauwerkOderSonstigeEinrichtung
- AX_BauwerkImVerkehrsbereich

A detailed list of all the defined building and structure functions for ALKIS and ATKIS can be found under the following link:

http://repository.gdi-de.org/schemas/adv/citygml/Codelisten/BuildingFunctionTypeAdV.xml

If the objects listed are recorded in ALKIS or ATKIS in the respective Land, they are an integral part of the 3D building models.

The building footprint is usually derived from the official real estate map. Alternatively, outlines of structures and buildings from ATKIS can be used. In the building representation the location accuracy corresponds to that of the underlying building footprint.

Differentiating features in the display depending on the LoD level:

LoD1-DE:

- The building is represented as a "block".
- The geometry is described by "solids".
- The height accuracy is mostly 5m.

LoD2-DE:

- The building representation is carried out with standardized styles of roof.
- The geometry is described by "solids" and their surface aggregates (Multisurface).
- Same geometries are redundant.
- The height accuracy is mostly 1m. Gross deviations are possible in individual cases with complex roof shapes.

Content of a building dataset

Besides the geometry description of the solid figure, the dataset of a building includes the following attributes:

- The height of the building as difference in metres between the highest reference point and the lowest reference point of the building
- Object identifier
- Building function
- Indications of quality (please see paragraph 3 Data contents → metadata)
- Official municipality key
- Name (if recorded)
- Number of storeys (if recorded)

Additional in **LoD2-DE**

- Standardized styles of roof

The coordinates for the geometries are specified by default as ETRS89/UTM coordinates in zones 32 and 33 (because of the image distortion only the eastern Laender can be delivered in zone 33) combined with the height data in the DHHN2016_NH in metres with a point and three decimal places.

3. Data contents

- The naming of the "CityModel" is based on the level of detail of the building model and is formed as follows:

    LoD<level>

- The filename is composed of the "CityModel" LoD<level>, the UTM zone, the tile area (coordinates of the lower left corner [LU], coordinate values in km), the edge length of the tiles in kilometres and the two-character abbreviated designation of the Land:

    LoD<Level>_<UTM-Zone>_<Rechtswert_LU>_<Hochwert_LU>_<Kantenlänge>_<BL>.xml

    Example of data name (ETRS example):

    LoD2_32_EEE_NNNN_2_BY.xml

    Example of CityModels (ETRS example):

    <<gml:name>LoD2_32_EEE_NNNN_2_BY</gml:name>

    At the borders of the Laender tiles can be provided only including builings from one or all states affected. So the name of the tiles are depending on content of states.

    Example on the border between Saarland / Rheinland-Pfalz:

    - Standard tile with all buildings in this area: LoD2_32_320_5488_2_RP_SL.xml
    - Tile only with buildings from Saarland: LoD2_32_320_5488_2_SL.xml

        Tile only with buildings from Rheinland-Pfalz: LoD2_32_320_5488_2_RP.xml

- Per CityModel (file) only one coordinate reference system (CRS) is defined, which is recorded at the highest geometry level according to AdV convention with six digits plus three decimal places: ETRS89_UTM<zn>*DE_DHHN2016_NH

- Likewise only one envelope (bounding box) per CityModel (file) is created. The coordinates and heights can either be specified in a list (posList) or as individual positions (pos).

```
Example:
<gml:name>LoD1_32_EEE_NNNN_2_BY</gml:name>
<gml:boundedBy>
<gml:Envelope srsName="urn:adv:crs:ETRS89_UTM32*DE_DHHN2016_NH">
<gml:lowerCorner srsDimension="3">EEEEEE.EEE NNNNNNN.NNN
HHHH.HHH</gml:lowerCorner>
<gml:upperCorner srsDimension="3">EEEEEE.EEE NNNNNNN.NNN
HHHH.HHH</gml:upperCorner>
</gml:Envelope>
</gml:boundedBy>
…
<gml:posList srsDimension="3">381954.215 5721415.891 66.542 381956.984 5721428.649
66.542 381957.034 5721428.638 66.542 381957.877 5721432.519 66.542 381957.829
5721432.530 66.542 381960.651 5721445.524 66.542 381962.801 5721445.057 66.542
381973.572 5721442.723 66.542 381970.857 5721430.094 66.542 381973.902
5721429.432 66.542 381972.911 5721424.874 66.542 381969.875 5721425.533 66.542
381967.185 5721413.131 66.542 381954.215 5721415.891 66.542</gml:posList>

or
<gml:pos srsDimension="3">381954.215 5721415.891 66.542</gml:pos>
<gml:pos srsDimension="3">381956.984 5721428.649 66.542</gml:pos>
…
```

- Object identifier (gml:id):

  Per building or building part (in the sense of a "3D-Bauteil" / 3D_component) there is an object identifier (OID) for each level of detail (LoD); it starts with "DE" and a two-character abbreviated designation of the Land "BL":

  ```
  <bldg:Building gml:id="DEMVAL75000AFzxo">
  ```

- Reference to the 2D building (externalReferenz):

  In addition to the object identifier of the 3D building, a reference to the 2D building is recorded in the dataset. If the building polygons from ATKIS are used, the OID of the ATKIS object is to be stated.

  ```
  <core:externalReference>
        <core:informationSystem>
              http://repository.gdi-de.org/schemas/adv/citygml/fdv/art.htm#_9100
        </core:informationSystem>
        <core:externalObject>
        <!-- OID of the object type AX_Gebaeude (structure) from ALKIS or ATKIS -->
              <core:name>DENW52AL05562020</core:name>
        </core:externalObject>
  </core:externalReference>
  ```

- Production date (creationDate):

  The production date states when the LoD data have been imported into the database of the respective Land. This is a data processing production date, which is recorded as "creationDate" yyyy-mm-dd.

  ```
  <core:creationDate>2008-08-13</core:creationDate>
  ```

The production data tells nothing about the up-to-dateness of the individual object.

- Metadata:

The metadata are recorded as generic attributes. Only attribute names and values shown in the Product standard for 3D building models have to be used.

```
<!-- Begin metadata as generic attribute of the AdV                          -->
      <!-- Begin Datenquelle Dachhoehe                                       -->
            <gen:stringAttribute name="DatenquelleDachhoehe">
                  <gen:value>1000</gen:value>
            </gen:stringAttribute>
      <!-- End Datenquelle Dachhoehe                                         -->

      <!-- Begin Datenquelle Lage                                            -->
            <gen:stringAttribute name="DatenquelleLage">
                  <gen:value>1000</gen:value>
            </gen:stringAttribute>
      <!-- End Datenquelle Lage                                              -->

      <!-- Begin Datenquelle Bodenhoehe                                      -->
            <gen:stringAttribute name="DatenquelleBodenhoehe">
                  <gen:value>1000</gen:value>
            </gen:stringAttribute>
      <!-- End Datenquelle Bodenhoehe                                        -->

      <!-- Begin Geometrietyp2DReferenz                                      -->
            <gen:stringAttribute name="Geometrietyp2DReferenz">
                  <gen:value>3000</gen:value>
            </gen:stringAttribute>
      <!-- End Geometrietyp2DReferenz                                        -->
      <!-- Anfang DatenquelleGeschossanzahl                                  -->
            <gen:stringAttribute name="DatenquelleGeschossanzahl">
                  <gen:value>1000</gen:value>
            </gen:stringAttribute>
      <!-- Ende DatenquelleGeschossanzahl                                    -->

      <!-- Begin Grundrissaktualitaet                                        -->
            <gen:stringAttribute name="Grundrissaktualitaet">
                  <gen:value>2020-06-30</gen:value>
            </gen:stringAttribute>
      <!-- End Grundrissaktualitaet                                          -->


<!-- Only for LoD1 -->

      <!-- Begin Bezugspunkt Dach                                            -->
            <gen:stringAttribute name="BezugspunktDach">
                  <gen:value>1000</gen:value>
            </gen:stringAttribute>
      <!-- End Bezugspunkt Dach                                              -->
<!-- End of metadata as generic attribute                                    -->
```

- Building function (function):

  The building function in ALKIS respectively ATKIS is to be recorded as "function" only with the attribute values. In the case of several functions only the first attribute value is delivered. Since the ranges of values of building function (GFK) and structure function (BWF) overlap, with the LoD objects the attribute value is preceded by the identifier of the object type with an underscore.

  ALKIS building function (object type identifier, underscore, GFK respectively BWF)

  <bldg:function>31001_1121</bldg:function>

- Municipality key:

  Under the attribute *Gemeindeschlüssel*, the eight-character municipality key is to be recorded:

  <gen:stringAttribute name="Gemeindeschluessel"

  <gen:value>09679122</gen:value>

  </gen:stringAttribute>

- Measured height of the building (measuredHeight):

  The "measuredHeight" is defined as difference between the highest and lowest reference point (above mean sea level) of the building. In accordance with the conventions of the GeoInfoDok it is to be recorded in metres with three decimal places. It's a measured value, so the value is the same for LoD1 and LoD2.

  <6ldg.:measuredHeight uom="urn:adv:uom:m">7.700</6ldg.:measuredHeight>

- Name (only if recorded with the object in ALKIS or in the digital real estate map):

  Under the attribute *Name*, only the proper name of the building should be stated, not the descriptive designation of the building/structure function:

  <gml:name>Maria_Montessori_Schule</gml:name>

- Number of storeys (storeysAboveGround) – if recorded:

  The attribute provides the number of storeys. How it has been recorded is defined in the attribute "Datenquelle Geschossanzahl".

Additonal content in **LoD2:**

- Standardized types of roof (roofType):

  The list is correspondening to the catalog in the GeoinfoDok:

  <bldg:roofType>3100</bldg:roofType>

  Note: LoD2-buldings with a flat roof, automatically derived from a LoD1-Object, have as roofType 9999 (other).

For more details on this information, please do not hesitate to contact ZSHH.

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[1] http://repository.gdi-de.org/schemas/adv/citygml/
[2] http://www.adv-online.de/AdV-Produkte/Standards-und-Produktblaetter/ZSHH/
[3] https://www.opengeospatial.org/standards/citygml
[4] http://www.adv-online.de/GeoInfoDok/