

# CityGML 3DCityDB-Loader plugin for QGIS

## A quick overview

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# Overview

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- Plugin overview
- Software installation
- Software use
- Advanced options
- Software uninstall
- Current limitations
- QGIS Package
- Resources

# Motivation

## Motivation

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## IDEA:

- Why not letting users benefit from directly working with the CityGML 3D City Database (aka 3DCityDB)?
  - No need to work with files
  - Editing of features attributes could become way easier
  - SQL/relational model are rather well-known in the user community
  - Last but not least.... "3D city models belong best in a database" ☺

# Motivation

**BUT:**

- 3DCityDB structure is rather complex
  - Lots of nested tables, intricate structure
  - Data management is difficult, although some functions are provided (e.g. delete functions)
  - There can be multiple "scenarios" in the same database instance ("citydb\_1", "citydb\_2", "citydb\_3", ...)
- CityGML does not follow the Simple Feature for SQL model (SFS)
  - Nested features
  - One feature can have multiple representations (multiple LoDs, multiple geometry types)
- The existing Importer/Exporter offers some functionalities, but its *raison d'être* is basically different (...as the name says!)

# Motivation

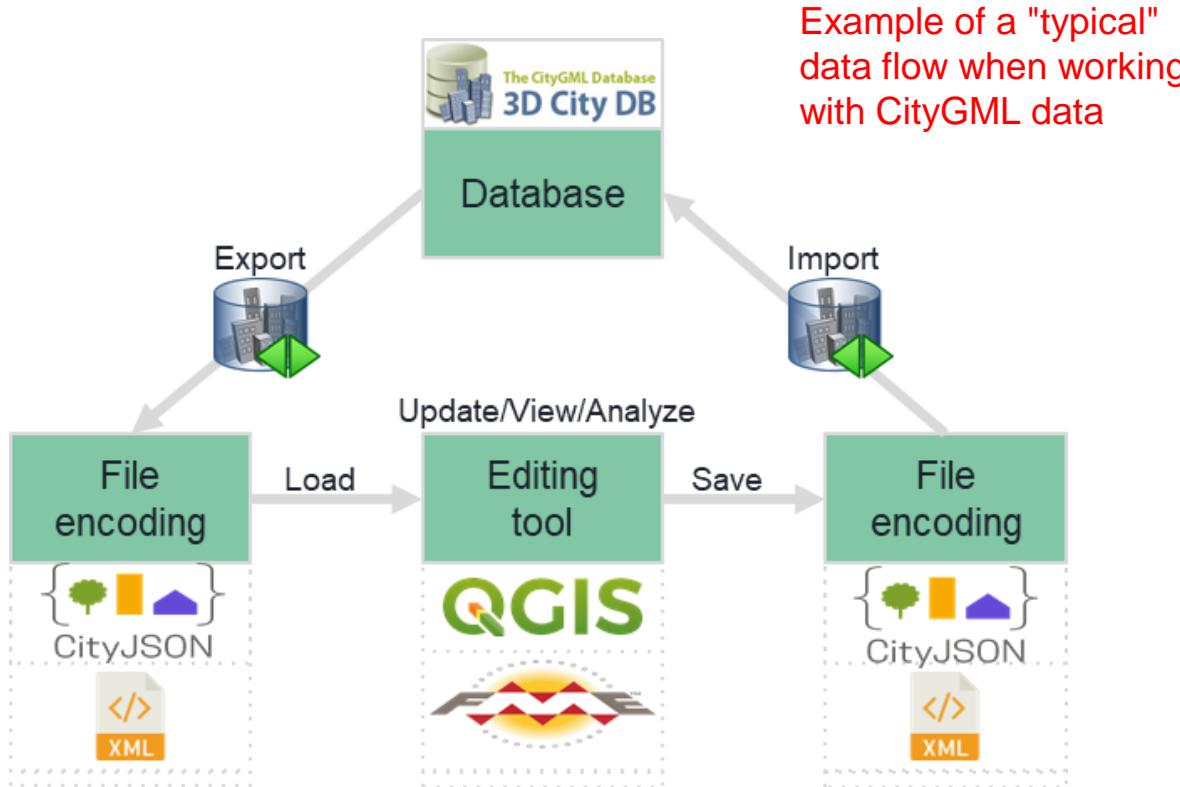
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SO:

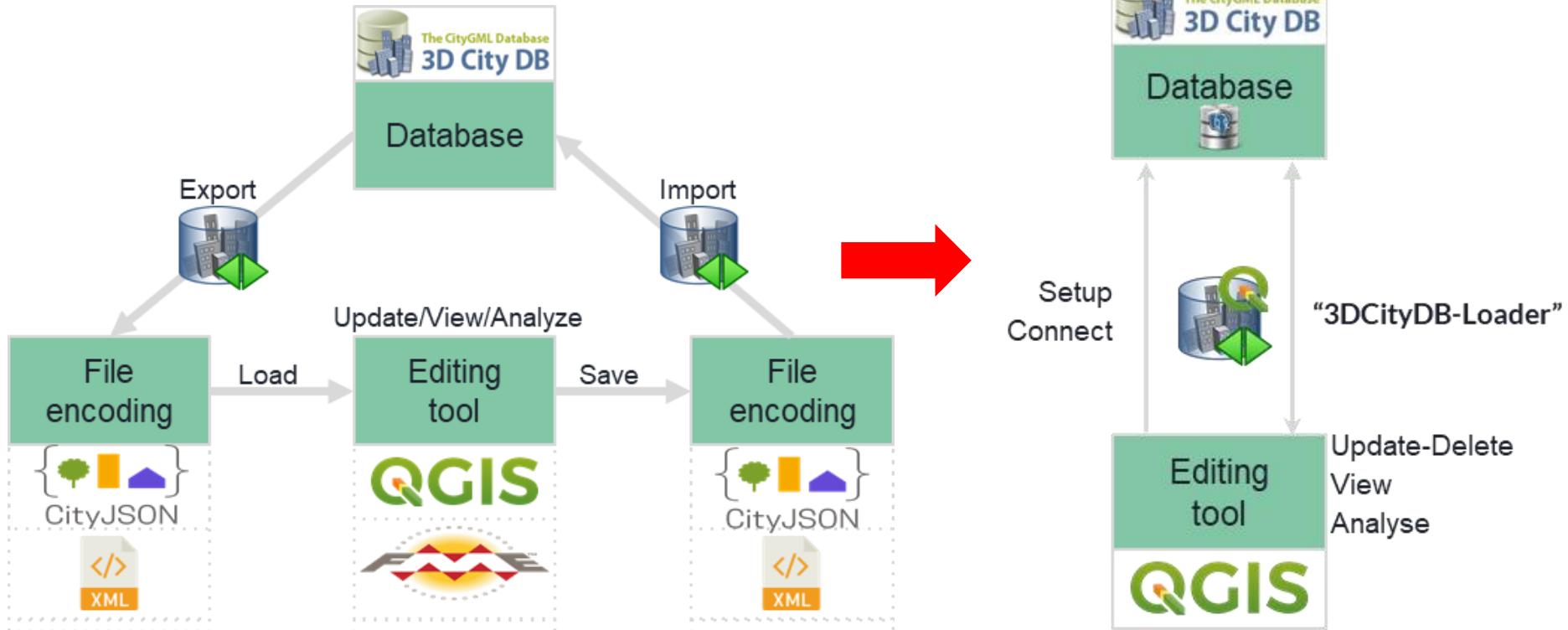
- Why not using QGIS?
  - Well-known and established open-source software
  - Rather mature, version 3.22 released in autumn 2021, well documented
  - Native support for PostgreSQL/PostGIS, support also for Oracle Spatial
  - Has strong 2D and some (less mature) 3D visualisation functionalities
  - Can be extended with Python-based plugins

# Motivation



# Motivation

Vision / goal of the plugin



# Plugin overview

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## Main functionalities

- Create "SFS-like" layers to hide 3DCityDB complexity when interacting with data
  - Deal efficiently with multi-LoD / different geometries / implicit representations
    - Up to 530+ possible combinations from CityGML
  - Merge all standard attributes of a cityobject into a single "table"
- Deal with the (possible) *huge* size of city models stored in a database
- Support for multiple users with different privileges (read-only, read-write)
- Editing of attributes: possible (depending on user privileges)
- Deletion of features: possible (depending on user privileges)
- Editing of geometries: NOT possible
- Support for multiple 3DCityDB scenarios (aka "citydb schemas")

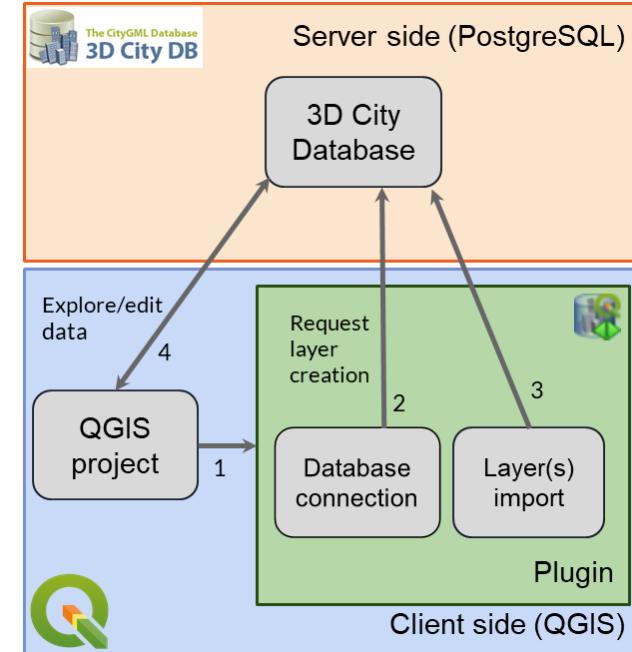
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## Server-side

### PostgreSQL "QGIS Package"

- Create and manage layers as views (for attributes) linked to materialized views (for geometry) following the SFS model
- Manage users and privileges
- Manage multiple scenarios ("citydb schemas")
- Add default users with ro & rw privileges



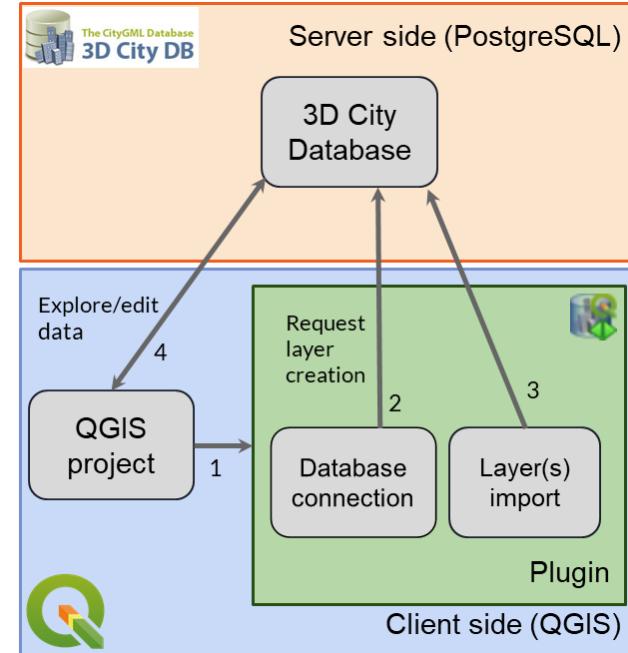
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## Client-side

### QGIS plugin “3DCityDB-Loader”

- Manage database connections + QGIS Package installation
- GUI-based layer creation and management
- GUI-based management of multiple scenarios
- GUI-based attribute editing via “attribute forms”
- Include CityGML enumerations and children tables (e.g. generic attributes) + optionally codelists
- Create a hierarchical QGIS Table of Contents
- Apply standard colours per feature type



# BEWARE

The following slides assume that you are already familiar with the 3DCityDB Suite

In particular you must:

- Have an already installed 3DCityDB database instance
- Be able to use the 3DCityDB Importer/Exporter
- Be able to import CityGML data into the 3DCityDB
- (Optionally) be able to create additional citydb schemas

Otherwise, here a tutorial: <https://github.com/3dcitydb/tutorials>

Last but not least...

- You need at least a basic knowledge of the main CityGML concepts ☺
- Otherwise, here a crash course for free: <http://www.urbangeobigdata.it/?p=195>

# Installation

## Software requirements

- CityGML 3D City Database v. 4.x or higher for PostgreSQL
  - Tested on PostgreSQL v. 10 and higher
  - <https://github.com/3dcitydb/3dcitydb-suite/releases>
  - <https://3dcitydb-docs.readthedocs.io/en/latest/>
  - **BEWARE:** 3DCityDB v. 3.x and older are NOT supported!
- QGIS 3.22
  - Works from v. 3.20 onwards
  - NOT compatible with older versions
  - <https://qgis.org/en/site/forusers/download.html>
- PgAdmin (suggested, not required)
  - <https://www.pgadmin.org/download/>

# Installation

3DCityDB-Loader compatibility matrix as of June 2022

QGIS version	3DCityDB-Loader works?	Comments
QGIS 3.26 RC	✓	Works
QGIS 3.24	✓	Works
<b>QGIS 3.22 LTR</b>	✓	<b>Works. Reference version used for development</b>
QGIS 3.20	✓	Works
QGIS 3.18	✗	"Import selected layers" button always disabled
QGIS 3.16 LTR	✗	User's GUI won't load. Issues with (outdated?) method QgsExtentGroupBox.setMapCanvas()

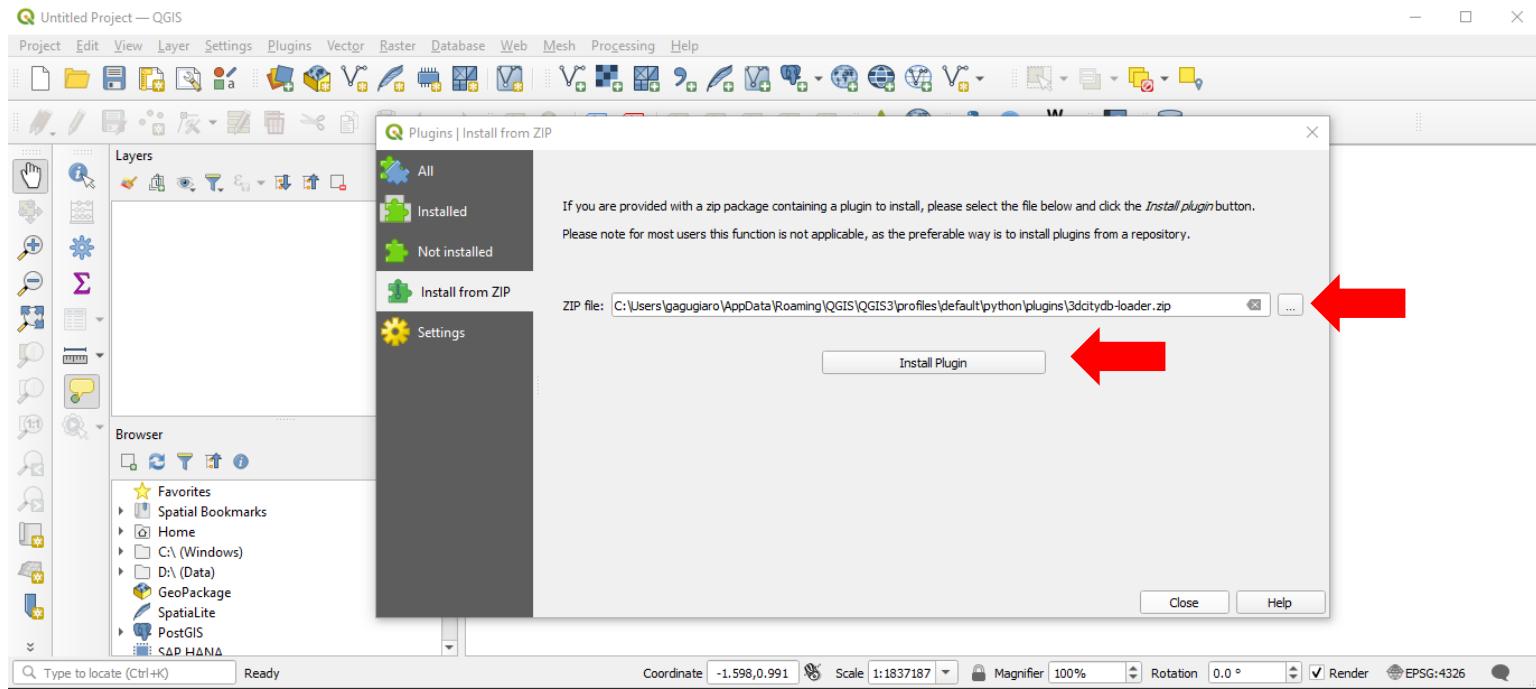
# Testing machines as of September 2022

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OS	Processor(s)	HD	RAM	PostgreSQL	PostGIS
Windows 10 2009 64bit	Core i7-8650U 1.7 GHz	SSD 2 TB	32 GB	14, 64bit	3.2
Linux (Ubuntu 20.04.3 LTS x86_64)	Intel i7-7500U (4) 3.500GHz	SSD 250 GB	8 GB	12, 64bit	3.1
Mac OS (11.6.2 64bit)	Core i9-??	1TB SSD	32 GB	13, 64bit	3.1
Linux server (Ubuntu 18.4)	TUD Virtual Machine			10, 64bit	3.0

# Installation

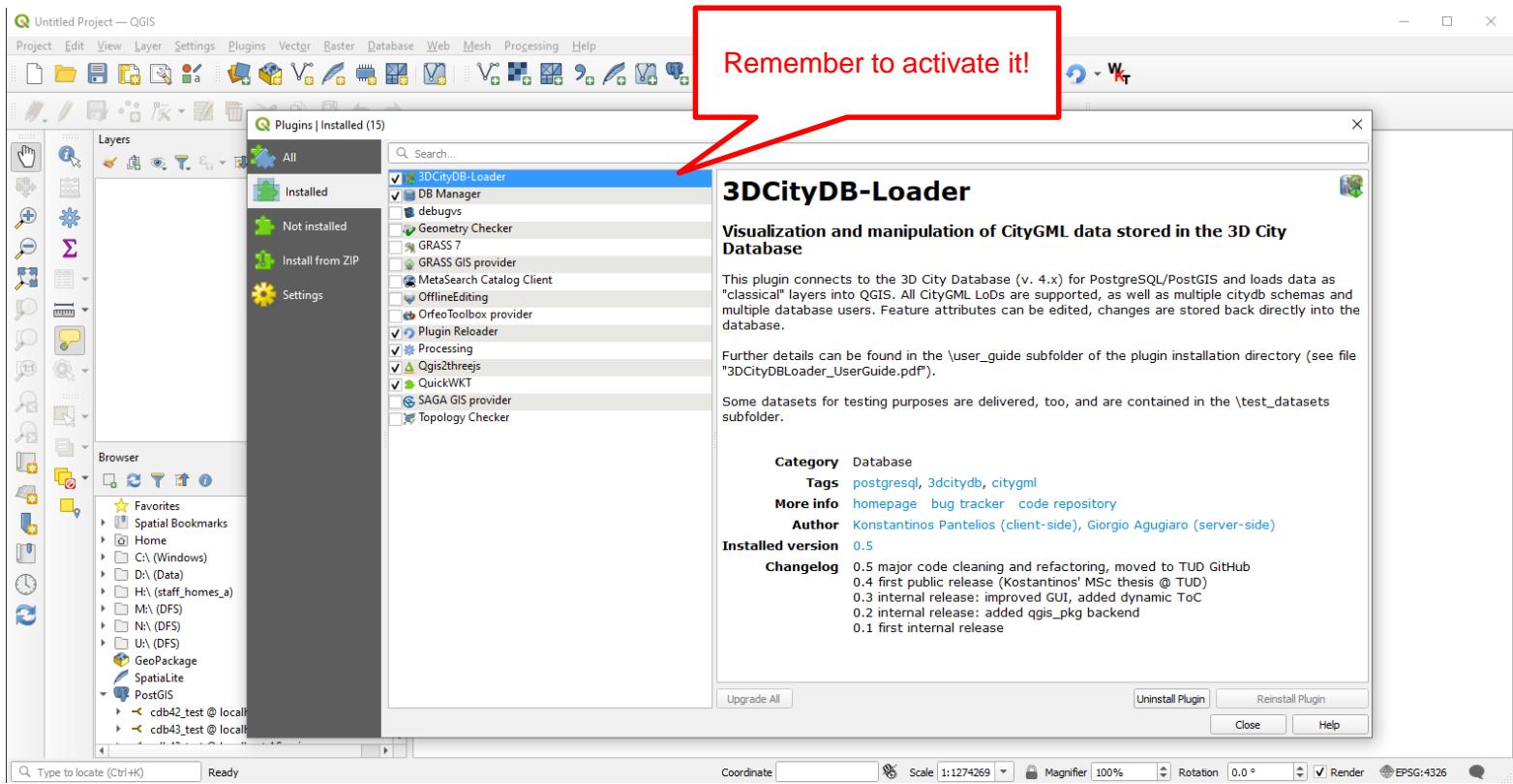
- The "3DCityDB-Loader" for QGIS is currently available as zip file
- In QGIS, open the Plugins\Manage and install plugins window, and choose "Install from ZIP". Select the provided zip file and click the "Install Plugin" button



# Installation

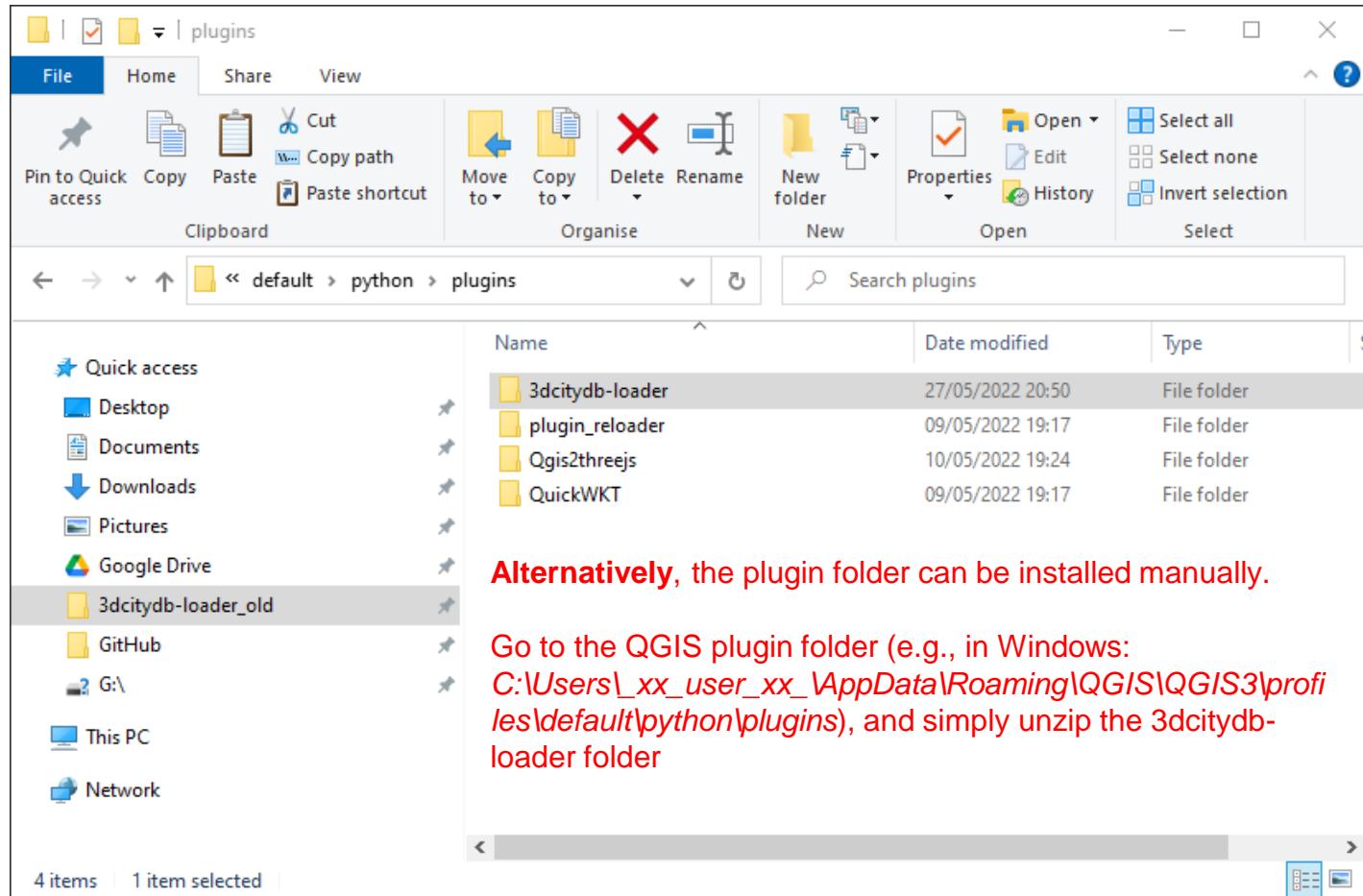
- Upon installation, you must activate the plugin

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# Installation

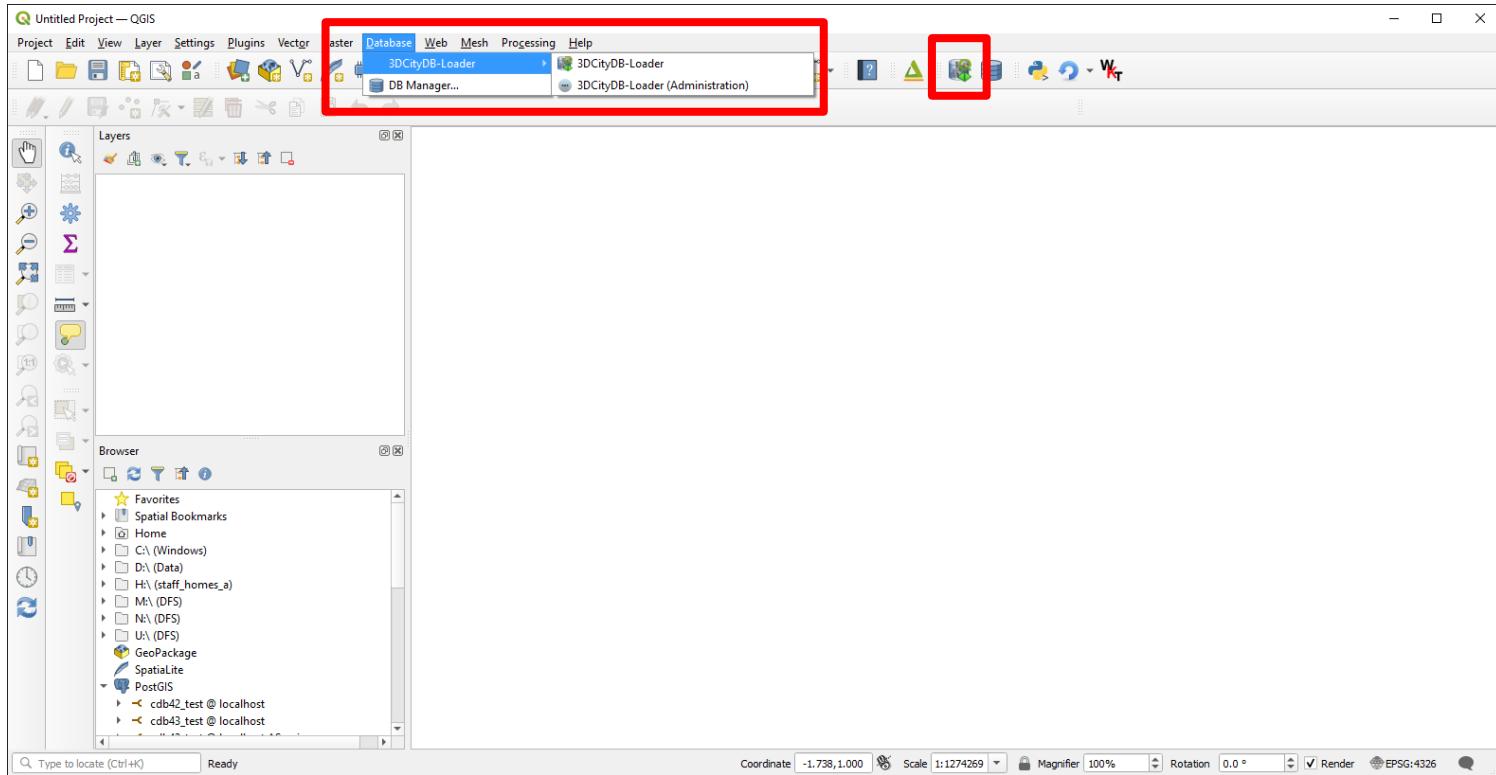
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# Installation

The Database menu will now contain a new entry, and the icon will be visible in the database icon bar (if the icon bar is activated)

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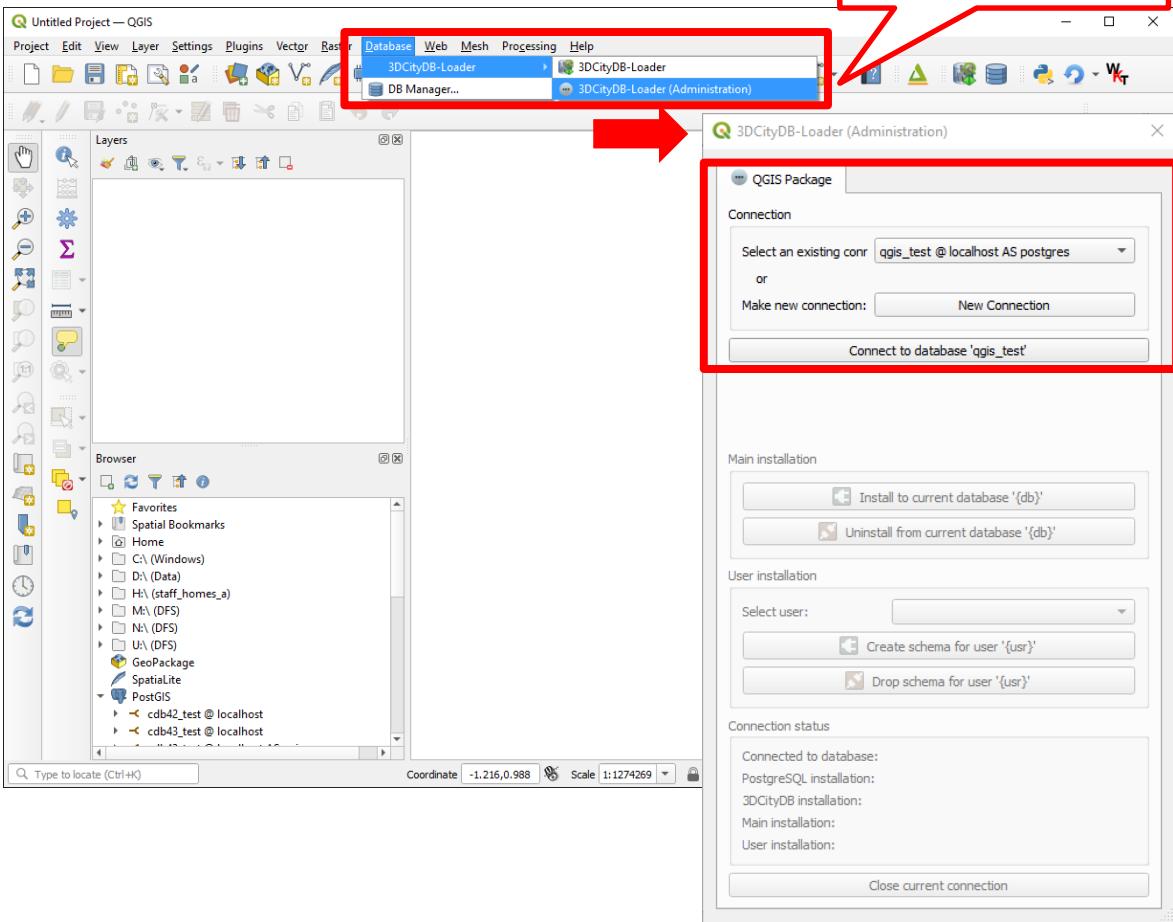
# Use: As database administrator

Watch out! Pick the Administration one!

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The database administrator (superuser) is responsible for setting up in advance the server-side part of the plugin for *any* user

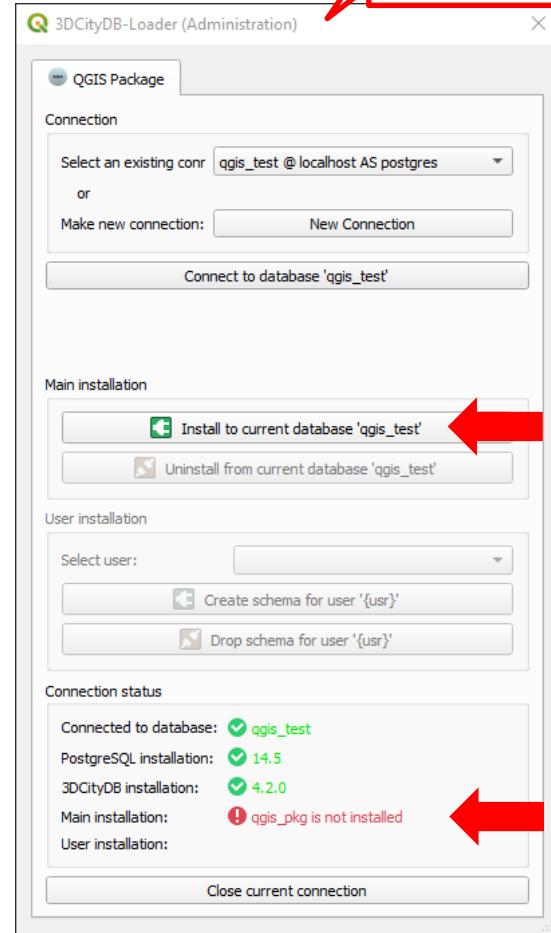
1) Create a new connection or use an existing one to the desired 3DCityDB instance (here: "qgis\_test")



# Use: As database administrator

Watch out! Pick the Administration one!

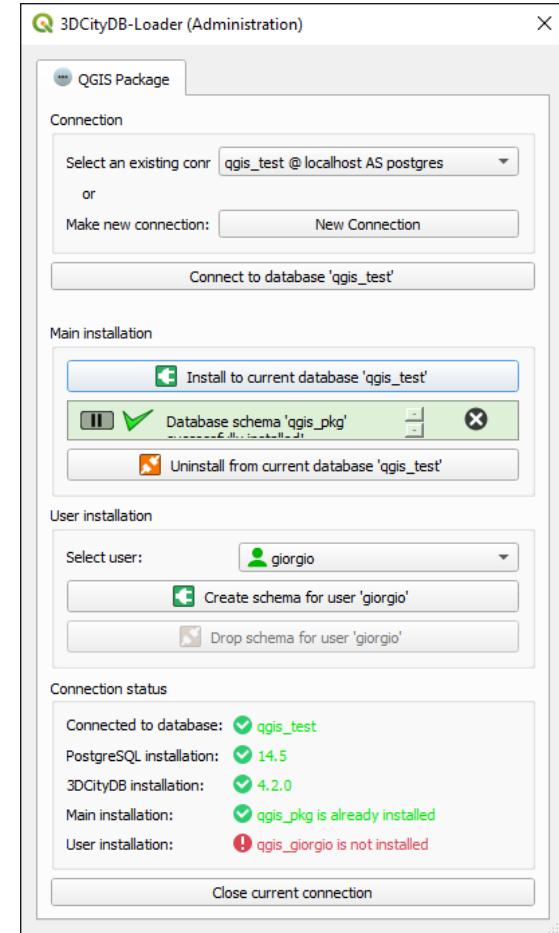
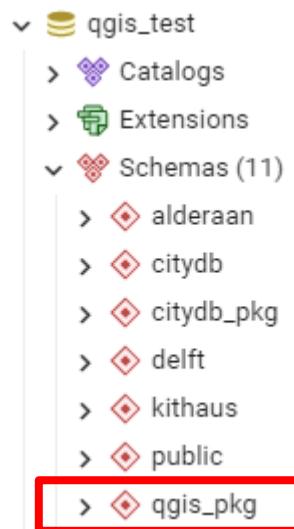
## 2) Install the QGIS Package ("Main installation")



# Use: As database administrator

## 2) Install the QGIS Package ("Main installation")

Upon successful installation, in the 3DCityDB, a "qgis\_pkg" database schema is created in the selected 3DCityDB instance

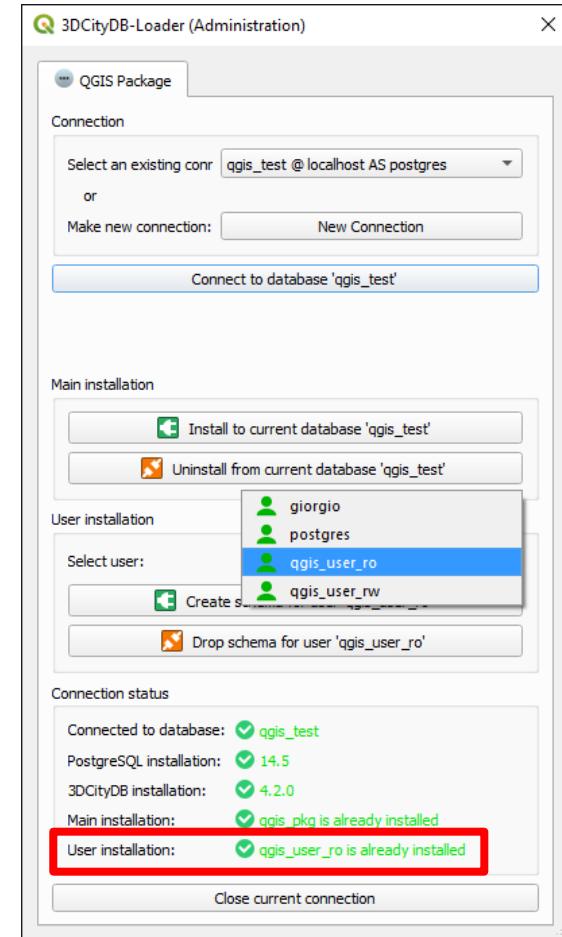


# Use: As database administrator

## 3) (Optionally) create user schemas

In order to use the plugin, a user needs a schema, named "qgis\_" + username

- 2 users are **automatically** added, and their schemas created by default ("qgis\_user\_ro", "qgis\_user\_rw")
- You can also create the user schema for database user "postgres" (NOT recommended!)
- For other database users, see the **Advanced options** slides (later on)



# Use: As database administrator

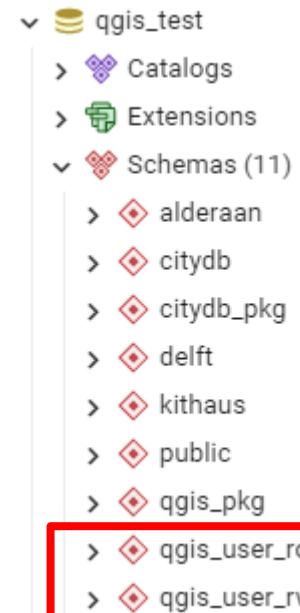
## 3) (Optionally) create user schemas.

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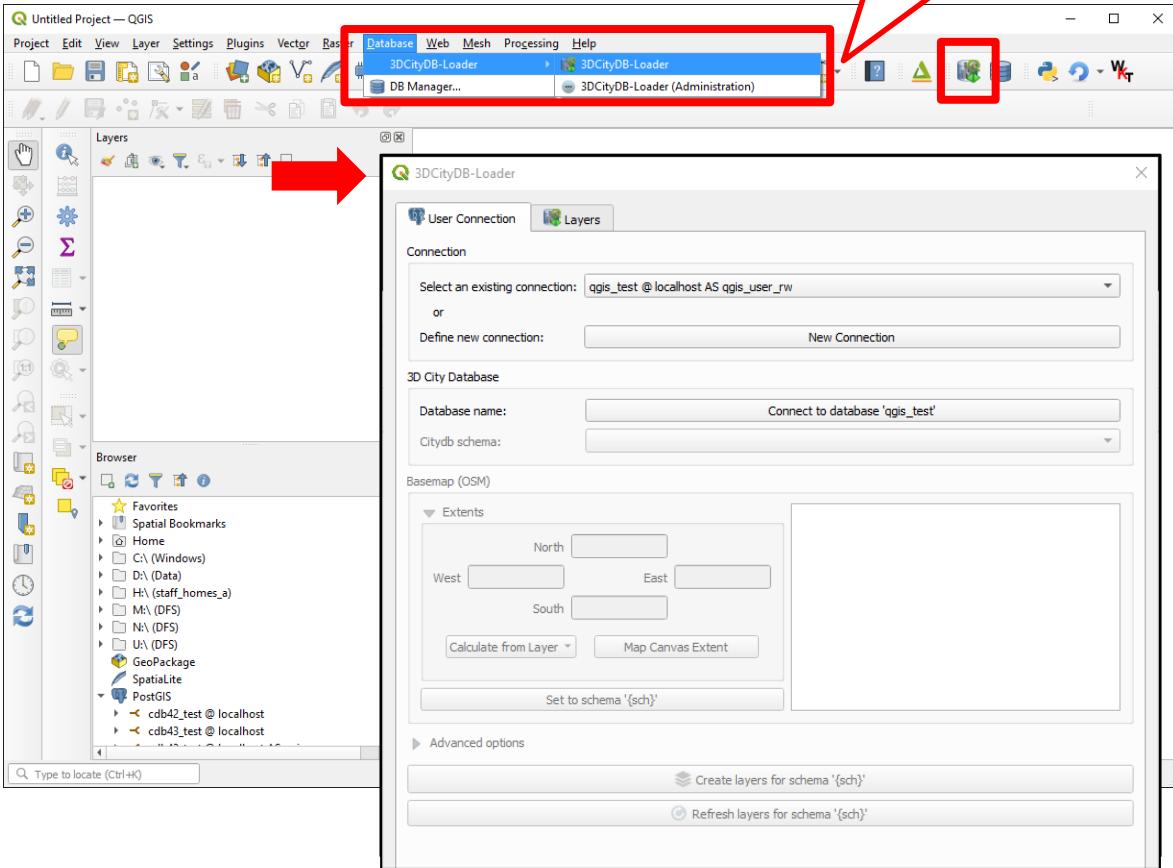
Connection parameter:

- Login/password: "qgis\_user\_ro"
- Login/password: "qgis\_user\_rw"



# Use: As user

As "normal" user open the plugin from the menu or by clicking on the icon

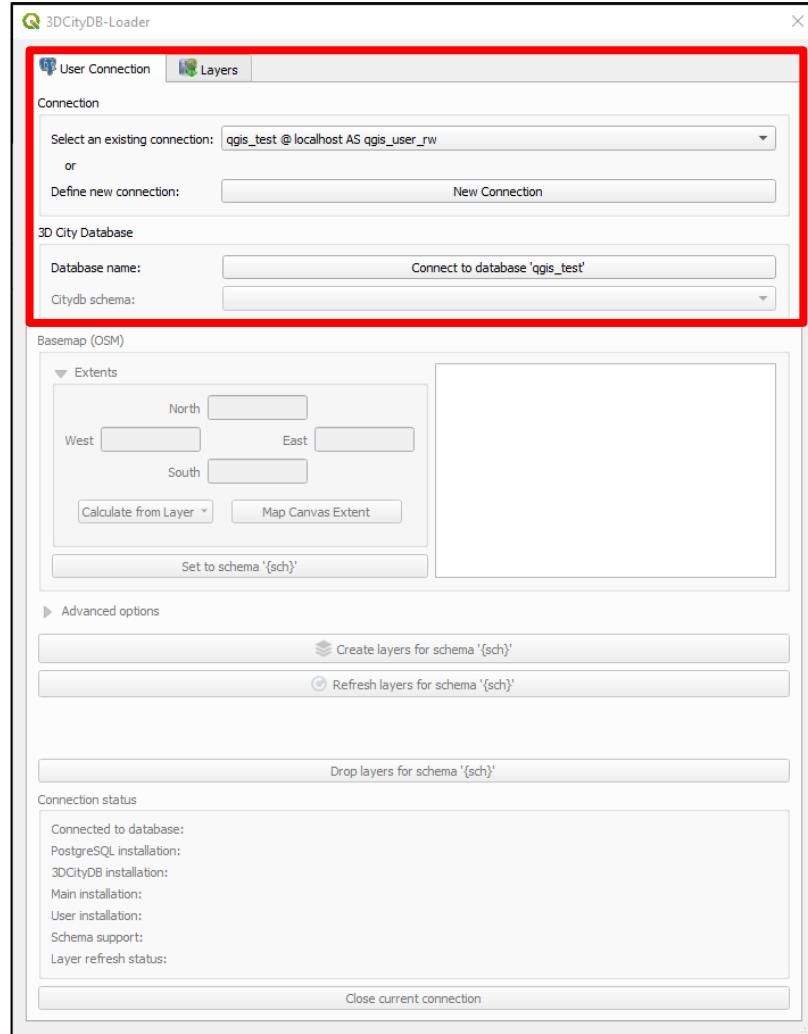


# Use: As user

In the "User connection" tab

- 1) Create a new connection or use an existing one to the desired 3DCityDB instance (here: "qgis\_test")
  
- 2) Use the credentials of the default users:
  - "`qgis_user_ro`" has read-only privileges
  - "`qgis_user_rw`" has read-write privileges

(You may also connect with your own credentials if the database administrator has set up your user schema before)



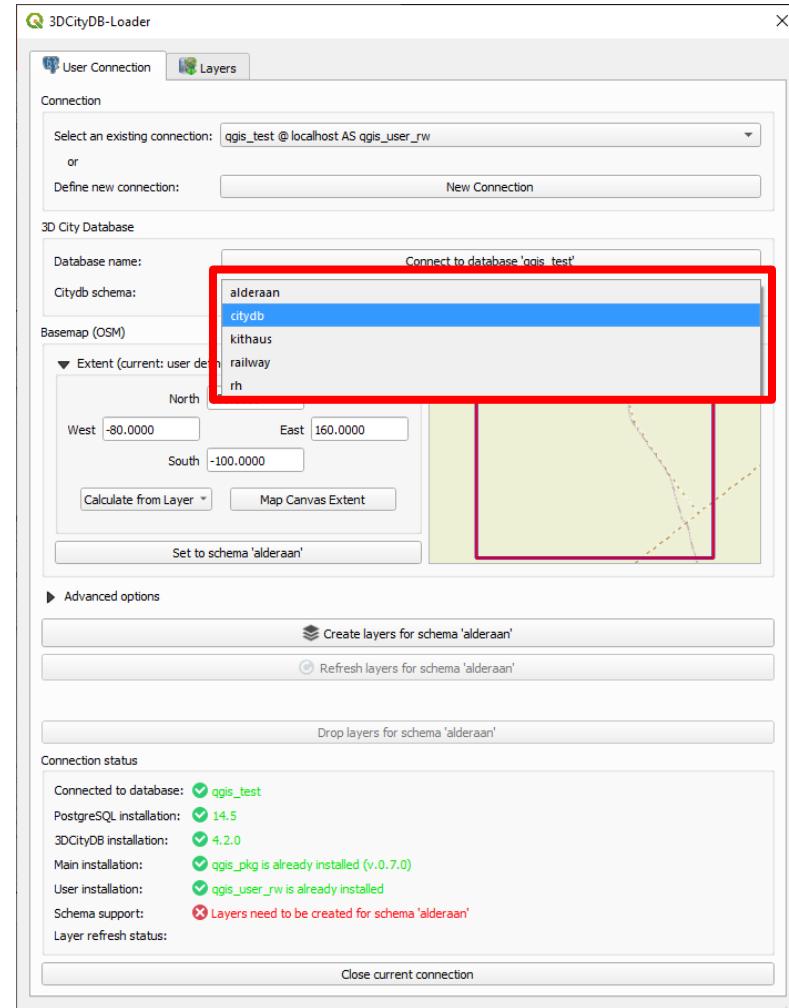
# Use: As user

In the "User connection" tab

3) Choose one of the existing scenarios (i.e. citydb schemas). If they contain CityGML data, they will be listed.  
**"citydb"** is the most common one – and, very often, the only one!!

**Nota bene:** the next slides refer to the "rh" schema

How to create additional citydb schemas  
<https://3dcitydb-docs.readthedocs.io/en/latest/3dcitydb/multi-schema.html>

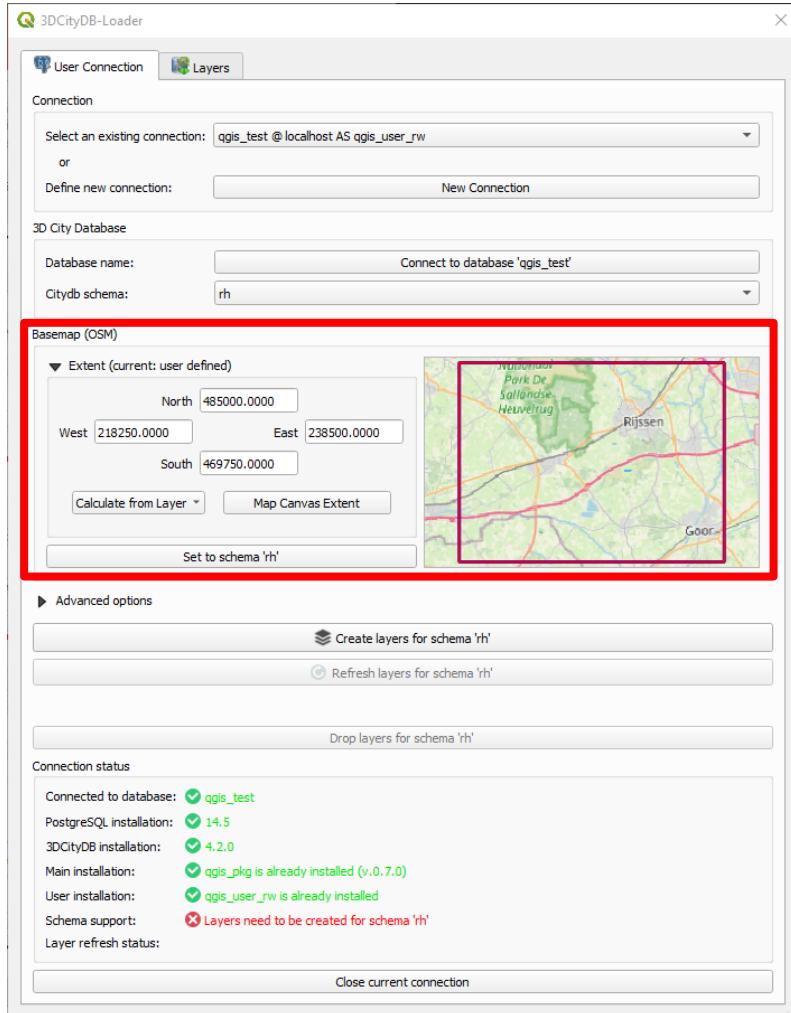


# Use: As user

In the "User connection" tab

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4) Upon selection of the database schema, you will see the extents of the dataset



# Use: As user

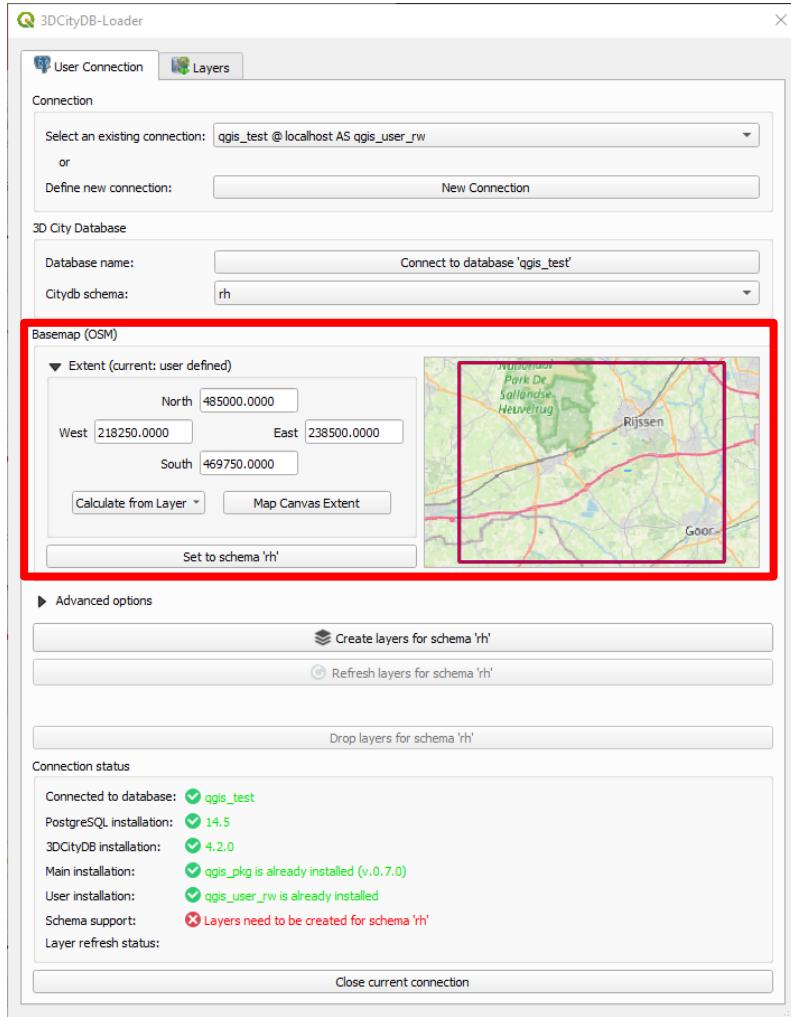
In the "User connection" tab

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- 5) Depending on your needs, you can set the spatial extents of the study area for which the layers will be created
- Default: same size of the whole dataset
  - Otherwise: zoom in the map and choose your own area

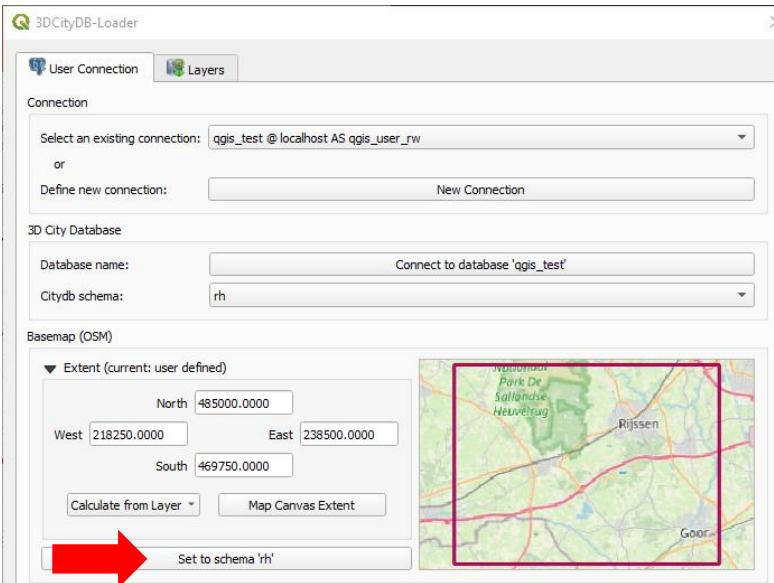
**Beware:** the bigger the size, the more time it will take to populate the layers!

**Behind the scenes:** In the database, materialised views of the geometries will be generated according to the selected extents. In case of very large cities, it might take a long time (and a lot of space on the server)!

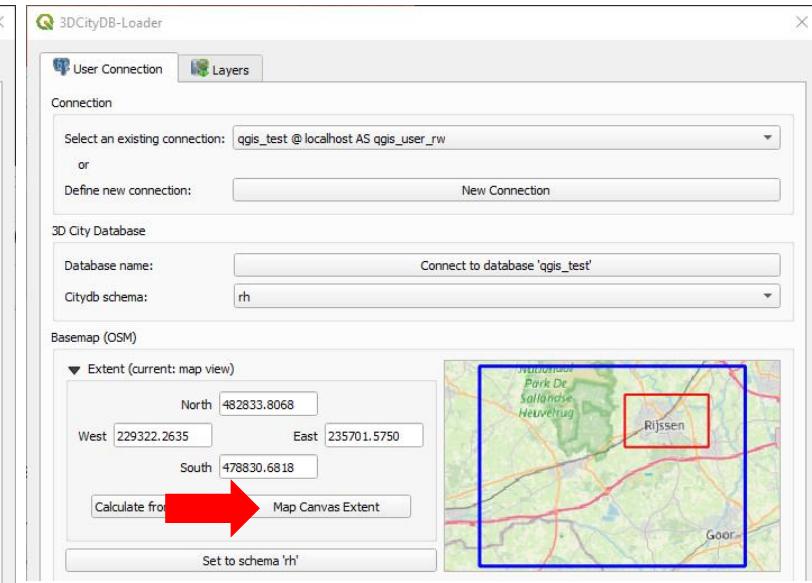


# Use: As user

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Both areas coincide (default)



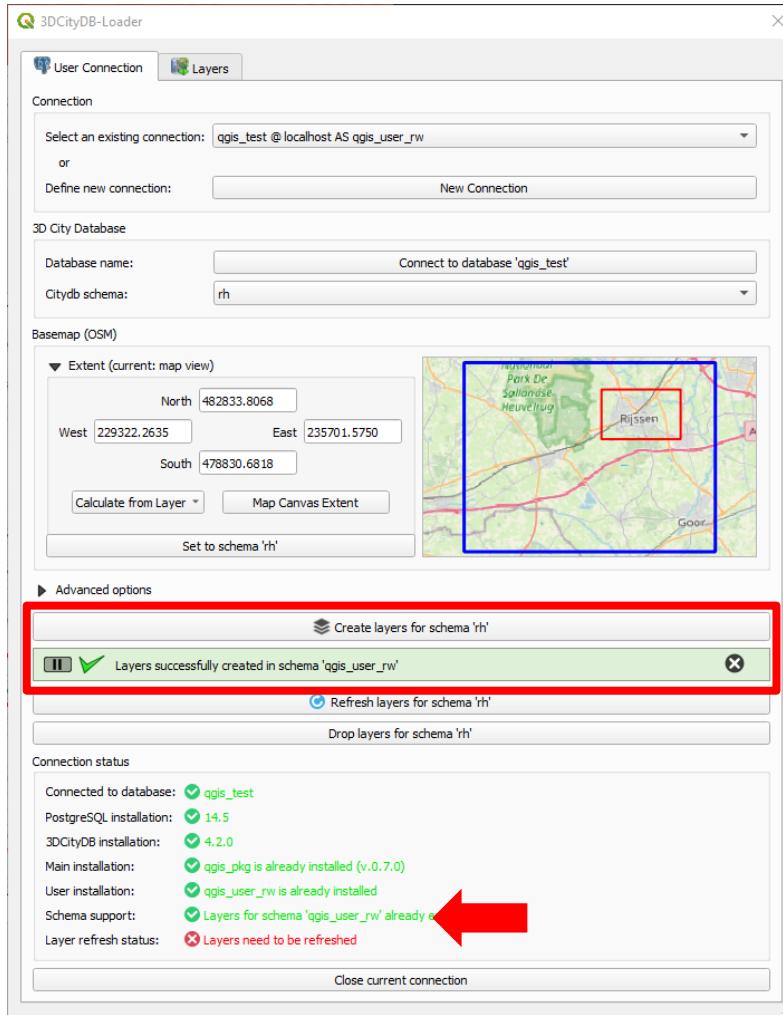
User-selected layers extents

# Use: As user

In the "User connection" tab

## 6) Create the layers

Otherwise, if available, layers created in a previous session can be used



**Behind the scenes:** In the database, (empty) materialised views of the geometries and views will be created as layers.

Only layers for *existing* data will be created.

# Use: As user

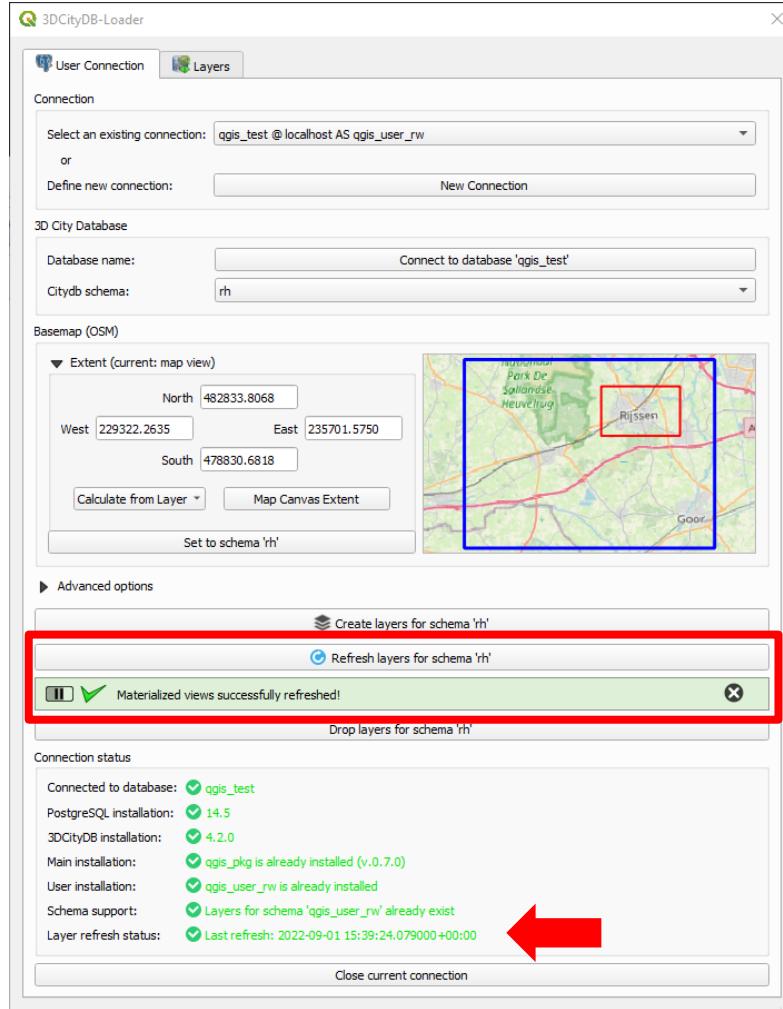
In the "User connection" tab

## 7) Populate/refresh the layers

Otherwise, if available, layers created in a previous session can be used (or refreshed again)

**Beware:** depending on the size of the selected area, and the amount of data in the city model, this operation might take long.

**Behind the scenes:** In the database, the materialised views of the geometries are refreshed.



# Use: As user

## Behind the scenes:

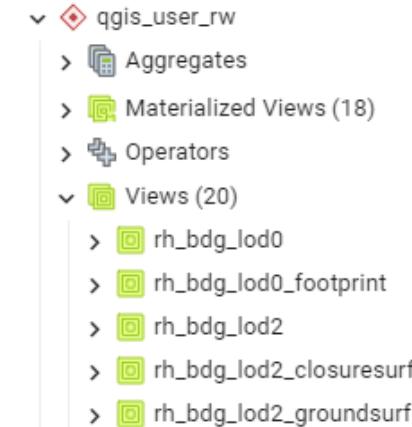
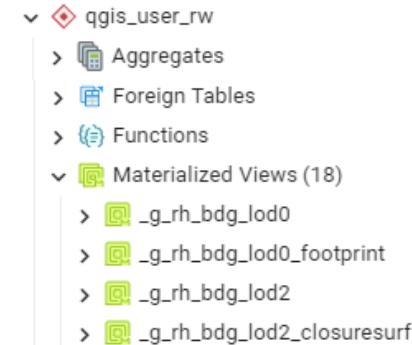
In the database user schema, both materialised views (containing the feature geometries) and the layers (as updatable views, containing the feature attributes linked to the corresponding geometries in the materialised views) can be accessed.

### Materialised views name coding:

- "\_g\_" prefixed + citydb schema name + feature name + lodx + (optional) semantic details

### Views name coding:

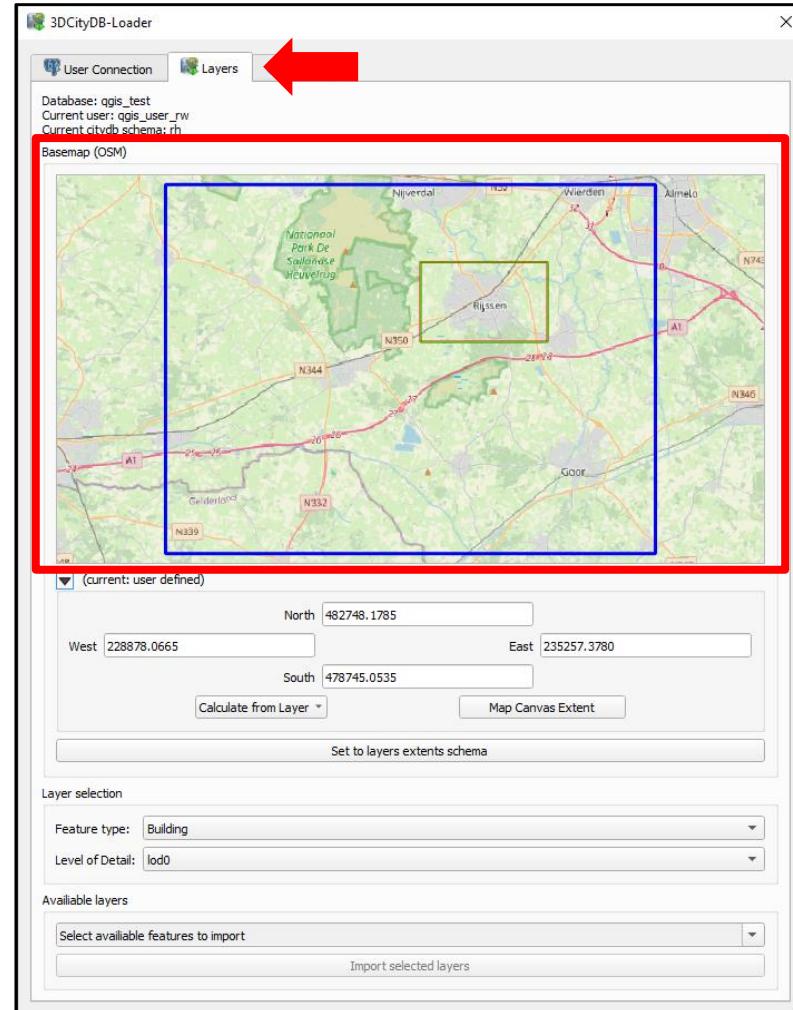
- citydb schema name + feature name + lodx + (optional) semantic details
- Linked via column co\_id (PK and FK to the materialised views)



# Use: As user

In the "Layers" tab

- 8) The dataset and the (database-side) layer extents are shown again in the map

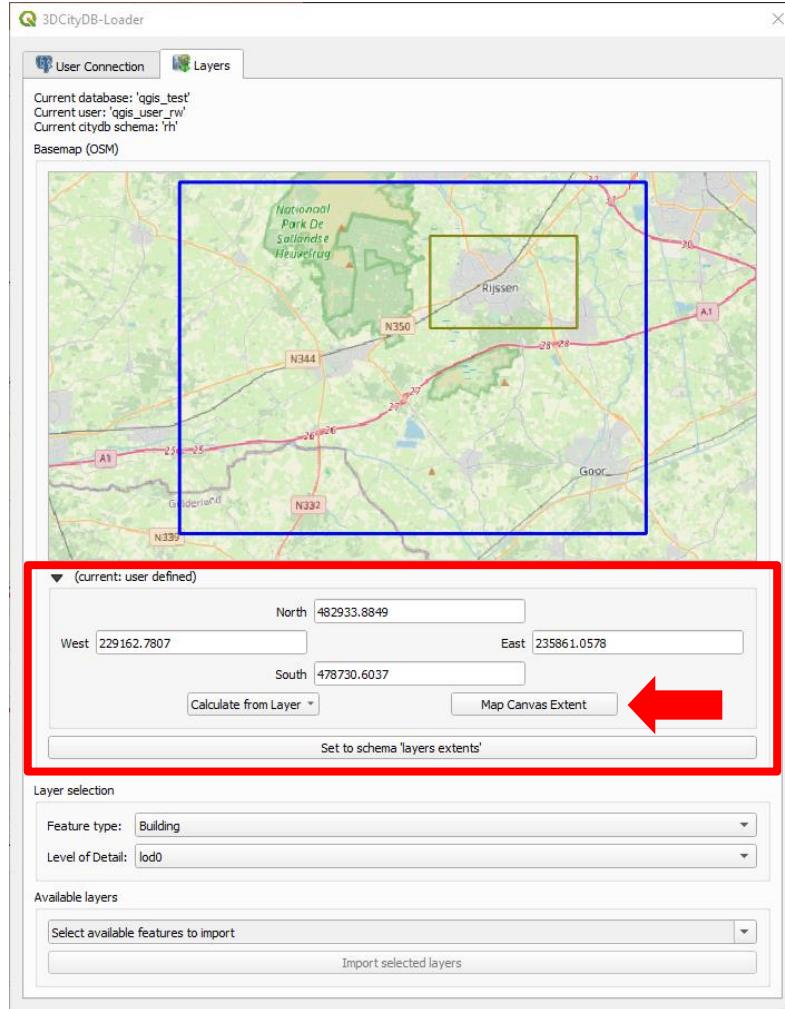


# Use: As user

In the "Layers" tab

9) Depending on your needs, you can further reduce the extents of the layers to be loaded into QGIS

- Default: same size of the materialised view extents
- Otherwise: zoom in the map and choose your own area



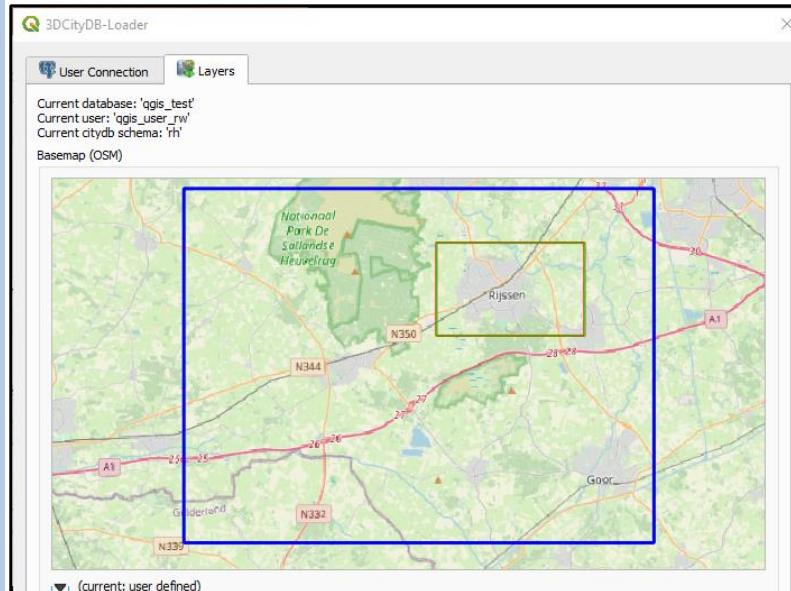
# Use: As user

**Blue:** database schema extents (i.e. extents of the whole city model/dataset)

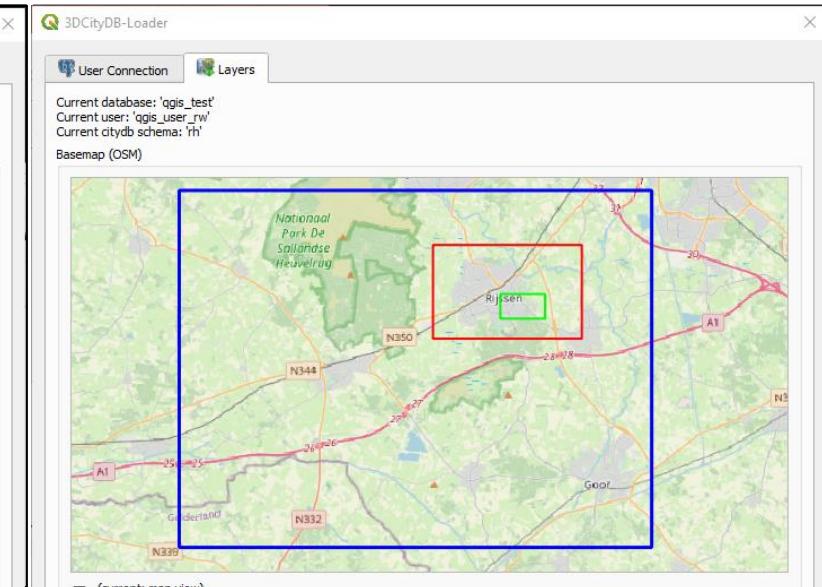
**Red:** database-side layers extents (i.e. extents of the materialised views)

**Green:** QGIS-side layers extents (i.e. extents of the data loaded into QGIS)

Remember: **QGIS-extents  $\subseteq$  Mat. views extents  $\subseteq$  City model extents**



Database- and QGIS-side extents coincide (default)



User-selected QGIS-layers extents

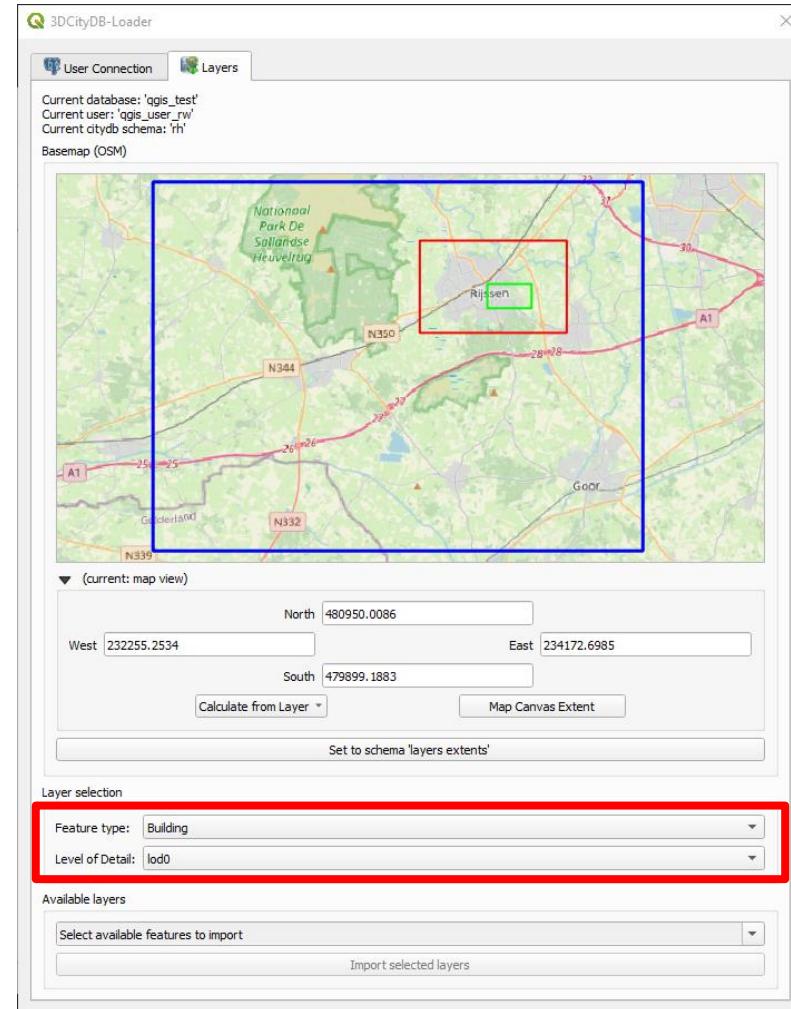
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# Use: As user

In the "Layers" tab

## 10) Select feature type and LoD

- Layers are grouped according to the CityGML modules (or "Feature Types", such as "Bridge", "Building", "Tunnel", "Relief", etc.)
- Depending on the data stored in the database, only certain Feature Types and LoDs will be selectable

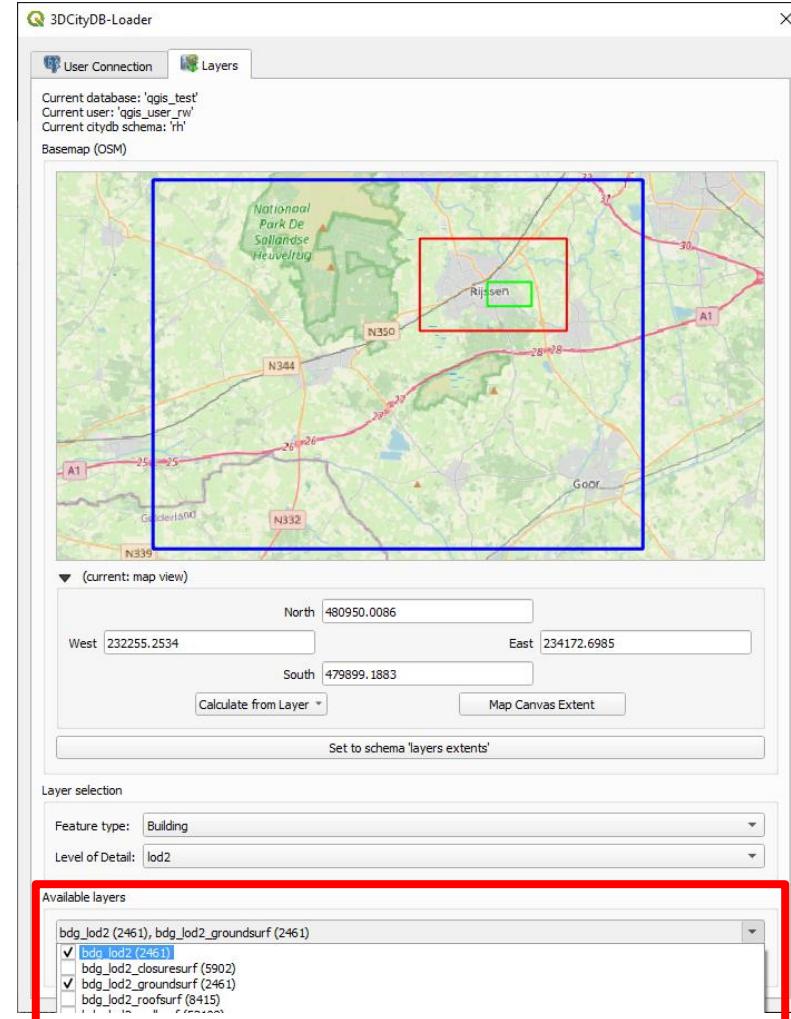


# Use: As user

In the "Layers" tab

## 11) Select the layer(s) to import in QGIS

- The number of available features is shown next to the layer name



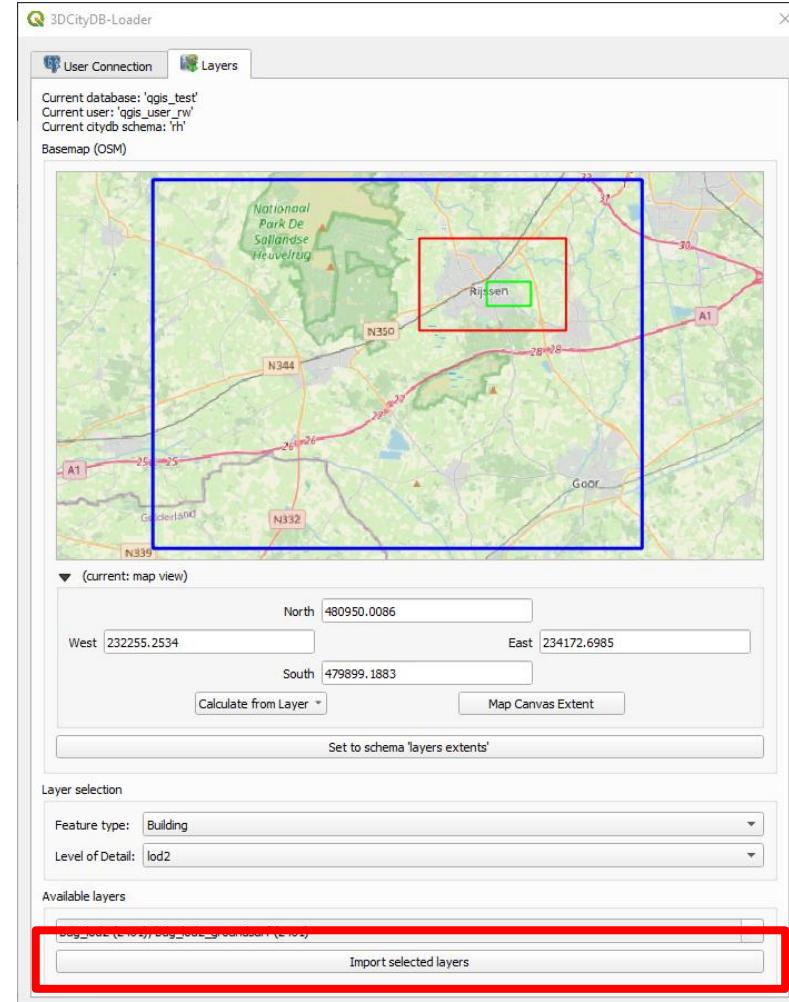
**Behind the scenes:** Depending on the QGIS layers extents, the plugin shows only the available layers for which data are available *within* the given extents.

# Use: As user

In the "Layers" tab

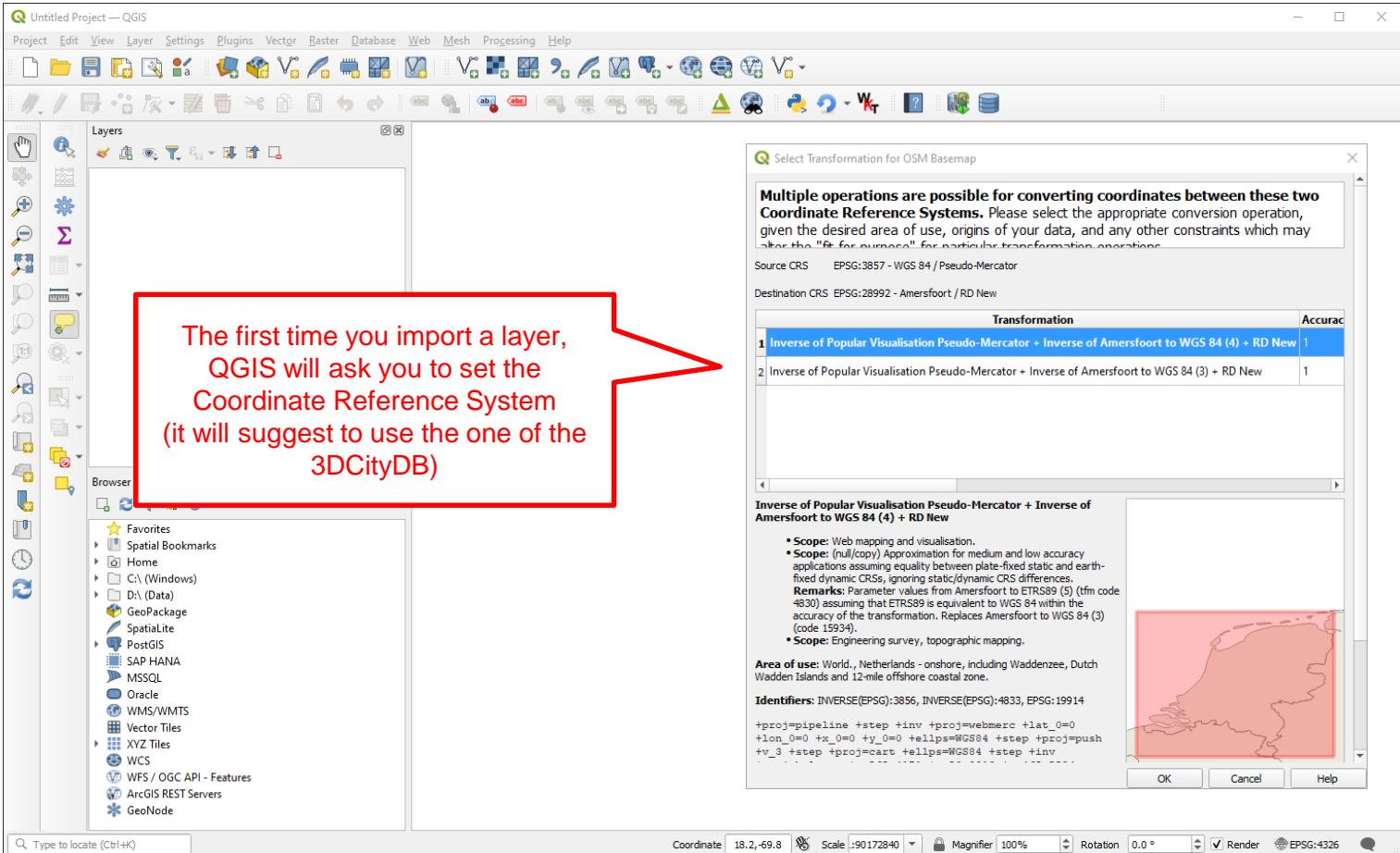
## 12) Import the selected layers into QGIS

- The import operation can be repeated with different layers
- The layers will be automatically added to the QGIS Table of Contents
- The Plugin window can be closed, the connection parameters and settings will be kept until the connection is intentionally closed by the user (in the "User connection" tab)



# Use in QGIS: Layers

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The first time you import a layer, QGIS will ask you to set the Coordinate Reference System (it will suggest to use the one of the 3DCityDB)

Multiple operations are possible for converting coordinates between these two Coordinate Reference Systems. Please select the appropriate conversion operation, given the desired area of use, origins of your data, and any other constraints which may alter the "fit for purpose" for particular transformation operations.

Transformation	Accuracy
1 Inverse of Popular Visualisation Pseudo-Mercator + Inverse of Amersfoort to WGS 84 (4) + RD New	1
2 Inverse of Popular Visualisation Pseudo-Mercator + Inverse of Amersfoort to WGS 84 (3) + RD New	1

Inverse of Popular Visualisation Pseudo-Mercator + Inverse of Amersfoort to WGS 84 (4) + RD New

- Scope: Web mapping and visualisation.
- Scope (null/copy) Approximation for medium and low accuracy applications assuming equality between plate-fixed static and earth-fixed dynamic CRSs, ignoring static/dynamic CRS differences.
- Remarks: Parameter values from Amersfoort to ETRS89 (5) (tfm code 4830) assuming that ETRS89 is equivalent to WGS 84 within the accuracy of the transformation. Replaces Amersfoort to WGS 84 (3) (code 19934).
- Scope Engineering survey, topographic mapping.

Area of use: World, Netherlands - onshore, including Waddenzee, Dutch Wadden Islands and 12-mile offshore coastal zone.

Identifiers: INVERSE[EPSG]:3856, INVERSE[EPSG]:4833, EPSG:19914

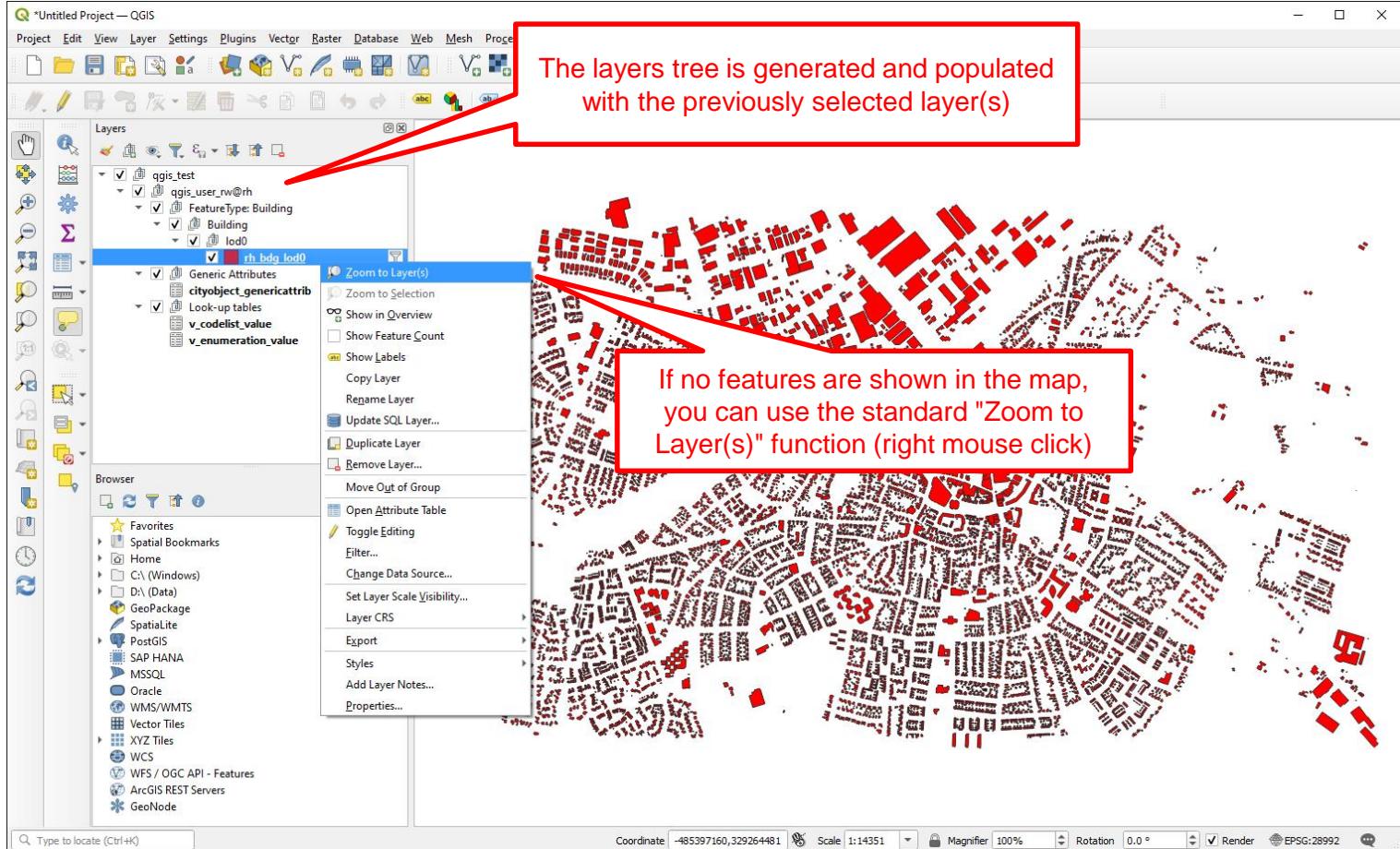
```
+proj=pipeline +step +inv +proj=webmerc +lat_0=0
+lon_0=0 +x_0=0 +y_0=0 +ellps=WGS84 +step +proj=push
+v_3 +step +proj=cart +ellps=WGS84 +step +inv
```

OK Cancel Help

Layers panel showing various layers and a browser panel showing spatial bookmarks and other resources.

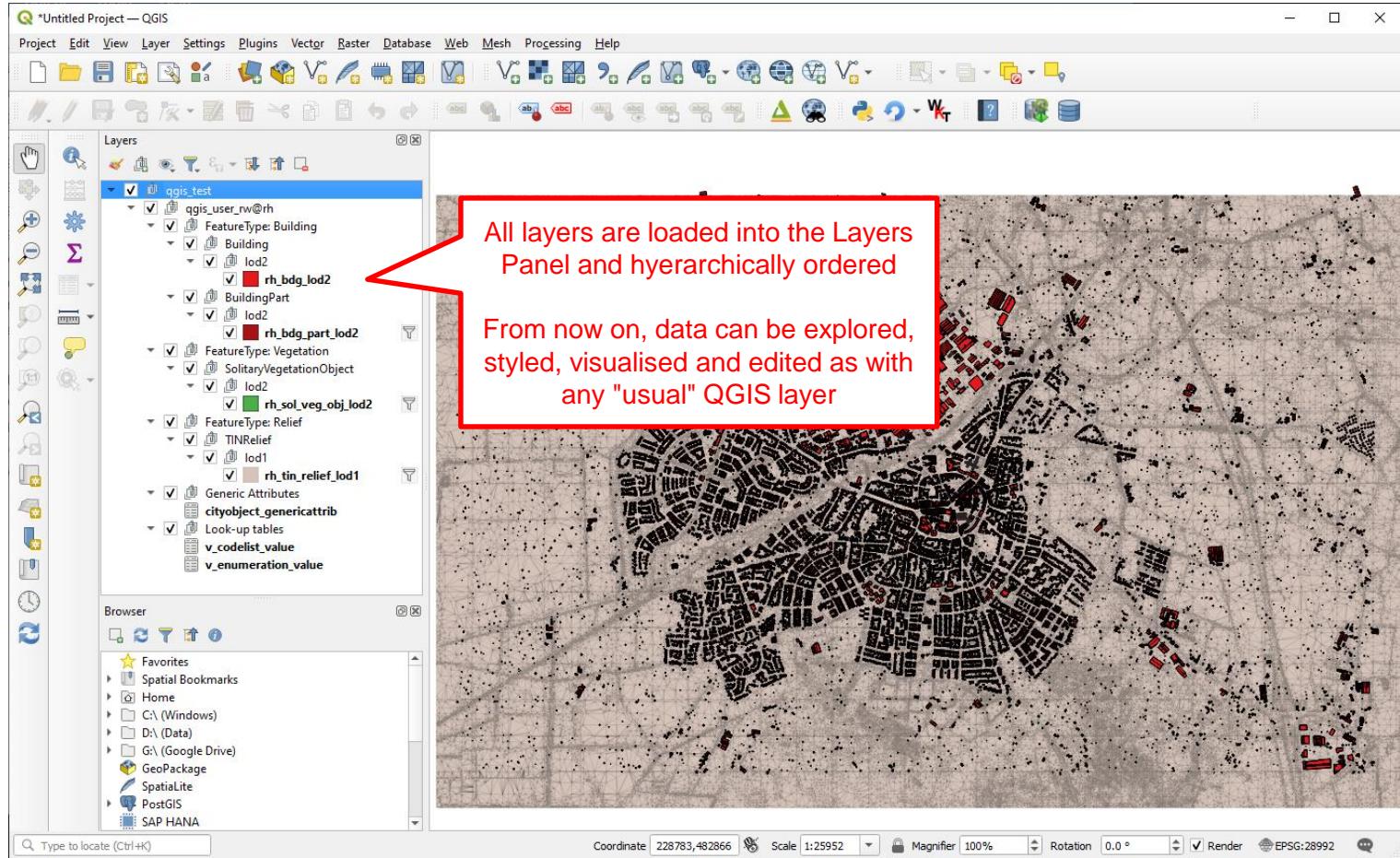
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# Use in QGIS: Layers



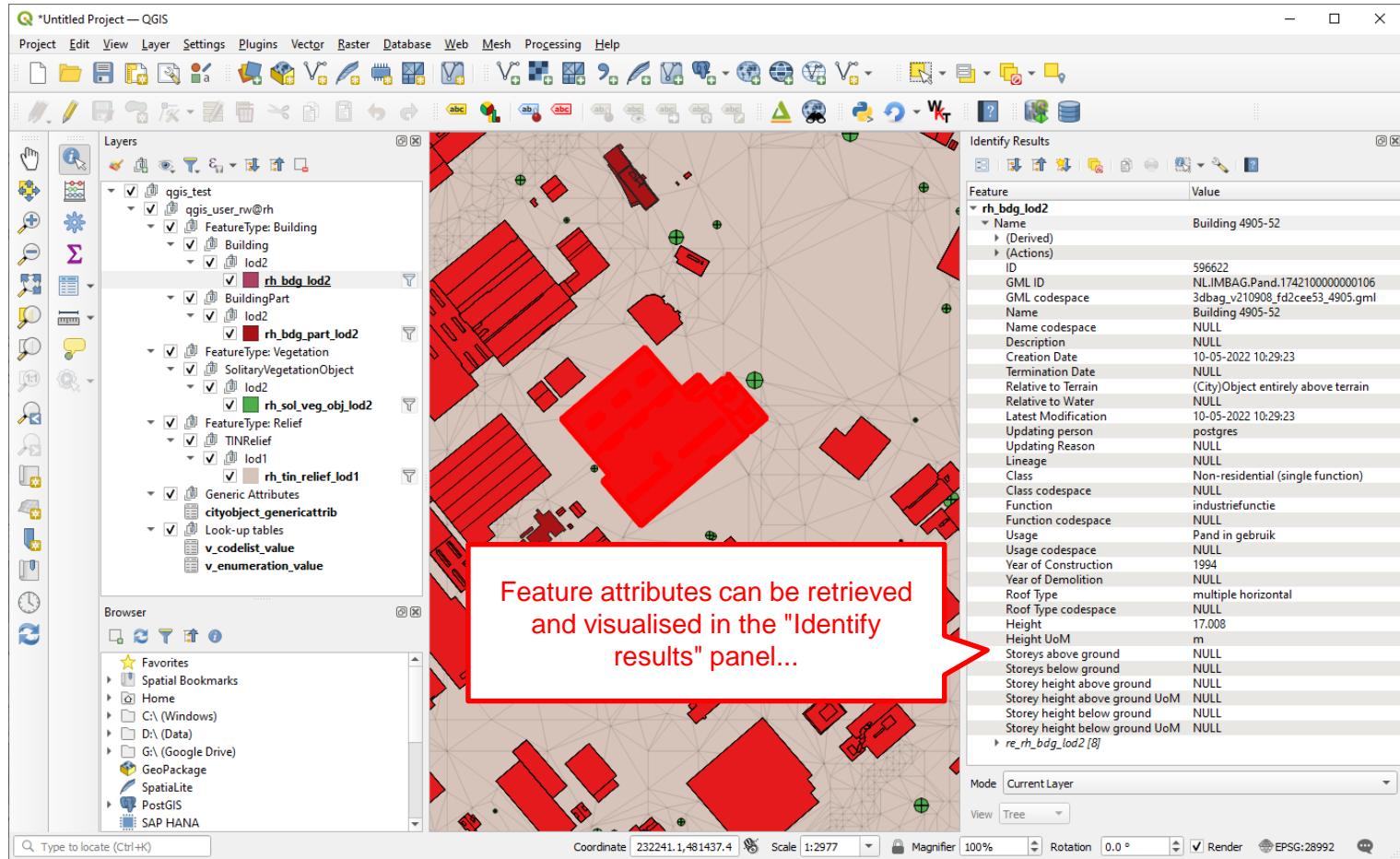
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# Use in QGIS: Attributes

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The screenshot shows the QGIS interface with a map view containing red polygonal buildings on a grey terrain background. A callout bubble points from the text below to the 'Identify Results' panel on the right.

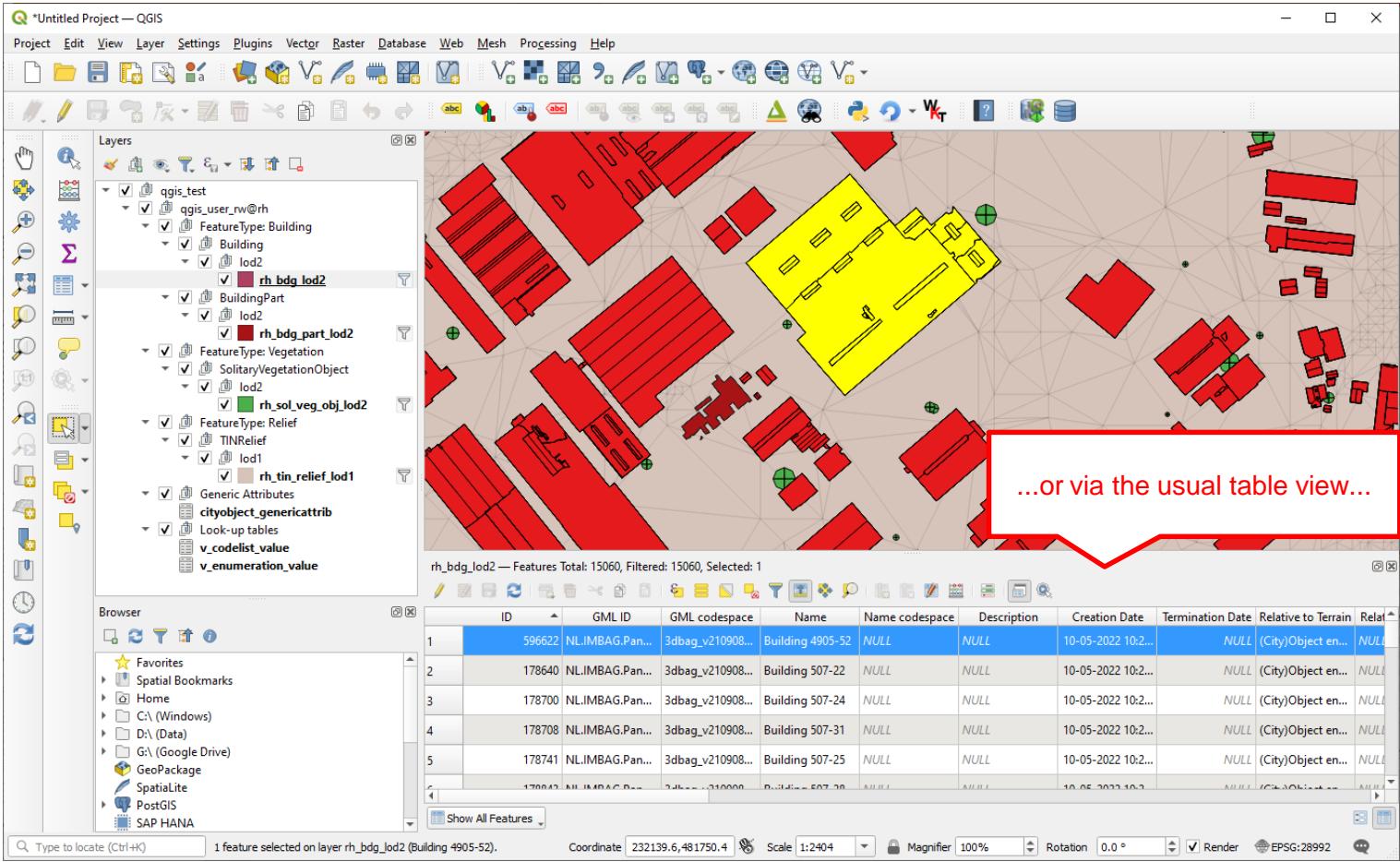
Feature attributes can be retrieved and visualised in the "Identify results" panel...

Feature	Value
rh_bdg_lod2	Building 4905-52
Name	Building 4905-52
(Derived)	
(Actions)	
ID	596622
GML ID	NLIMBAG.Pand.174210000000106
GML codespace	3dbag_v210908_fd2ceef53_4905.gml
Name	Building 4905-52
Name codespace	NULL
Description	NULL
Creation Date	10-05-2022 10:29:23
Termination Date	NULL
Relative to Terrain	(City)Object entirely above terrain
Relative to Water	NULL
Latest Modification	10-05-2022 10:29:23
Updating person	postgres
Updating Reason	NULL
Lineage	NULL
Class	Non-residential (single function)
Class codespace	NULL
Function	industriefunctie
Function codespace	NULL
Usage	Pand in gebruik
Usage codespace	NULL
Year of Construction	1994
Year of Demolition	NULL
Roof Type	multiple horizontal
Roof Type codespace	NULL
Height	17.008
Height UoM	m
Storeys above ground	NULL
Storeys below ground	NULL
Storey height above ground	NULL
Storey height above ground UoM	NULL
Storey height below ground	NULL
Storey height below ground UoM	NULL
re_rh_bdg_lod2 [8]	

Mode: Current Layer  
 View: Tree  
 Coordinate: 232241.1, 481437.4  
 Scale: 1:2977  
 Magnifier  
 100%  
 Rotation: 0.0°  
 Render  
 EPSG:28992

# Use in QGIS: Attributes

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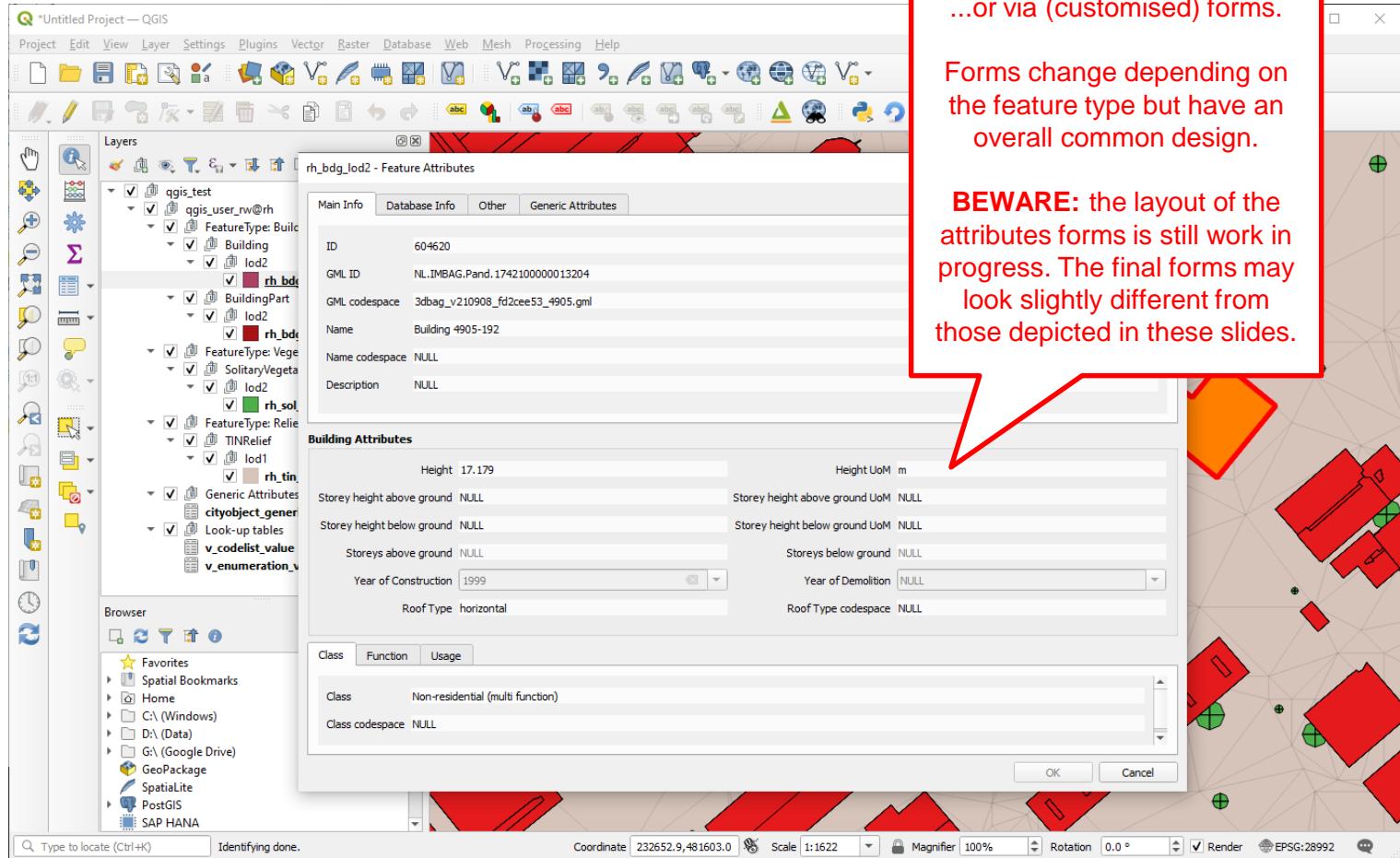
The screenshot shows the QGIS interface with a map of buildings and vegetation. A red callout box points to the attribute table at the bottom right of the interface.

...or via the usual table view...

ID	GML ID	GML codespace	Name	Name codespace	Description	Creation Date	Termination Date	Relative to Terrain	Relat...
1	596622	NL.3DGeoInfo.3dbag_v210908...	Building 4905-52	NULL	NULL	10-05-2022 10:2...	NULL	(City)Object en...	NULL
2	178640	NL.3DGeoInfo.3dbag_v210908...	Building 507-22	NULL	NULL	10-05-2022 10:2...	NULL	(City)Object en...	NULL
3	178700	NL.3DGeoInfo.3dbag_v210908...	Building 507-24	NULL	NULL	10-05-2022 10:2...	NULL	(City)Object en...	NULL
4	178708	NL.3DGeoInfo.3dbag_v210908...	Building 507-31	NULL	NULL	10-05-2022 10:2...	NULL	(City)Object en...	NULL
5	178741	NL.3DGeoInfo.3dbag_v210908...	Building 507-25	NULL	NULL	10-05-2022 10:2...	NULL	(City)Object en...	NULL
	178640	NL.3DGeoInfo.3dbag_v210908...	Building 507-20	NULL	NULL	10-05-2022 10:2...	NULL	(City)Object en...	NULL

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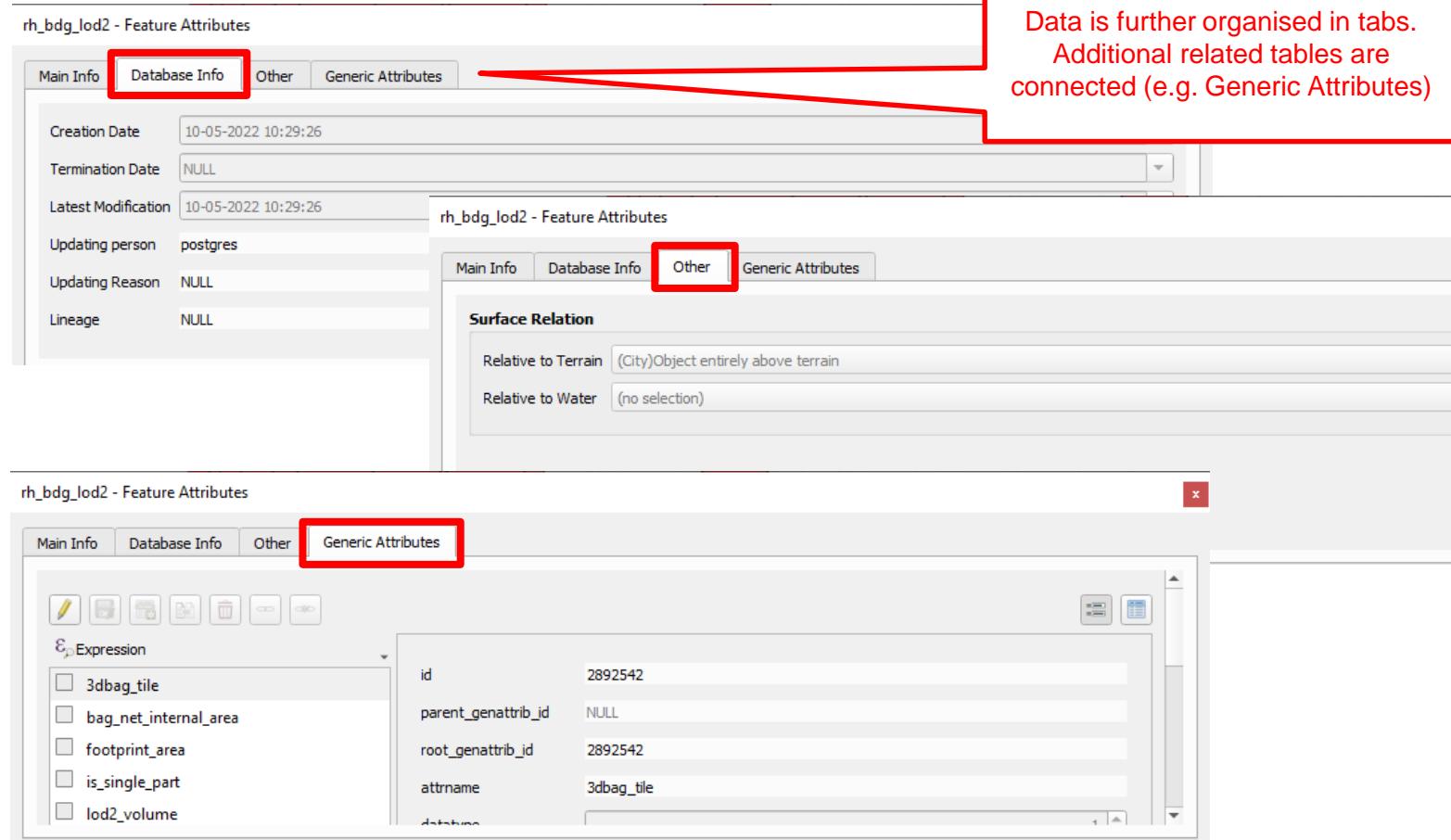
...or via (customised) forms.

Forms change depending on the feature type but have an overall common design.

**BEWARE:** the layout of the attributes forms is still work in progress. The final forms may look slightly different from those depicted in these slides.

# Use in QGIS: Attributes

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Data is further organised in tabs.  
Additional related tables are connected (e.g. Generic Attributes)

rh\_bdg\_lod2 - Feature Attributes

Main Info Database Info Other Generic Attributes

Creation Date 10-05-2022 10:29:26

Termination Date NULL

Latest Modification 10-05-2022 10:29:26

Updating person postgres

Updating Reason NULL

Lineage NULL

rh\_bdg\_lod2 - Feature Attributes

Main Info Database Info Other Generic Attributes

**Surface Relation**

Relative to Terrain (City)Object entirely above terrain

Relative to Water (no selection)

rh\_bdg\_lod2 - Feature Attributes

Main Info Database Info Other Generic Attributes

**Generic Attributes**

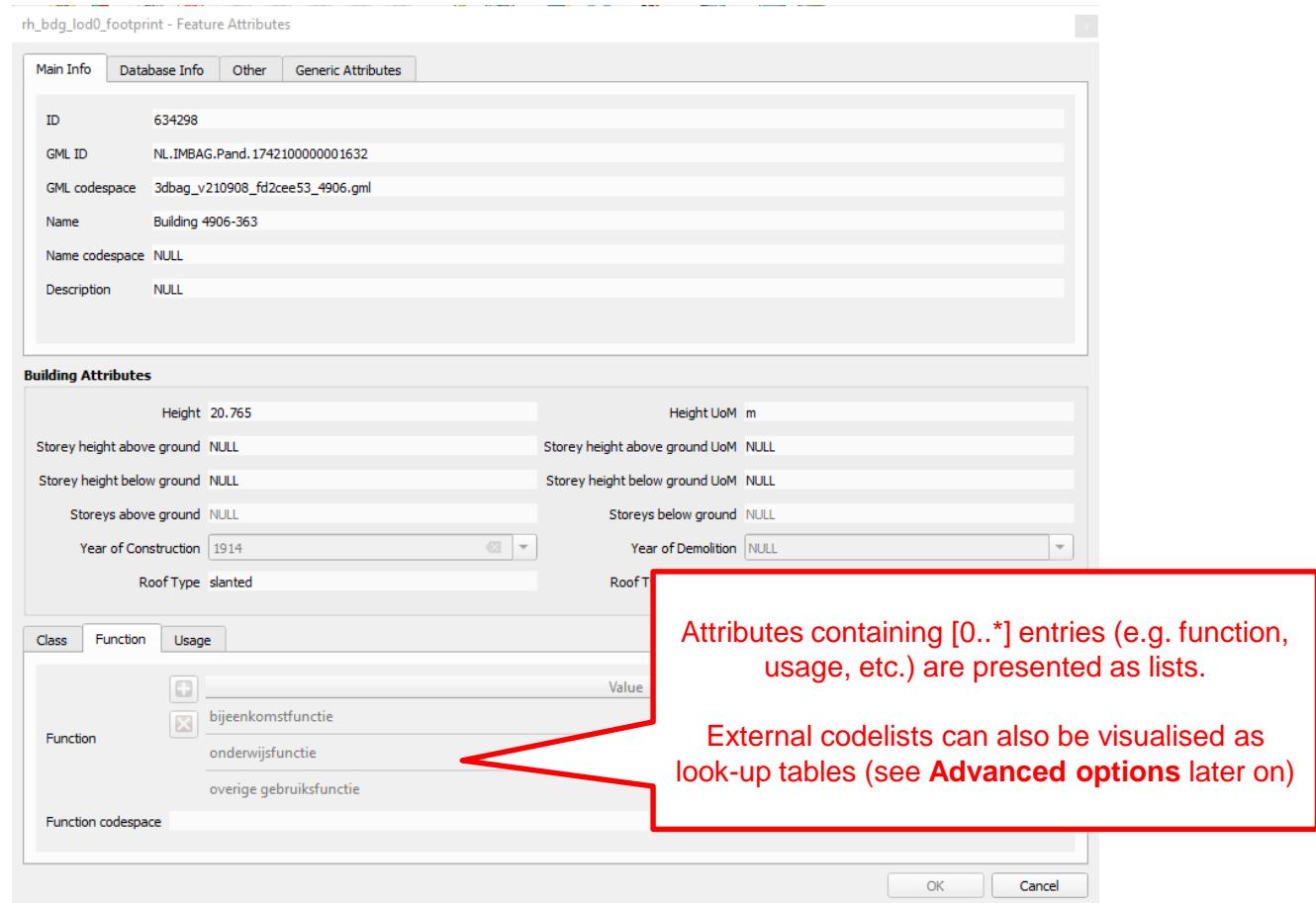
Expression

- 3dbag\_tile
- bag\_net\_internal\_area
- footprint\_area
- is\_single\_part
- lod2\_volume

id	2892542
parent_genattrib_id	NULL
root_genattrib_id	2892542
attrname	3dbag_tile
datatype	

# Use in QGIS: Attributes

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The screenshot shows the 'Feature Attributes' dialog for a building feature in QGIS. The dialog is divided into several sections:

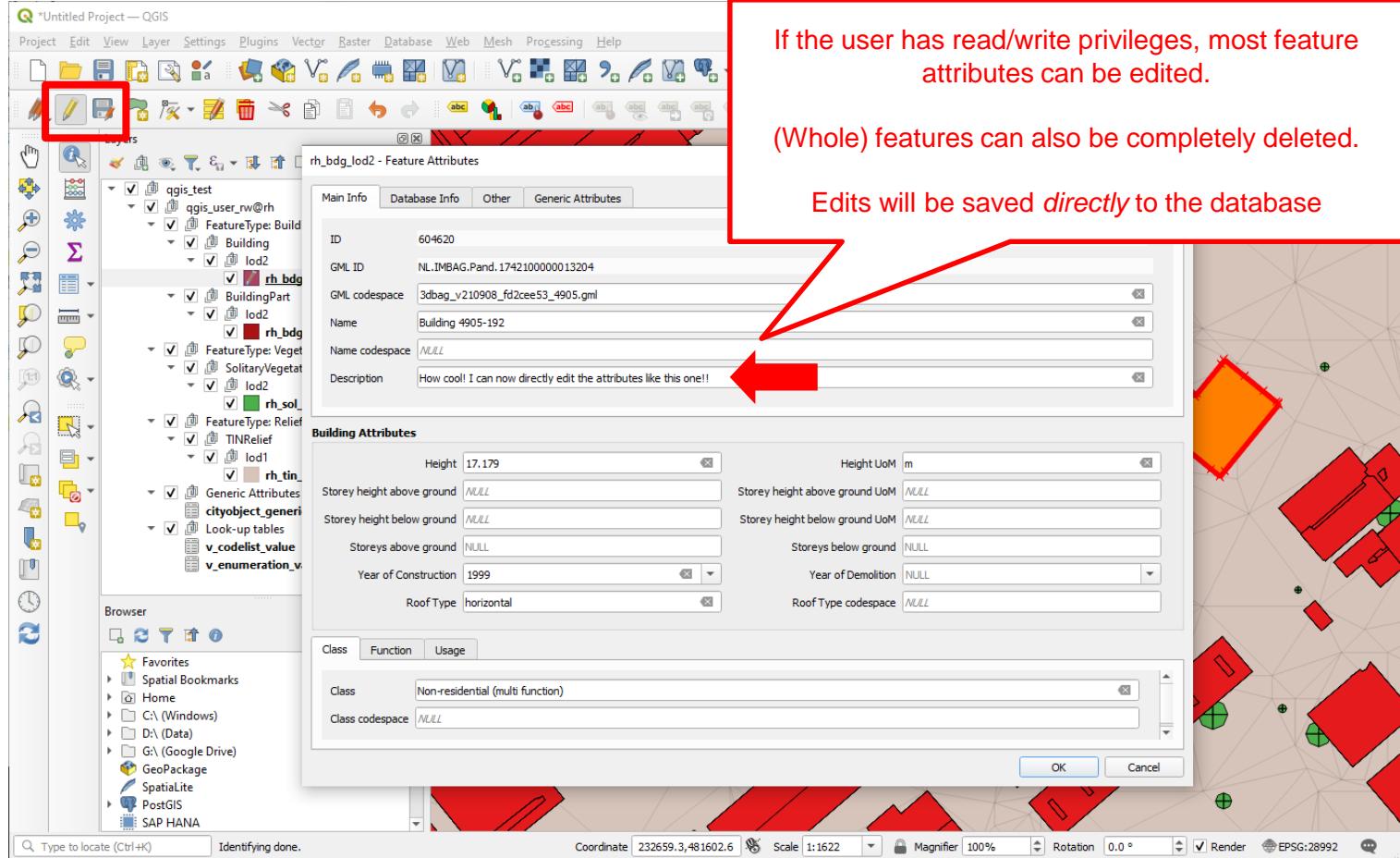
- Main Info:** Contains fields for ID (634298), GML ID (NL.IMGAG.Pand.1742100000001632), GML codespace (3dbag\_v210908\_fd2cee53\_4906.gml), Name (Building 4906-363), Name codespace (NULL), and Description (NULL).
- Building Attributes:** Contains fields for Height (20.765), Height UoM (m), Storey height above ground (NULL), Storey height above ground UoM (NULL), Storey height below ground (NULL), Storey height below ground UoM (NULL), Storeys above ground (NULL), Storeys below ground (NULL), Year of Construction (1914), Year of Demolition (NULL), and Roof Type (slanted).
- Function:** A section showing a list of function types: bijeenkomstfunctie, onderwijsfunctie, and overige gebruiksfunctie. This section is highlighted with a red box and a red arrow points to the following text.

**Attributes containing [..\*] entries (e.g. function, usage, etc.) are presented as lists.**

**External codelists can also be visualised as look-up tables (see [Advanced options](#) later on)**

# Use in QGIS: Attribute editing

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The screenshot shows the QGIS interface with a red box highlighting the 'Edit' button in the toolbar. The 'Feature Attributes' dialog is open for a feature named 'rh\_bdg\_lod2'. The 'Main Info' tab is selected, showing fields like ID (604620), GML ID (NL.UMBAG.Pand.1742100000013204), and Name (Building 4905-192). A large red callout box contains the following text:

If the user has read/write privileges, most feature attributes can be edited.  
 (Whole) features can also be completely deleted.  
 Edits will be saved *directly* to the database

A red arrow points from the bottom of the callout box to the 'OK' button in the dialog. Another red arrow points from the top of the callout box to the 'Description' field in the dialog.

The 'Building Attributes' tab is also visible, containing fields such as Height (17.179), Storey height above ground (NULL), and Storeys above ground (NULL).

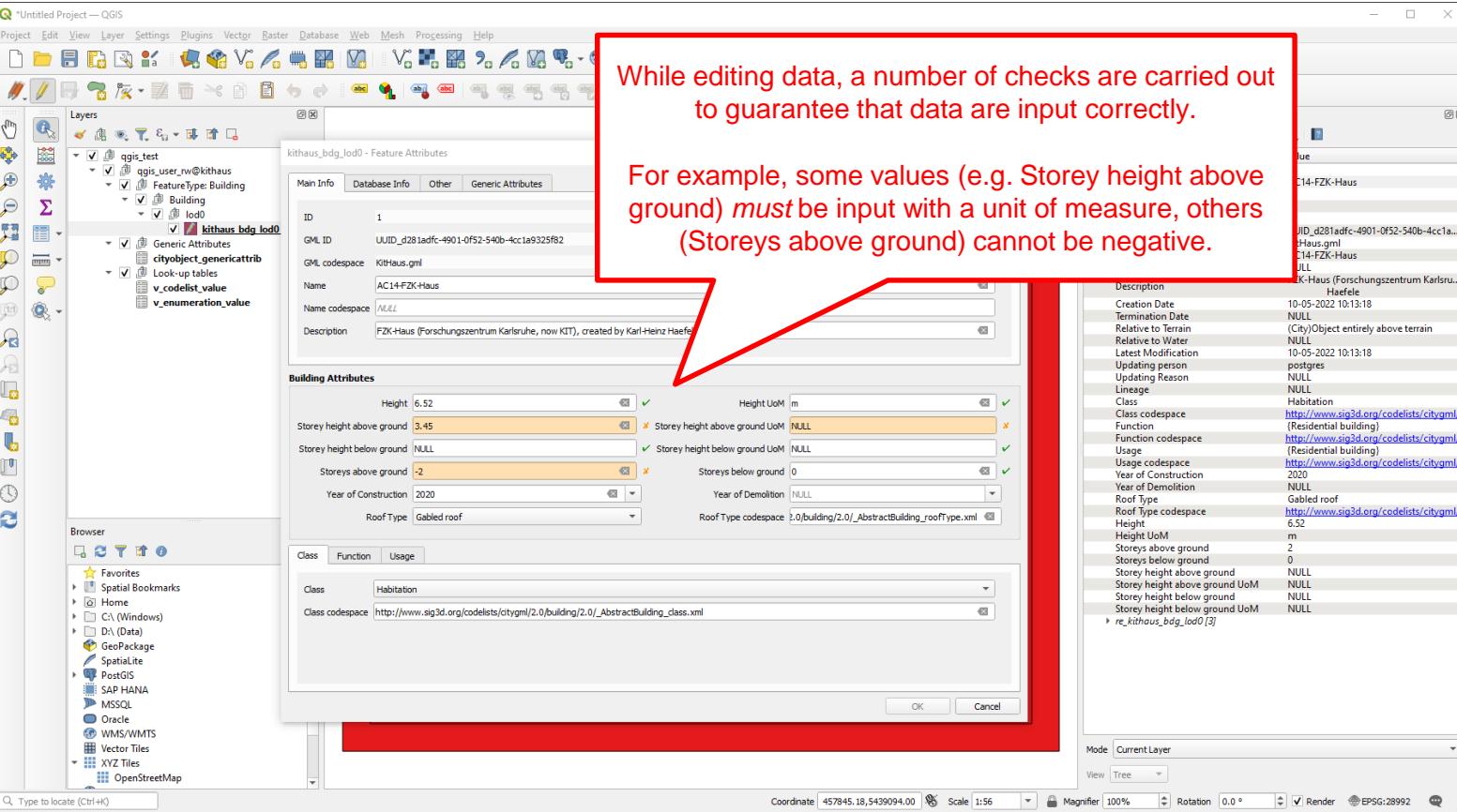
The map view on the right shows several buildings highlighted in red and orange, corresponding to the features being edited.

# Use in QGIS: Attribute editing

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While editing data, a number of checks are carried out to guarantee that data are input correctly.

For example, some values (e.g. Storey height above ground) *must* be input with a unit of measure, others (Storeys above ground) cannot be negative.



The screenshot shows the QGIS attribute editor for a building feature. A red box highlights several validation errors:

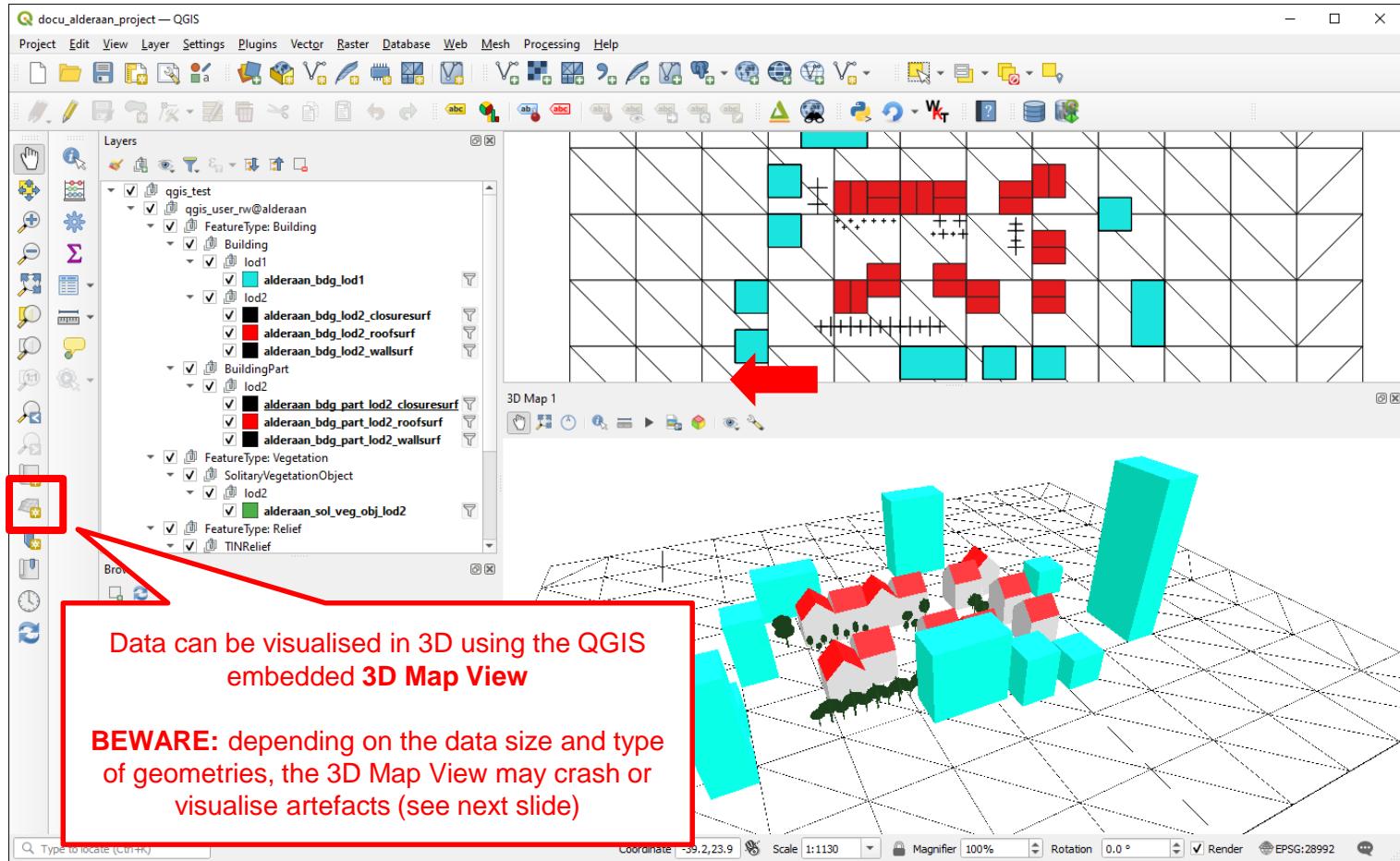
- "Storey height above ground" is highlighted in orange with an error icon, indicating it must be a positive value with a unit of measure.
- "Storey height below ground" is highlighted in orange with an error icon, indicating it must be a positive value with a unit of measure.
- "Storeys above ground" is highlighted in orange with an error icon, indicating it must be a non-negative integer.
- "Height" and "Height UoM" are shown as valid entries (6.52 m).
- "Storey height above ground UoM" and "Storeys below ground" are shown as invalid entries (NULL).
- "Storey height below ground UoM" and "Year of Demolition" are shown as valid entries (NULL).
- "Roof Type" and "Roof Type codespace" are shown as valid entries (Gabled roof).

The bottom right corner shows the full list of attribute values for the feature, including the validation status for each field.

Attribute	Description	Value	Validation Status
ID	ID	1	Valid
GML ID	GML ID	UUID_d281adfc-4901-0f52-540b-4cc1a9325f82	Valid
GML codespace	GML codespace	Kithaus.gml	Valid
Name	Name	AC14-FZK-Haus	Valid
Name codespace	Name codespace	NULL	Valid
Description	Description	FZK-Haus (Forschungszentrum Karlsruhe, now KIT), created by Karl-Heinz Haefele	Valid
Building Attributes			
Height	Height	6.52	Valid
Storey height above ground	Storey height above ground	3.45	Invalid (orange)
Storey height below ground	Storey height below ground	NULL	Valid
Storeys above ground	Storeys above ground	-2	Invalid (orange)
Year of Construction	Year of Construction	2020	Valid
Roof Type	Roof Type	Gabled roof	Valid
Height UoM	Height UoM	m	Valid
Storey height above ground UoM	Storey height above ground UoM	NULL	Invalid (orange)
Storeys below ground UoM	Storeys below ground UoM	NULL	Valid
Storey height below ground UoM	Storey height below ground UoM	NULL	Valid
Storey height above ground	Storey height above ground	NULL	Valid
Storey height below ground	Storey height below ground	NULL	Valid
Storey height below ground UoM	Storey height below ground UoM	NULL	Valid

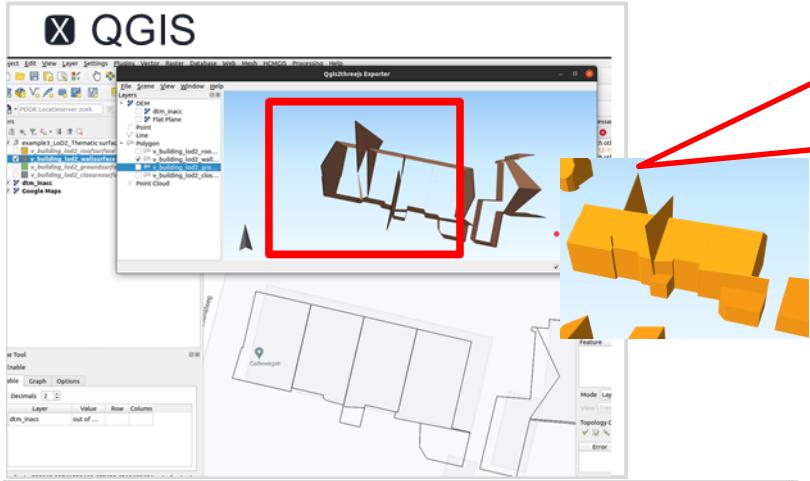
# Use in QGIS: 3D visualisation

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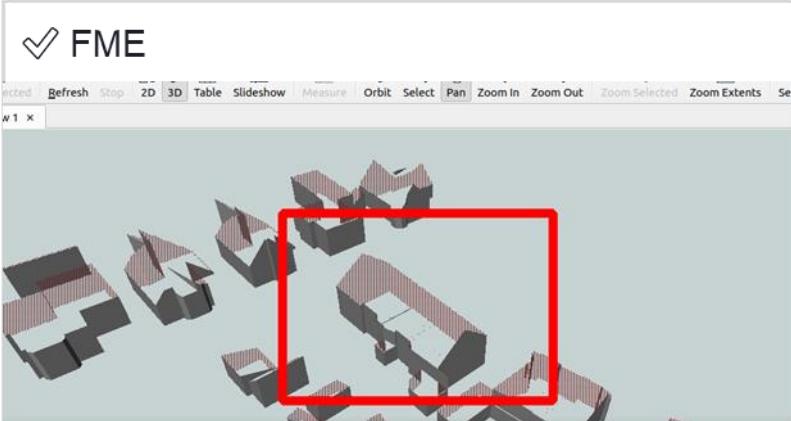
# Use in QGIS: 3D visualisation

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In our tests, such artefacts are however a 3D visualisation issue (QGIS 3D renderer?) and *not* related to the actual data. 3D visualisation in FME and in Google Earth show indeed correct results.

In order to minimise this problem, please refer to  
**Advanced options** (see later)



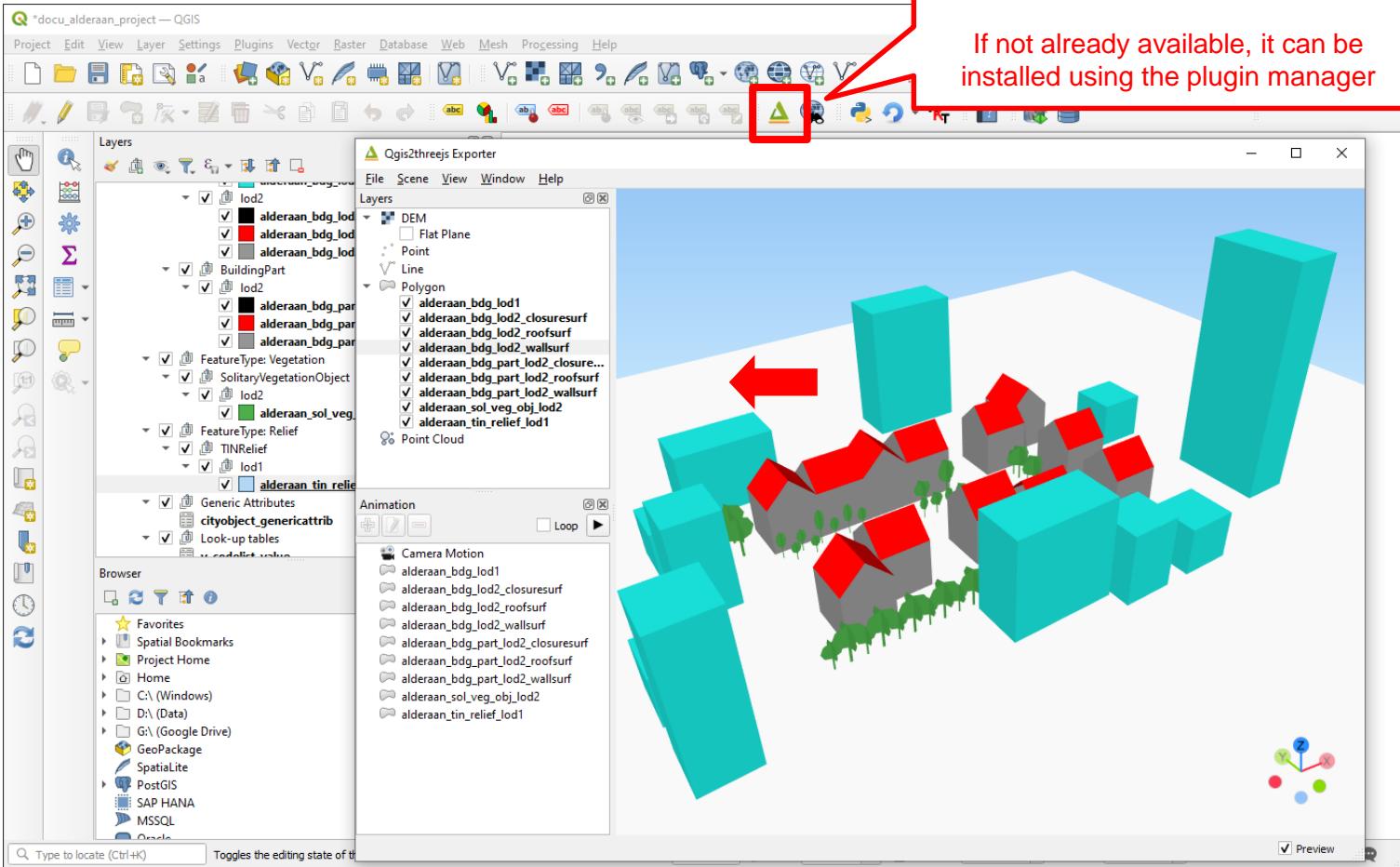
✓  
**Google earth**  
 (as KML)

# Use in QGIS: 3D visualisation

Alternatively, the **Qgis2threejs** plugin can be used for 3D visualisation.

If not already available, it can be installed using the plugin manager

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# Advanced options

- As administrator
  - Add and manage non-default database users
  - Fine-tune privileges
- As user
  - Simplify geometries in materialised views
  - Set up look-up tables in the attribute forms
  - Add personalised codelists

# Database user management (as Administrator)

**IMPORTANT:** The following operations are currently NOT supported by the QGIS 3DCityDB-Loader plugin and must be carried out by the database administrator via a SQL console, e.g. from PgAdmin.

In general, the database administrator (or a superuser) can:

- Allow or disallow database users to use the QGIS plugin
- Choose specifically which citydb schema(s) a user can access
- Grant/revoke read-only or read-write privileges per user and per citydb schema
- Uninstall the default users "qgis\_user\_ro" and/or "qgis\_user\_rw"

The required SQL functions are all available in schema **qgis\_pkg** and will be explained in the next slides.

# Database user management (as Administrator)

In order to be visible from the Plugin, a user must be added to the group "qgis\_pkg\_usrgroup". Predefined PL/pgSQL functions take care of it.

Function **qgis\_pkg.grant\_qgis\_usr\_privileges(usr\_name, priv\_type [, cdb\_schema])** can be used and offers multiple possibilities.

## SQL examples

-- Database user "giorgio" is added to group "qgis\_pkg\_usrgroup", can access data in citydb schema "citydb" of the current database with read-only privileges

```
SELECT qgis_pkg.grant_qgis_usr_privileges('giorgio', 'ro','citydb');
```

-- Database user "kostantinos" is added to group "qgis\_pkg\_usrgroup", can access data in citydb schema "citydb\_2" of the current database with read-write privileges

```
SELECT qgis_pkg.grant_qgis_usr_privileges('kostantinos ', 'rw','citydb_2');
```

-- Database user "camilo" is added to group "qgis\_pkg\_usrgroup", can access data in ALL citydb schemas of the current database with read-write privileges

```
SELECT qgis_pkg.grant_qgis_usr_privileges('camilo ', 'rw');
```

# Database user management (as Administrator)

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To revoke the privileges, the corresponding function is **qgis\_pkg.revoke\_qgis\_usr\_privileges(usr\_name [, cdb\_schema])** and offers multiple possibilities.

## SQL examples

-- Database user "giorgio" cannot access anymore data in citydb schema "citydb" of the current database  
**SELECT** qgis\_pkg.revoke\_qgis\_usr\_privileges('giorgio', 'citydb');

-- Database user "camilo" cannot access anymore ANY citydb schemas of the current database  
**SELECT** qgis\_pkg.revoke\_qgis\_usr\_privileges('camilo');

**IMPORTANT:** The database users are NOT automatically removed from the group "qgis\_pkg\_usrgroup", as they could still be using other database instances of the 3D City Database. If required, the administrator has to remove them manually.

-- Database user "giorgio" is removed from group "qgis\_pkg\_usrgroup" and won't be able to use the QGIS plugin anymore  
**REVOKE** qgis\_pkg\_usrgroup **FROM** giorgio;

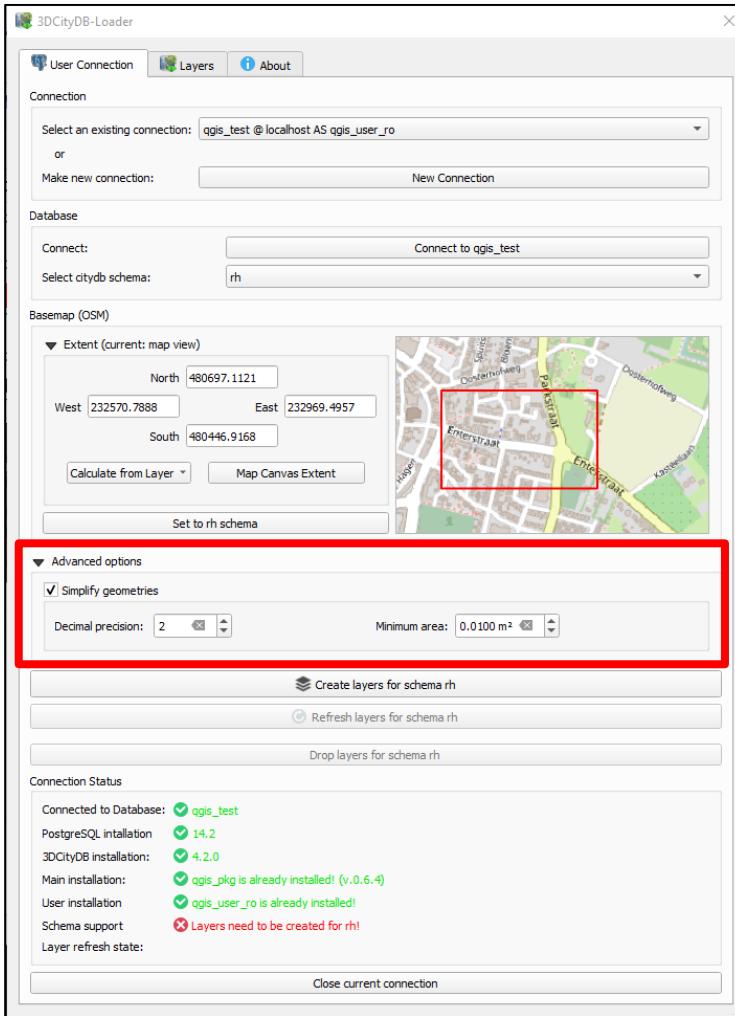
# Geometry simplification

In order to simplify geometries and (partially) cope with the 3D visualisation issues of the 3D View Map in QGIS, the user can set some simplification parameters *before* generating the views.

All polygons composing the geometries will be checked. The user can set the number of decimal positions in the coordinates. Resulting degenerate geometries are filtered out. The second parameter filters out all polygons smaller than the chosen threshold.

## BEWARE: this operation

- can significantly increase the time needed to refresh the layers
- does NOT change the original data in the database!



# Codelists and look-up tables

For certain CityGML properties (e.g. class, function, usage, roof type, etc.) the QGIS attribute forms can be linked to look-up tables containing

- values from the non-normative CityGML specifications
- values optionally defined by the user

This applies to properties containing single (e.g. class, roof type) or, possibly, multiple values (e.g. function, usage)

If required, in this way the user does not have to "remember" specific codes, thus reducing the chances of wrong data input.

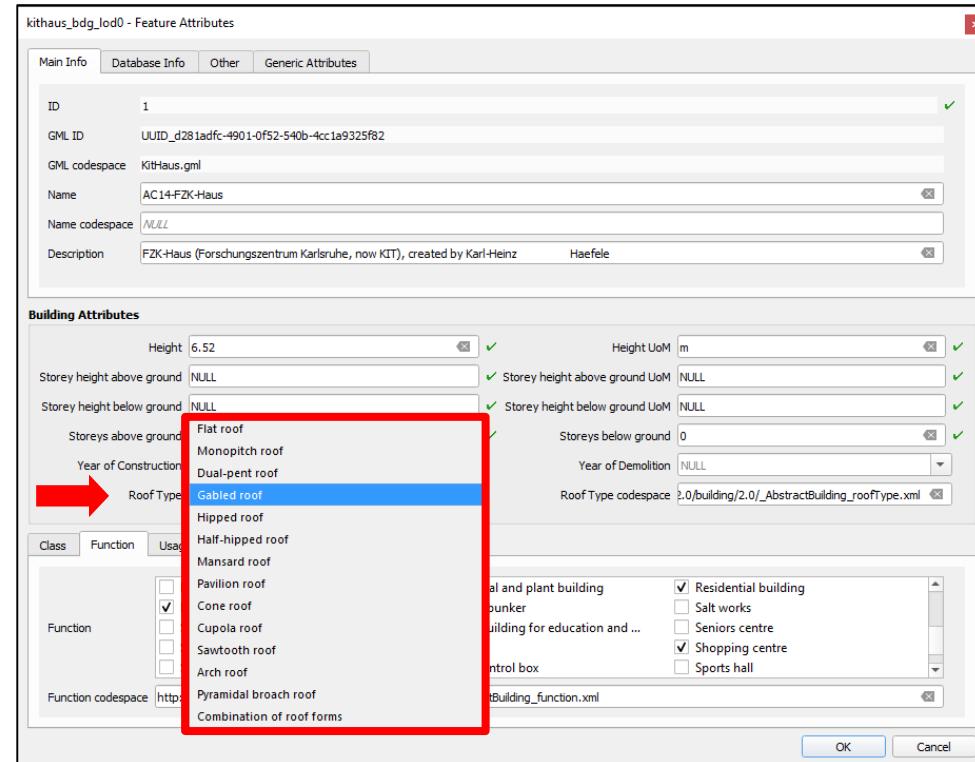
See next slides for examples

# Codelists and look-up tables

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In the case of a CityGML property with cardinality **[0..1]**, the associated codelist values are presented as a drop-down list.

Example: property **Roof type**



# Codelists and look-up tables

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In the case of a CityGML property with cardinality **[0..\*]**, the associated codelist values are presented as a multiple-selection list.

Example: property (Building) function

kithaus\_bdg\_Iod0 - Feature Attributes

Main Info Database Info Other Generic Attributes

ID: 1  
 GML ID: UUID\_d281adfc-4901-0f52-540b-4cc1a9325f82  
 GML codespace: KitHaus.gml  
 Name: AC14-FZK-Haus  
 Name codespace: NULL  
 Description: FZK-Haus (Forschungszentrum Karlsruhe, now KIT), created by Karl-Heinz Haefele

**Building Attributes**

Height: 6.52	Height UoM: m
Storey height above ground: NULL	Storey height above ground UoM: NULL
Storey height below ground: NULL	Storey height below ground UoM: NULL
Storeys above ground: 2	Storeys below ground: 0
Year of Construction: 2020	Year of Demolition: NULL
Roof Type: Gabled roof	Roof Type codespace: 2.0/building/2.0/_AbstractBuilding_roofType.xml

**Function**

<input type="checkbox"/> Residential and office building	<input type="checkbox"/> Residential and plant building	<input checked="" type="checkbox"/> Residential building
<input checked="" type="checkbox"/> Restaurant	<input type="checkbox"/> Rubbish bunker	<input type="checkbox"/> Salt works
<input type="checkbox"/> Sanatorium	<input type="checkbox"/> School Building for education and ...	<input type="checkbox"/> Seniors centre
<input type="checkbox"/> Shipping terminal	<input type="checkbox"/> Shipyard	<input checked="" type="checkbox"/> Shopping centre
<input type="checkbox"/> Signal box or stop signal	<input type="checkbox"/> Signal control box	<input type="checkbox"/> Sports hall

Function codespace: [http://www.sig3d.org/codelists/citygml/2.0/building/2.0/\\_AbstractBuilding\\_function.xml](http://www.sig3d.org/codelists/citygml/2.0/building/2.0/_AbstractBuilding_function.xml)

OK Cancel



# Codelists and look-up tables

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## Behind the scenes:

In the 3DCityDB, string-based columns of attributes containing multiple values (separated by the --\-- field separator) are transformed into arrays in the QGIS Package layers.

Trigger functions take care of data conversion from/to arrays when needed.

## 3DCityDB table BUILDING (excerpt)

<b>id</b> [PK] bigint	<b>class</b> character varying (256)	<b>function</b> character varying (1000)
1531	Mixed-use	overige gebruiksfunctie--/\-woonfunctie
4431	Mixed-use	winkelfunctie--/\-woonfunctie
7839	Non-residential (multi function)	gezondheidszorgfunctie--/\-kantoorfunctie--/\-winkel functie
15423	Non-residential (multi function)	gezondheidszorgfunctie--/\-kantoorfunctie
15499	Mixed-use	gezondheidszorgfunctie--/\-kantoorfunctie--/\-winkelfunctie--/\-woonf.
16545	Mixed-use	overige gebruiksfunctie--/\-woonfunctie
14490	Mixed-use	bijeenkomstfunctie--/\-gezondheidszorgfunctie--/\-kantoorfunctie--/\-.
15956	Mixed-use	overige gebruiksfunctie--/\-woonfunctie

## QGIS Package layer BUILDING (excerpt)

```
function
character varying[])
("overige gebruiksfunctie",woonfunctie)
(winkelfunctie,woonfunctie)
(gezondheidszorgfunctie,kantoorfunctie,winkelfunctie)
(gezondheidszorgfunctie,kantoorfunctie)
(gezondheidszorgfunctie,kantoorfunctie,winkelfunctie,woonfunctie)
("overige gebruiksfunctie",woonfunctie)
(bijeenkomstfunctie,gezondheidszorgfunctie,kantoorfunctie,"overi...
("overige gebruiksfunctie",woonfunctie)
```



# Codelists and look-up tables



- All codelists values are retrieved from the view **v\_codelist\_value** in the qgis schema of every user (e.g. "qgis\_user\_rw")
- By default, all CityGML codelists are already available
- To set up the QGIS attributes form, please refer to the next slides

**View V\_CODELISTS\_VALUE (excerpt)**

<b>id</b> bigint	<b>data_model</b> character varying	<b>name</b> character varying	<b>value</b> character varying	<b>description</b> text	<b>name_space</b> character varying
1	CityGML 2.0	MimeType	model/vrml	VRML97	<a href="https://www.sig3d.org/codelists/stan...">https://www.sig3d.org/codelists/stan...</a>
2	CityGML 2.0	MimeType	application/x-3ds	3ds max	<a href="https://www.sig3d.org/codelists/stan...">https://www.sig3d.org/codelists/stan...</a>
3	CityGML 2.0	MimeType	application/dxf	AutoCad DXF	<a href="https://www.sig3d.org/codelists/stan...">https://www.sig3d.org/codelists/stan...</a>
4	CityGML 2.0	MimeType	application/x-autocad	AutoCad DXF	<a href="https://www.sig3d.org/codelists/stan...">https://www.sig3d.org/codelists/stan...</a>
39	CityGML 2.0	_AbstractBuildingClass	1110	Maintainence and waste mana...	<a href="https://www.sig3d.org/codelists/stan...">https://www.sig3d.org/codelists/stan...</a>
40	CityGML 2.0	_AbstractBuildingClass	1120	Healthcare	<a href="https://www.sig3d.org/codelists/stan...">https://www.sig3d.org/codelists/stan...</a>
41	CityGML 2.0	_AbstractBuildingClass	1130	Communicating	<a href="https://www.sig3d.org/codelists/stan...">https://www.sig3d.org/codelists/stan...</a>
42	CityGML 2.0	_AbstractBuildingClass	1140	Security	<a href="https://www.sig3d.org/codelists/stan...">https://www.sig3d.org/codelists/stan...</a>
43	CityGML 2.0	_AbstractBuildingClass	1150	Storage	<a href="https://www.sig3d.org/codelists/stan...">https://www.sig3d.org/codelists/stan...</a>
44	CityGML 2.0	_AbstractBuildingClass	1160	Industry	<a href="https://www.sig3d.org/codelists/stan...">https://www.sig3d.org/codelists/stan...</a>
45	CityGML 2.0	_AbstractBuildingClass	1170	Traffic	<a href="https://www.sig3d.org/codelists/stan...">https://www.sig3d.org/codelists/stan...</a>
46	CityGML 2.0	_AbstractBuildingClass	1180	Other function	<a href="https://www.sig3d.org/codelists/stan...">https://www.sig3d.org/codelists/stan...</a>
47	CityGML 2.0	_AbstractBuildingClass	9999	Unknown	<a href="https://www.sig3d.org/codelists/stan...">https://www.sig3d.org/codelists/stan...</a>
48	CityGML 2.0	_AbstractBuildingFunct...	1000	Residential building	<a href="https://www.sig3d.org/codelists/stan...">https://www.sig3d.org/codelists/stan...</a>
49	CityGML 2.0	_AbstractBuildingFunct...	1010	Tenement	<a href="https://www.sig3d.org/codelists/stan...">https://www.sig3d.org/codelists/stan...</a>

# Codelists and look-up tables

Example: property **Roof type**  
(cardinality [0..1])

## Motivation

## Software use

### Advanced options

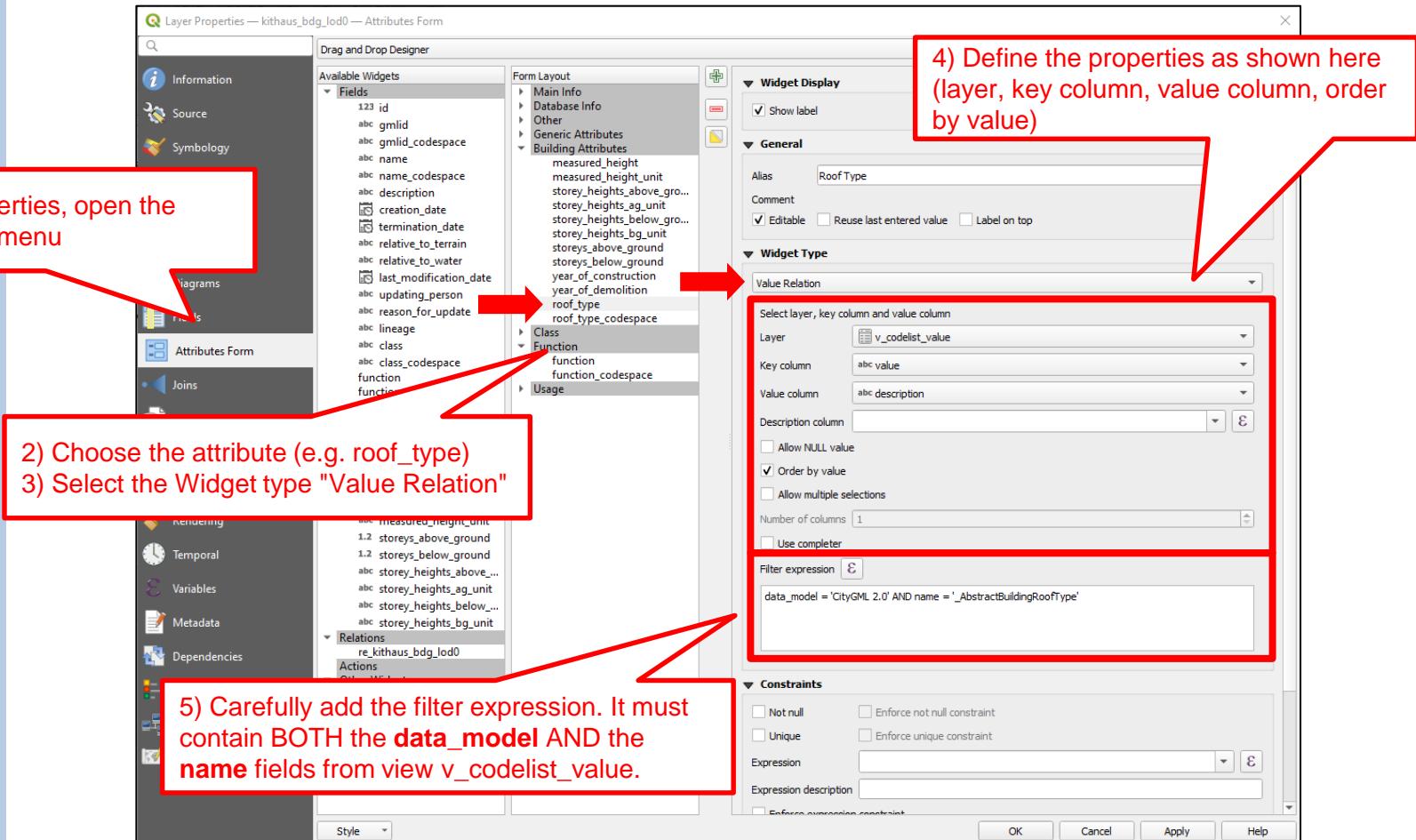
#### Software uninstall

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#### Resources

- 1) In the Layer properties, open the Attributes Form submenu



The screenshot shows the 'Layer Properties — kithaus\_bgd\_lod0 — Attributes Form' dialog. On the left, the 'Drag and Drop Designer' panel lists 'Available Widgets' under 'Fields'. A red box highlights the 'Fields' section, with an arrow pointing from the 'Motivation' list item 1. The 'Form Layout' section contains several items, and a red box highlights the 'Building Attributes' section, with an arrow pointing from the 'Software use' list item 2. The 'Widget Type' section is expanded, showing 'Value Relation' selected. A red box highlights this section, with an arrow pointing from the 'Advanced options' list item 3. The 'Value Relation' configuration area includes fields for 'Layer' (set to 'v\_codelist\_value'), 'Key column' ('abc value'), 'Value column' ('abc description'), and a 'Filter expression' field containing the value 'data\_model = 'CityGML 2.0'' AND name = '\_AbstractBuildingRoofType''. A red box highlights this filter expression field, with an arrow pointing from the 'Current limitations' list item 5. The 'Constraints' section at the bottom is also visible.

4) Define the properties as shown here (layer, key column, value column, order by value)

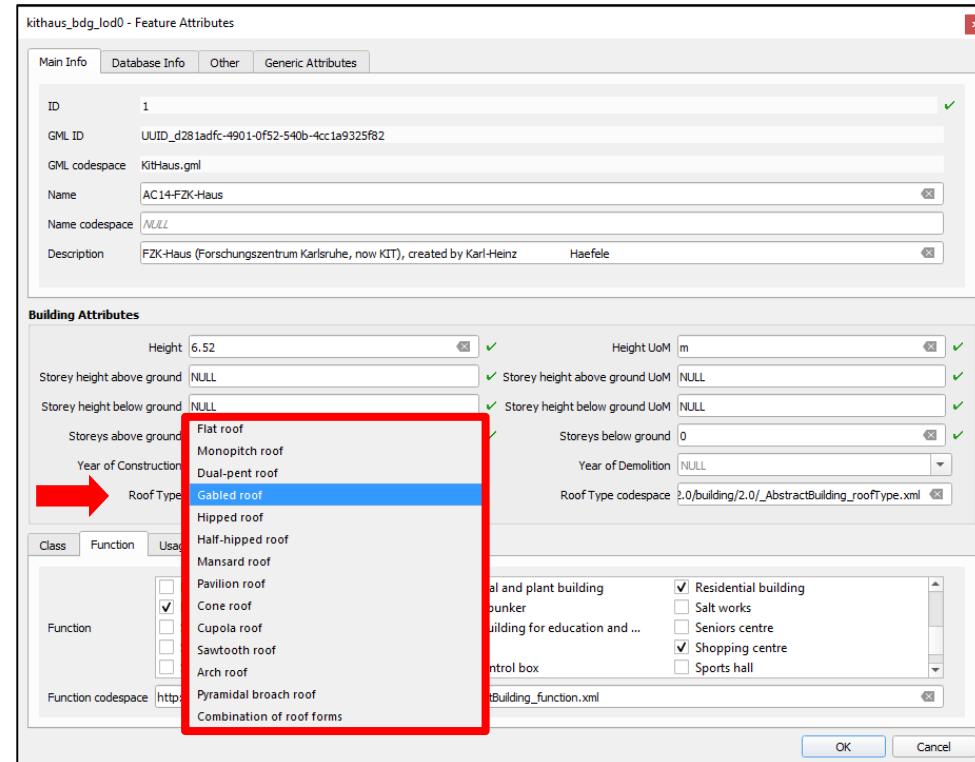
5) Carefully add the filter expression. It must contain BOTH the **data\_model** AND the **name** fields from view **v\_codelist\_value**.

# Codelists and look-up tables

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Apply the Layer Properties,  
 reload the attributes form  
 from QGIS as usual.

Et voilà! 😊

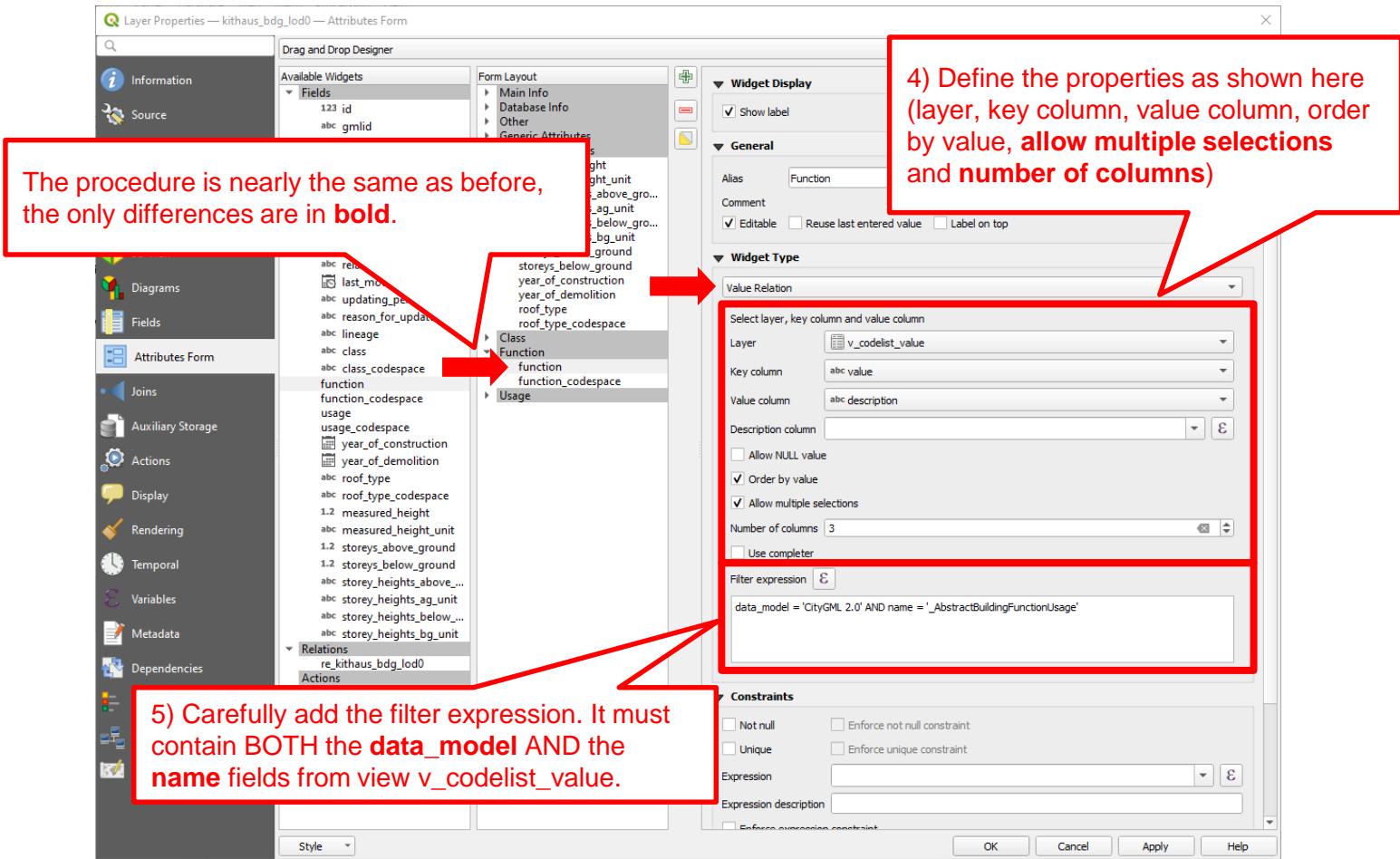


# Codelists and look-up tables

Example: property **(Building)**  
function (cardinality [0..\*])

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The procedure is nearly the same as before,  
 the only differences are in **bold**.



4) Define the properties as shown here (layer, key column, value column, order by value, **allow multiple selections** and **number of columns**)

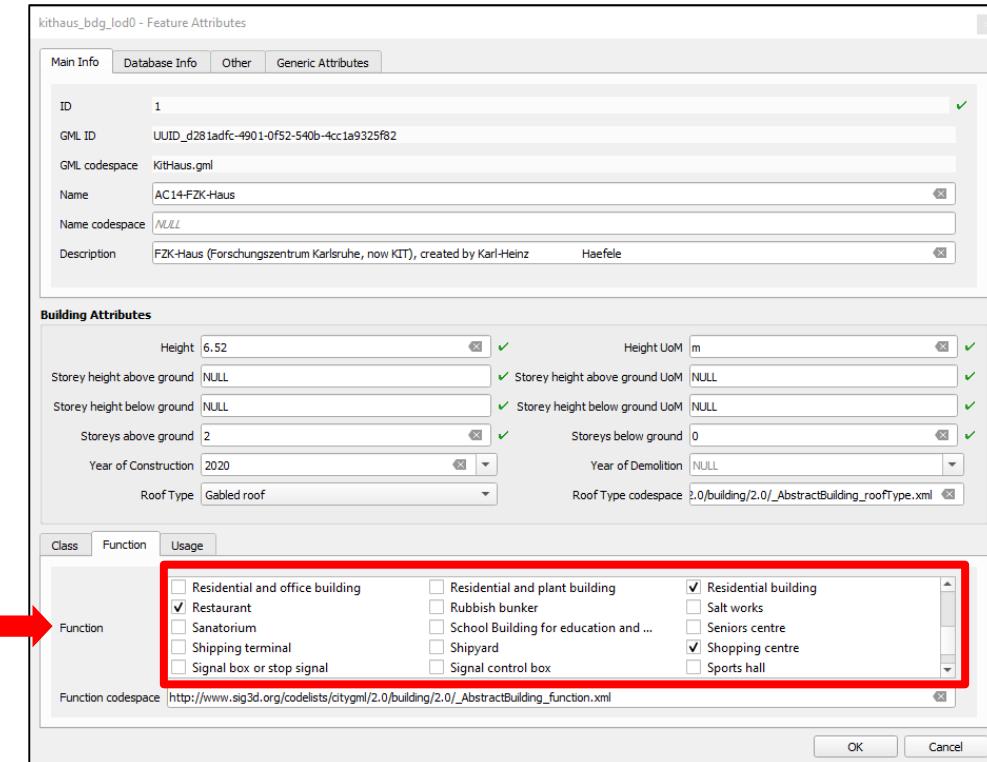
5) Carefully add the filter expression. It must contain **BOTH** the **data\_model** AND the **name** fields from view **v\_codelist\_value**.

# Codelists and look-up tables

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Apply the Layer Properties,  
 reload the attributes form  
 from QGIS as usual.

Et voilà! 😊



# Codelists and look-up tables

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To add or customise codelist values, **two tables** in the qgis user schema must be edited: **codelist** and **codelist\_value**

Table **codelist** contains some metadata values such as the codelist name, its name\_space and data\_model.

It is referenced by table **codelist\_value** which contains the actual values.

**Table CODELIST (excerpt)**

<b>id</b> [PK] bigint	<b>data_model</b> character varying	<b>name</b> character varying	<b>name_space</b> character varying	<b>description</b> text
1	CityGML 2.0	MimeType	https://www.sig3d.org/codelists/standard/core/2.0/ImplicitGeometry_mimeType.xml	[null]
2	CityGML 2.0	_AbstractBridgeClass	https://www.sig3d.org/codelists/standard/bridge/2.0/_AbstractBridge_class.xml	
3	CityGML 2.0	_AbstractBridgeFunctionUsage	https://www.sig3d.org/codelists/standard/bridge/2.0/_AbstractBridge_function.xml	
4	CityGML 2.0	_AbstractBuildingClass	https://www.sig3d.org/codelists/standard/building/2.0/_AbstractBuilding_class.xml	
5	CityGML 2.0	_AbstractBuildingFunctionUsage	https://www.sig3d.org/codelists/standard/building/2.0/_AbstractBuilding_function.xml	
6	CityGML 2.0	_AbstractBuildingRoofType	https://www.sig3d.org/codelists/standard/building/2.0/_AbstractBuildingRoof_type.xml	
7	CityGML 2.0	RoomClass	https://www.sig3d.org/codelists/standard/building/2.0/Room_class.xml	
8	CityGML 2.0	RoomFunctionUsage	https://www.sig3d.org/codelists/standard/building/2.0/RoomFunction_usage.xml	
9	CityGML 2.0	BuildingFurnitureClass	https://www.sig3d.org/codelists/standard/building/2.0/BuildingFurniture_class.xml	
10	CityGML 2.0	BuildingFurnitureFunctionUsage	https://www.sig3d.org/codelists/standard/building/2.0/BuildingFurnitureFunction_usage.xml	

**Table CODELIST\_VALUE (excerpt)**

<b>id</b> [PK] bigint	<b>code_id</b> integer	<b>value</b> character varying	<b>description</b> text
1	1	model/vrml	VRML97
2	1	application/x-3ds	3ds max
3	1	application/dxf	AutoCad DXF
4	1	application/x-autocad	AutoCad DXF
5	1	application/x-dxf	AutoCad DXF
6	1	application/acad	AutoCad DWG
13	1	image/tiff	*.tiff, *.tif images
14	1	image/bmp	*.bmp images
15	2	1000	Arced bridge
16	2	1010	Cable-stayed bridge
17	2	1020	Deck bridge
18	2	1030	Cable-stayed overpass

# Codelists and look-up tables

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To add (or remove) values from the **codelist** and **codelist\_value** tables, the user can for example issue a SQL statement such as:

```
-- Optionally, delete previously loaded values belonging to the same codelist in user schema "qgis_giorgio"  
DELETE FROM qgis_giorgio.codelist WHERE data_model = 'NL-BAG';  
-- Insert first the codelist metadata and then the values in one single SQL statement  
WITH cl AS (  
    INSERT INTO qgis_giorgio.codelist (data_model, name, name_space, description)  
    VALUES  
        ('NL-BAG', 'BAG', 'https://..some_url_here....', 'Codelist containing the values of the Dutch Basisregistratie  
        Adressen en Gebouwen')  
    RETURNING id)  
INSERT INTO qgis_giorgio.codelist_value (code_id, value, description)  
SELECT cl.id, v.value, v.description FROM cl, (VALUES  
    ('apple' , 'Codelist value for "apple"'),  
    ('orange' , 'Codelist value for "orange"'),  
    ('pear' , 'Codelist value for "pear"'),  
    ('banana' , 'Codelist value for "banana"')  
) AS v(value, description);
```

This SQL statement can be adapted by changing only the parts in red

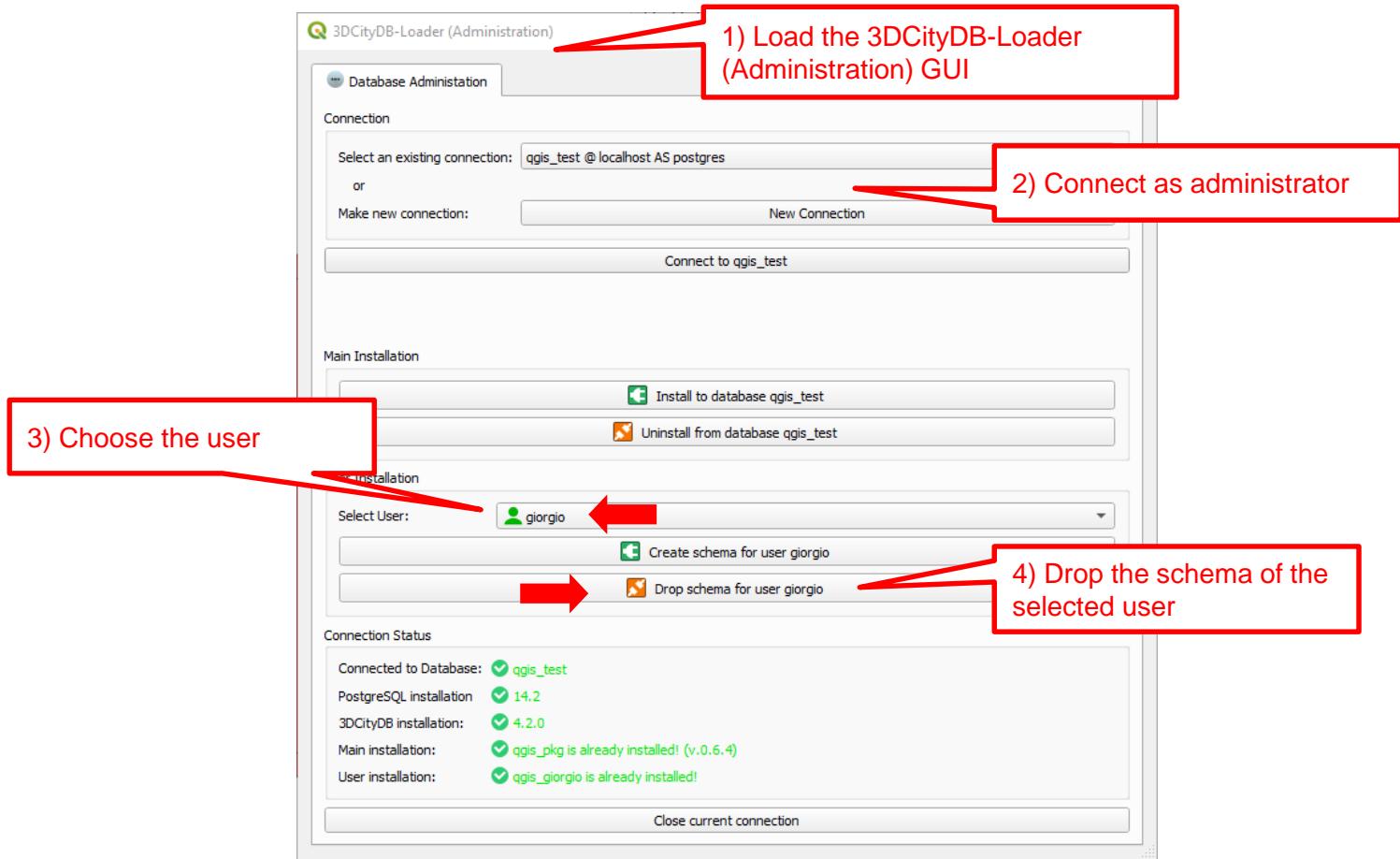
# Software uninstall

Uninstallation consists of two parts:

- 1) Partial/complete removal of the QGIS Package from PostgreSQL
  - This operation can be carried out only by the database administrator
  - The administrator can drop only the schema of a selected user (e.g. "qgis\_giorgio")
  - The administrator can remove all user schemas AND the qgis\_pkg schema
- 2) Removal of the 3DCityDB-Loader plugin from QGIS
  - This operation can be carried out by any user
  - The plugin can be uninstalled from the \Plugins\Manage and Install Plugins... Menu in QGIS
  - Alternatively, it can be uninstalled manually by simply removing the plugin folder

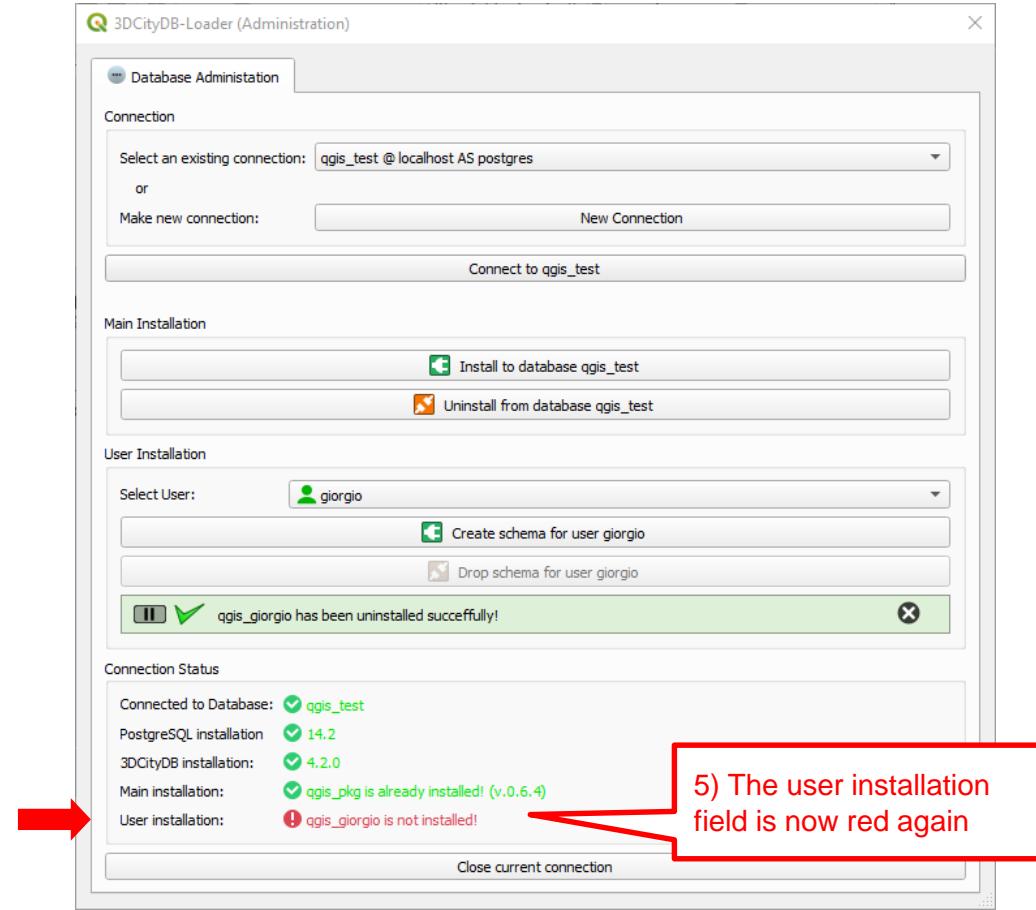
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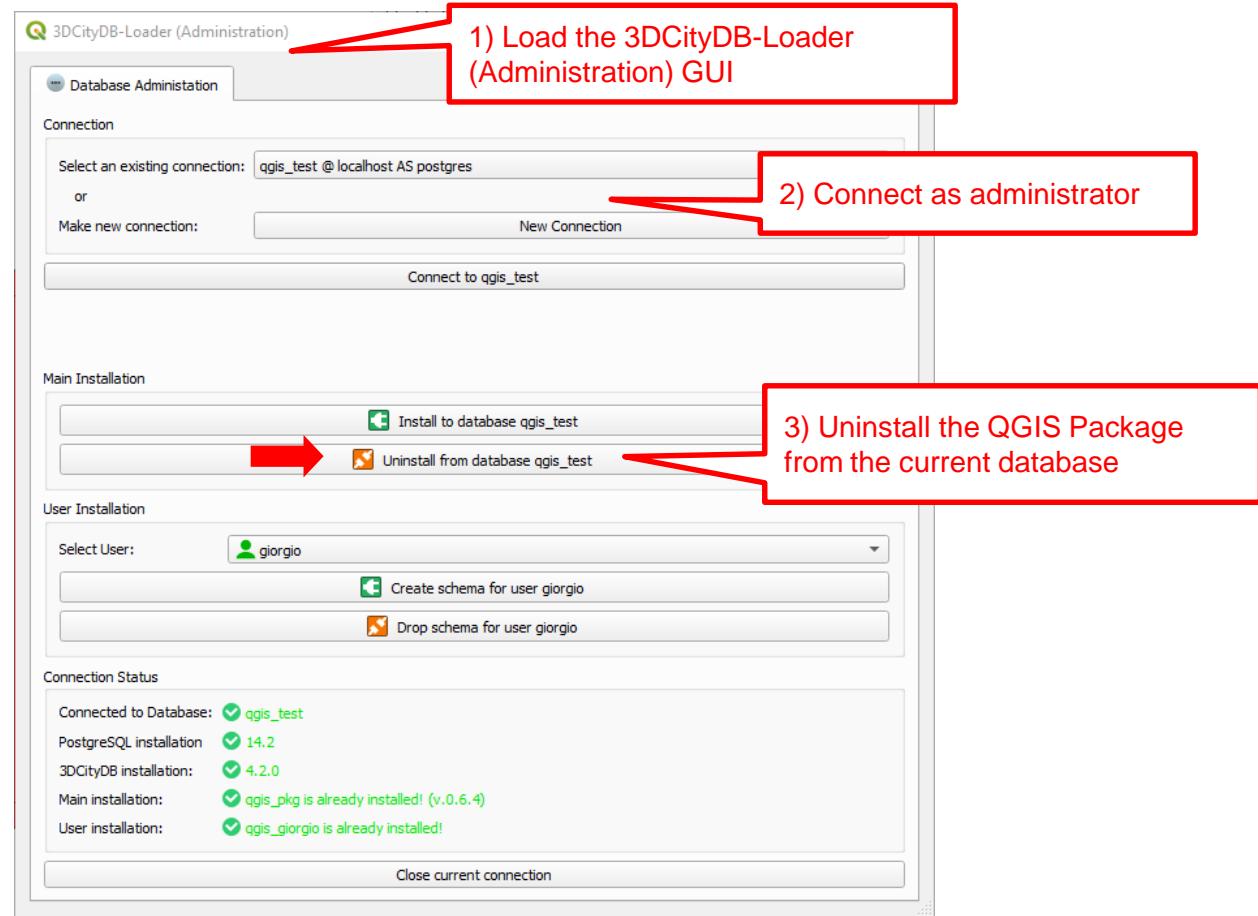
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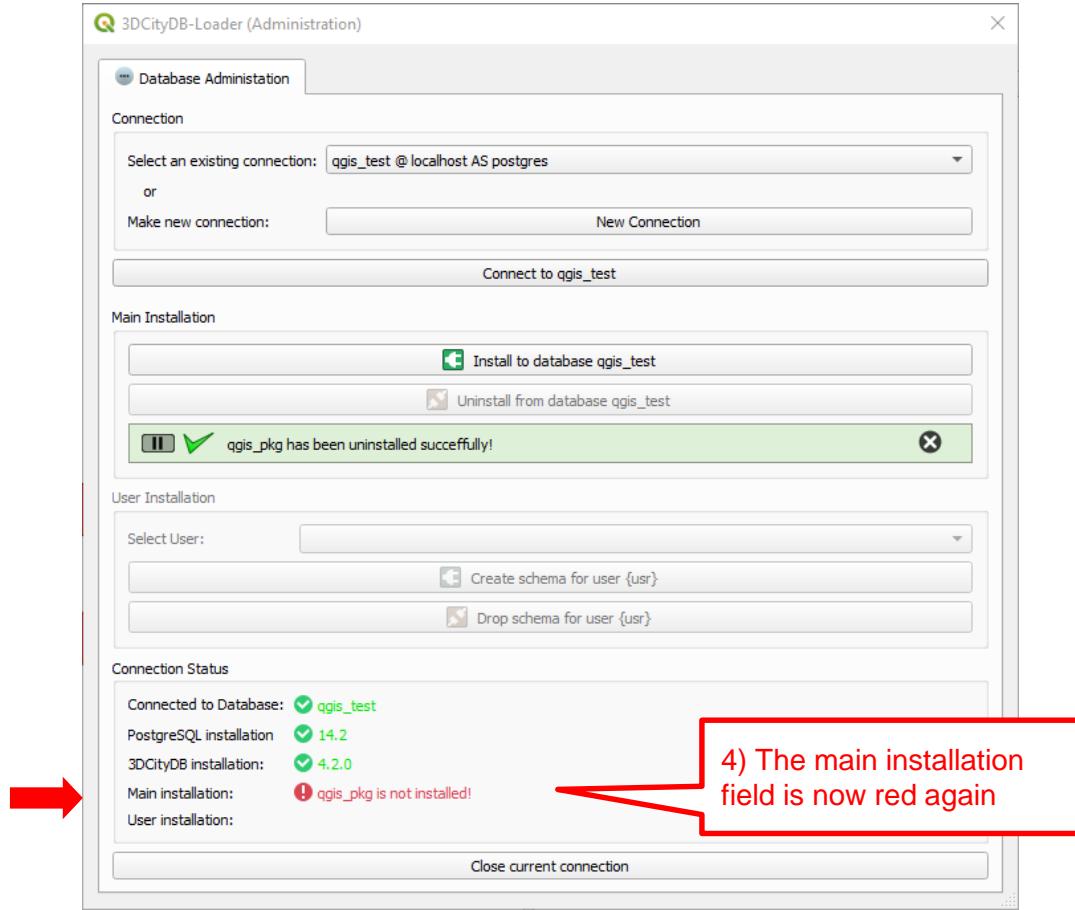
# Software uninstall: Uninstall QGIS Package

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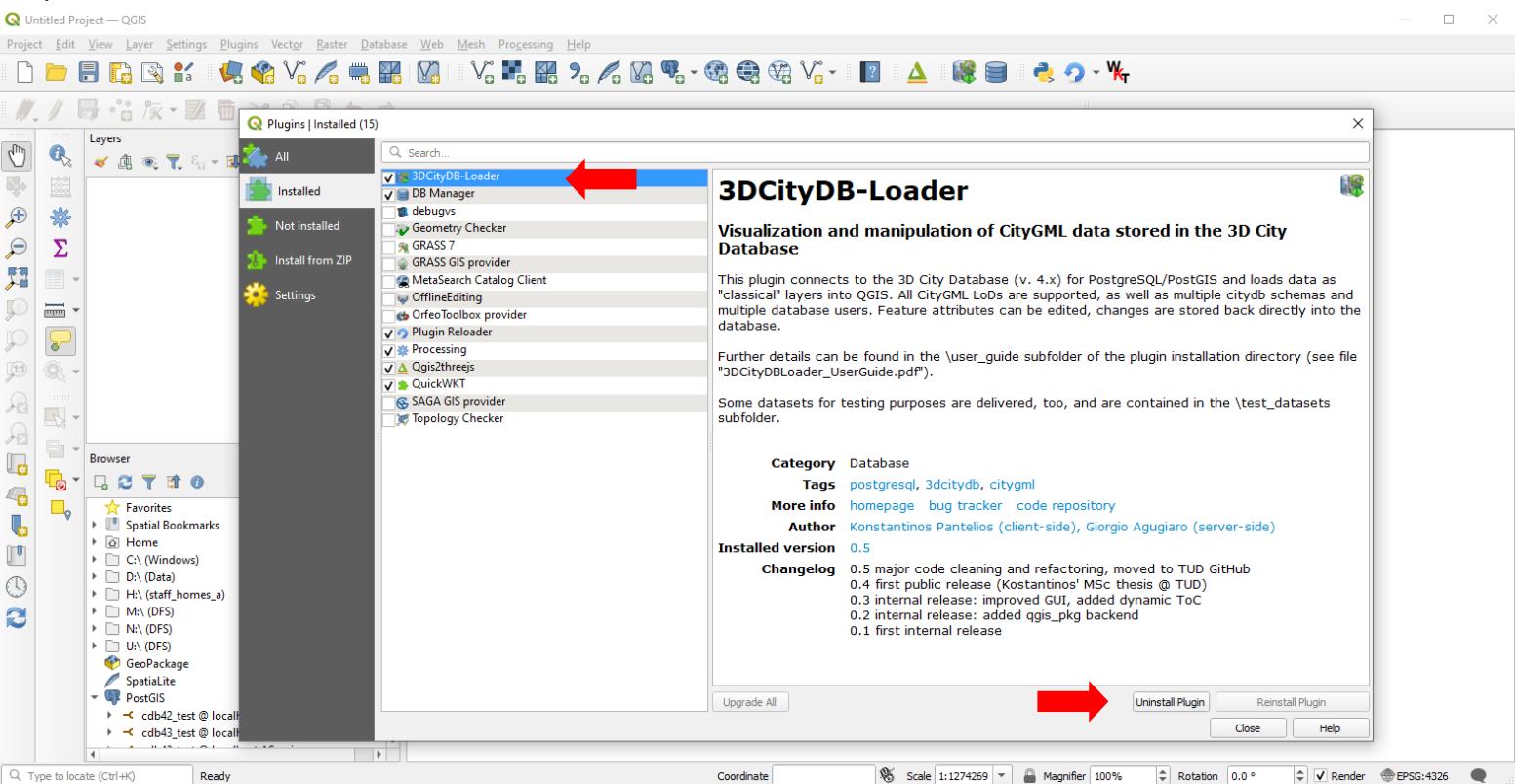
# Software uninstall: Uninstall QGIS Package

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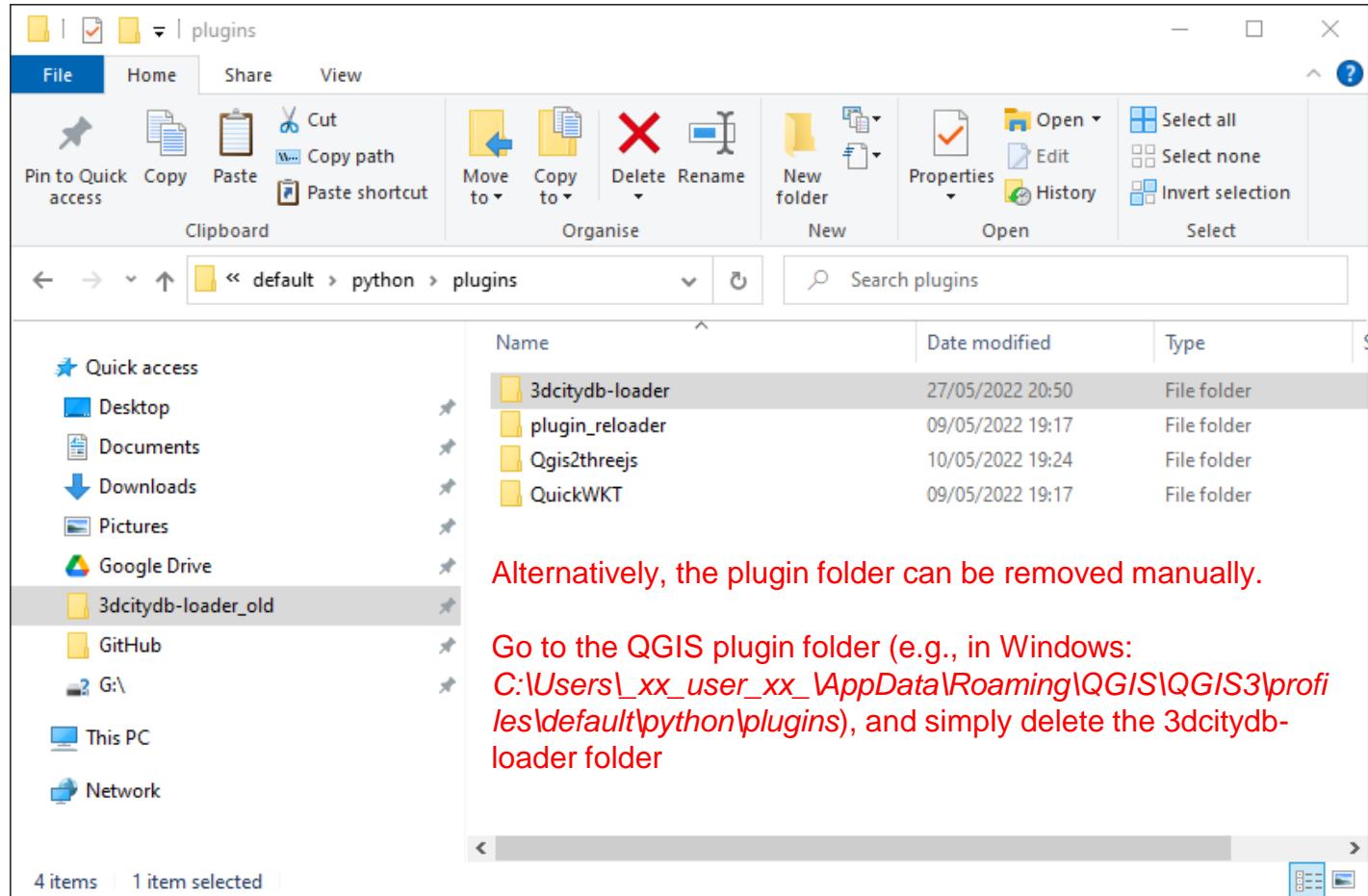
# Software uninstall: Uninstall 3DCityDB-Loader

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# Software uninstall: Uninstall 3DCityDB-Loader

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# Current limitations

**As of September 2022 (Plugin version 0.5)**

In general:

- CityGML appearances are not supported
- CityGML ADEs (Application Domain Extensions) are not supported

The QGIS Package does not support the following CityObjects

- Point-, breakline- and raster-based Relief features
- CityObjectGroups

# Current limitations

**As of September 2022 (Plugin version 0.5)**

In the 3DCityDB-Loader plugin, following functionalities are still missing

- GUI for advanced user management
- GUI for codelist/look-up table management and settings

In particular, when it comes to attributes editing

- The design of the attribute forms is still being improved
- Forms of children tables need redesign

# QGIS Package in a nutshell

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- It represents the server-side part of the QGIS plugin
- It can be installed and used independently from the QGIS plugin
  - E.g. with FME, or programmatically via Python, etc.
- It requires
  - PostgreSQL
  - An existing installation of the 3DCityDB (v. 4.x)
- All relevant entities are installed in the "qgis\_pkg" database schema
  - Database types
  - Triggers and trigger functions
  - Functions
  - Tables, mostly used as templates for the user schemas

# QGIS Package: As database administrator

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## Usage overview

- 1) Create user schemas, i.e. for each user a specific database schema is created. E.g.:
  - User "giorgio" -> schema "qgis\_giorgio"
  - User "kostantinos" -> schema "qgis\_kostantinos"
  - User "postgres" -> schema "qgis\_postgres"
  - Each user schema will be used only by the corresponding user
  - Each user schema is accessible only by the corresponding user (and the superusers)
  - In a user schema all necessary tables, updatable views, materialized views etc. will be created

## SQL examples

```
-- Create the schema for user "giorgio". It will create schema "qgis_giorgio" in the current database
SELECT qgis_pkg.create_qgis_usr_schema('giorgio');
```

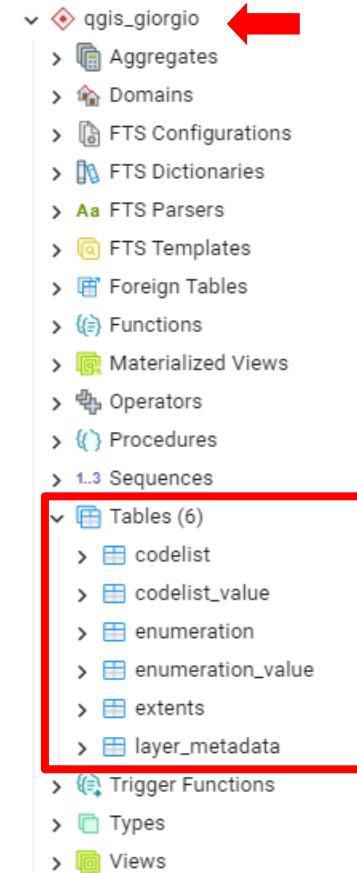
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## User schema overview

In each user schema (e.g. "qgis\_giorgio") some tables are generated upon schema creation:

- Table **LAYER\_METADATA** contains information about all generated and refreshed layers
- Table **EXTENTS** contains the bounding boxes of the citydb schemas, those of the materialized views, and those of the last QGIS session
- Tables **ENUMERATION** and **ENUMERATION\_VALUE** are used to store enumeration values
- Tables **CODELIST** and **CODELIST\_VALUE** are used to store codelist values. To add customized codelists, please refer to the previous slides on **advanced options** for more details.



# QGIS Package: As database administrator

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## Usage overview

- 2) Set the user privileges (see previous slides on **advanced options** for more details)

### SQL examples

-- Database user "giorgio" is added to group "qgis\_pkg\_usrgroup", can access data in citydb schema "citydb" of the current database with read-only privileges

```
SELECT qgis_pkg.grant_qgis_usr_privileges('giorgio', 'ro','citydb');
```

-- Database user "kostantinos" is added to group "qgis\_pkg\_usrgroup", can access data in citydb schema "citydb\_2" of the current database with read-write privileges

```
SELECT qgis_pkg.grant_qgis_usr_privileges('kostantinos ', 'rw','citydb_2');
```

-- Database user "camilo" is added to group "qgis\_pkg\_usrgroup", can access data in ALL citydb schemas of the current database with read-write privileges

```
SELECT qgis_pkg.grant_qgis_usr_privileges('camilo ', 'rw');
```

# QGIS Package: As database administrator

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## Usage overview

### 3) Drop a user schema

FIRST, revoke privileges of the user for all citydb schemas, THEN drop the user schema. Please refer to the previous slides on the **advanced options** for more details about user privileges.

#### SQL example

```
-- First revoke all ro/rw privileges of user "giorgio" for all citydb schemas
SELECT qgis_pkg.revoke_qgis_usr_privileges('giorgio');

-- Then drop the user schema
DROP SCHEMA qgis_giorgio CASCADE;
-- Optionally (if possible/necessary) remove user "giorgio" from the "qgis_pkg_usrgroup"
REVOKE qgis_pkg_usrgroup FROM giorgio;
```

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## Usage overview

- 4) Drop the qgis\_pkg schema and remove the QGIS Package completely

FIRST, revoke privileges of all users for all citydb schemas, THEN drop the qgis\_pkg schema. Please refer to the previous slides on the **advanced options** for more details about user privileges.

### SQL example

-- First revoke all ro/rw privileges of users "qgis\_user\_ro", "qgis\_user\_rw", "giorgio", etc. for all citydb schemas

**SELECT** qgis\_pkg.revoke\_qgis\_usr\_privileges('qgis\_user\_ro');

**SELECT** qgis\_pkg.revoke\_qgis\_usr\_privileges('qgis\_user\_rw');

**SELECT** qgis\_pkg.revoke\_qgis\_usr\_privileges('giorgio');

-- Then drop the qgis\_pkg schema

**DROP SCHEMA** qgis\_pkg **CASCADE**;

-- Optionally (if possible/necessary) remove users from the "qgis\_pkg\_usrgroup"

**REVOKE** qgis\_pkg\_usrgroup **FROM** qgis\_user\_ro, qgis\_user\_rw, giorgio;

-- Finally, remove the user group

**DROP GROUP** qgis\_pkg\_usrgroup;

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## Usage overview

- 1) Create layers with function **qgis\_pkg.create\_layers(...)**.
  - All materialized views and updatable views are created, but only if corresponding data exist in the database
  - The user can create layers only for selected CityGML modules using the similar functions:
    - **qgis\_pkg.create\_layers\_bridge(...)**
    - **qgis\_pkg.create\_layers\_building(...)**
    - ...
    - **qgis\_pkg.create\_layers\_waterbody(...)**
  - All functions are in schema qgis\_pkg and have the same signature (see next slide)

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## Usage overview

### Function

```
qgis_pkg.create_layers(usr_schema, cdb_schema [, perform_snapping] [, digits]
[, area_poly_min] [, bbox_corners_array] [, force_layer_creation])
```

Parameter	Type	Description
<b>usr_schema</b>	varchar	The database user schema, e.g. "qgis_giorgio".
<b>cdb_schema</b>	varchar	the citydb schema where data are stored, e.g. "citycb", or "citydb2".
<b>perform_snapping</b>	integer	DEFAULT 0 (i.e. disabled). If 1, geometry simplification is performed. Unused if perform_snapping is set to 0.
<b>digits</b>	integer	DEFAULT 3. Number of decimal positions to keep during geometry simplification. Unused if perform_snapping is set to 0.
<b>area_poly_min</b>	numeric	DEFAULT 0.001 [m <sup>2</sup> ]. Minimum polygon area during geometry simplification. Unused if perform_snapping is set to 0.
<b>bbox_corners_array</b>	numeric[]	DEFAULT Null, i.e. the extents of the whole <i>cdb_schema</i> . Otherwise, extents of the materialized views to be created, e.g. {x_min, y_min, x_max, y_max}. Coordinates must be in the same SRS as the <i>cdb_schema</i> !
<b>force_layer_creation</b>	boolean	DEFAULT False. Otherwise: force creation of all layers, also the empty ones.

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## Usage overview

### SQL examples

-- For user "giorgio", create all layers for existing data in citydb schema "citydb"

**SELECT** qgis\_pkg.create\_layers('giorgio', 'citydb');

-- For user "giorgio", create all layers for existing data in citydb schema "citydb2" and perform geometry simplification with 2 decimal places and 0.01 m<sup>2</sup> minimum area for polygons

**SELECT** qgis\_pkg.create\_layers('giorgio', 'citydb', 1, 2, 0.01);

-- For user "camilo", create all building module layers for existing data in citydb schema "vienna"

**SELECT** qgis\_pkg.create\_layers\_building('camilo', 'vienna');

-- For user "kostantinos", create all waterbody module layers for existing data in citydb schema "alderaan" within a certain bounding box

**SELECT** qgis\_pkg.create\_layers\_waterbody('kostantinos', 'alderaan', bbox\_corners\_array := '{10, 20, 110, 220}');

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## Usage overview

### SQL examples

-- The following query works, but actually it is not written in a user-friendly way.

```
SELECT qgis_pkg.create_layers('giorgio', 'citydb', 1, 2, 0.01);
```

-- In general, therefore, it is always a good habit to use **named parameters** when calling functions!

```
SELECT qgis_pkg.create_layers(  
    usr_name := 'giorgio',  
    cdb_schema := 'citydb',  
    perform_snapping := 1,  
    digits := 2,  
    area_poly_min := 0.01)
```

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## Usage overview

- 2) Refresh the materialized views with function **qgis\_pkg.refresh\_mvviews(...)**.
  - All materialized views created before will be refreshed. This is necessary every time the layers are generated (or re-generated using a different bounding box).
  - The user can refresh the materialized views only for selected CityGML modules using the similar functions:
    - **qgis\_pkg.refresh\_mvviews\_bridge(...)**
    - **qgis\_pkg.refresh\_mvviews\_building(...)**
    - ...
    - **qgis\_pkg.refresh\_mvviews\_waterbody(...)**
  - All functions are in schema qgis\_pkg and have the same signature (see next slide)

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## Usage overview

### Function

**qgis\_pkg.refresh\_mviews(usr\_schema, cdb\_schema)**

Parameter	Type	Description
<b>usr_schema</b>	varchar	The database user schema, e.g. "qgis_giorgio".
<b>cdb_schema</b>	varchar	the citydb schema where data are stored, e.g. "citycb", or "citydb2".

## SQL examples

-- In user schema "qgis\_giorgio", refresh all materialized views in citydb schema "citydb"

**SELECT** qgis\_pkg.refresh\_mviews('qgis\_giorgio', 'citydb');

-- In user schema "qgis\_kostantinos", refresh all waterbody module materialized views in citydb schema "alderaan"

**SELECT** qgis\_pkg.refresh\_mviews\_waterbody('qgis\_kostantinos', 'alderaan');

# QGIS Package: As user

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## Usage overview

- 3) Drop layers with function **qgis\_pkg.drop\_layers(...)**.
  - All existing layers in the selected user schema and related to the selected citydb schema will be dropped
  - The user can drop layers only for selected CityGML modules using the similar functions:
    - **qgis\_pkg.drop\_layers\_bridge(...)**
    - **qgis\_pkg.drop\_layers\_building(...)**
    - ...
    - **qgis\_pkg.drop\_layers\_waterbody(...)**
  - All functions are in schema qgis\_pkg and have the same signature (see next slide)

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## Usage overview

### Function

**qgis\_pkg.drop\_layers(usr\_schema, cdb\_schema)**

Parameter	Type	Description
<b>usr_schema</b>	varchar	The database user schema, e.g. "qgis_giorgio".
<b>cdb_schema</b>	varchar	the citydb schema where data are stored, e.g. "citycb", or "citydb2".

### SQL examples

-- In user schema "qgis\_giorgio", drop all layers related to citydb schema "citydb"

**SELECT** qgis\_pkg.drop\_layers('qgis\_giorgio', 'citydb');

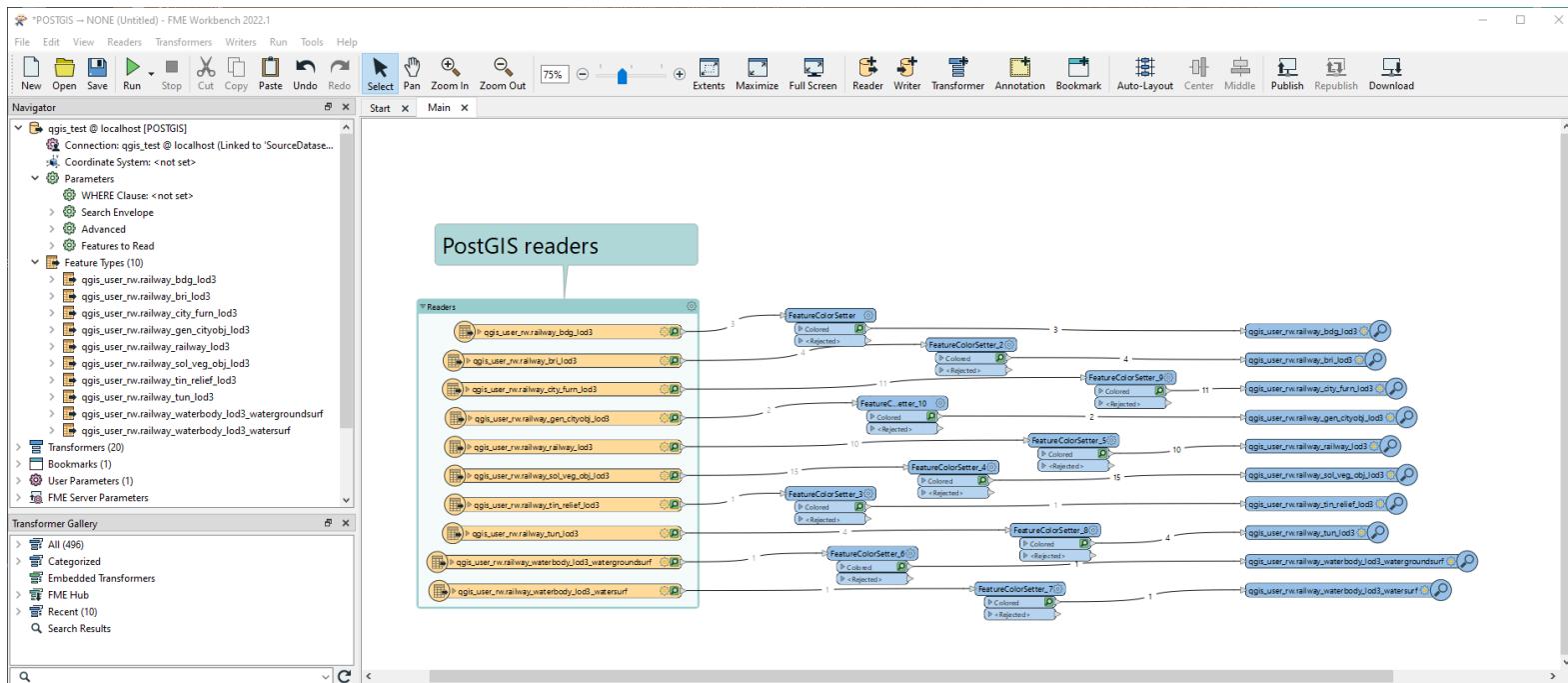
-- In user schema "qgis\_kostantinos", drop all waterbody module layers related to citydb schema "alderaan"

**SELECT** qgis\_pkg.drop\_layers\_waterbody('qgis\_kostantinos', 'alderaan');

# QGIS Package via FME

- This is a simple example of how the QGIS package can be used via FME
  - Simply connect to the 3D City Database and import the views with a PostGIS reader

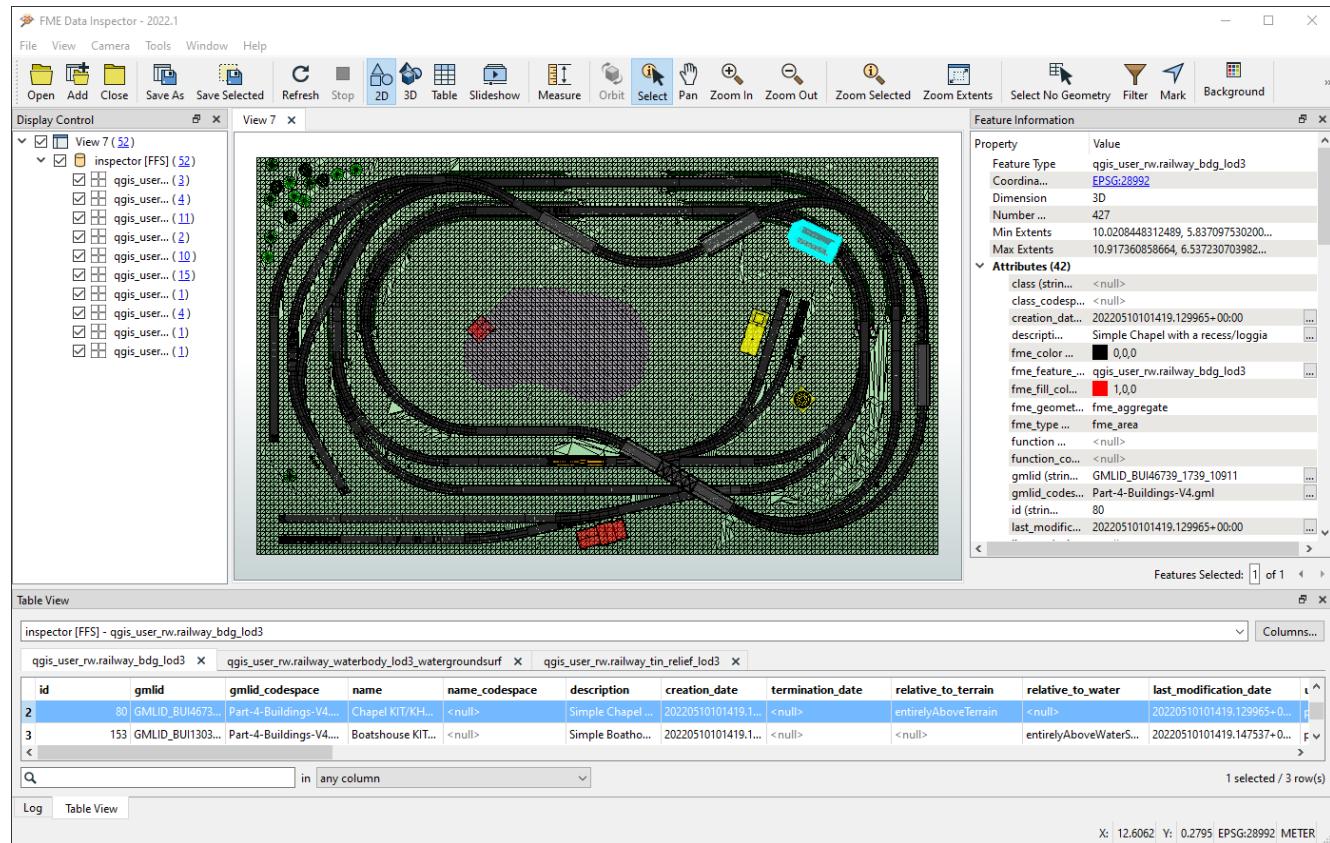
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# QGIS Package via FME

- 2D visualisation via FME Data Inspector

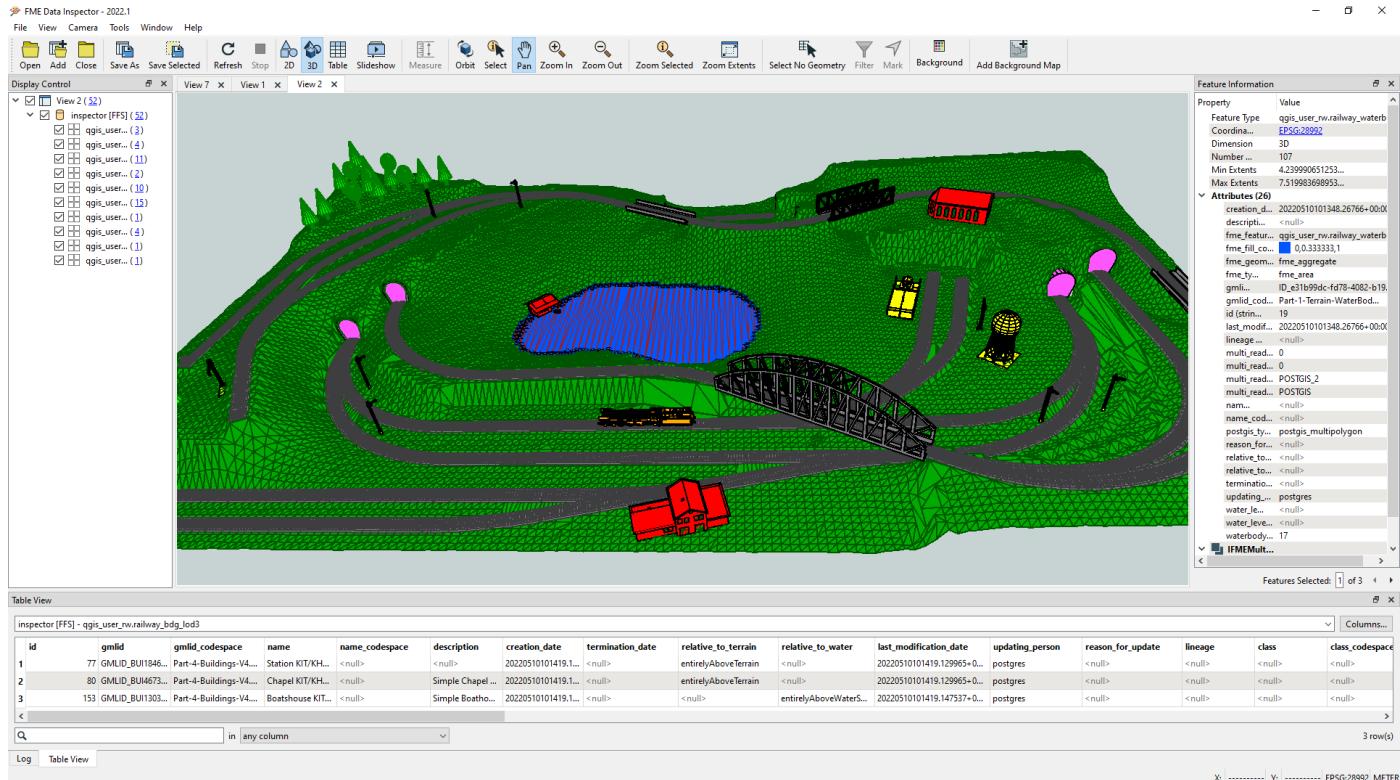
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# QGIS Package via FME

- 3D visualisation via FME Data Inspector

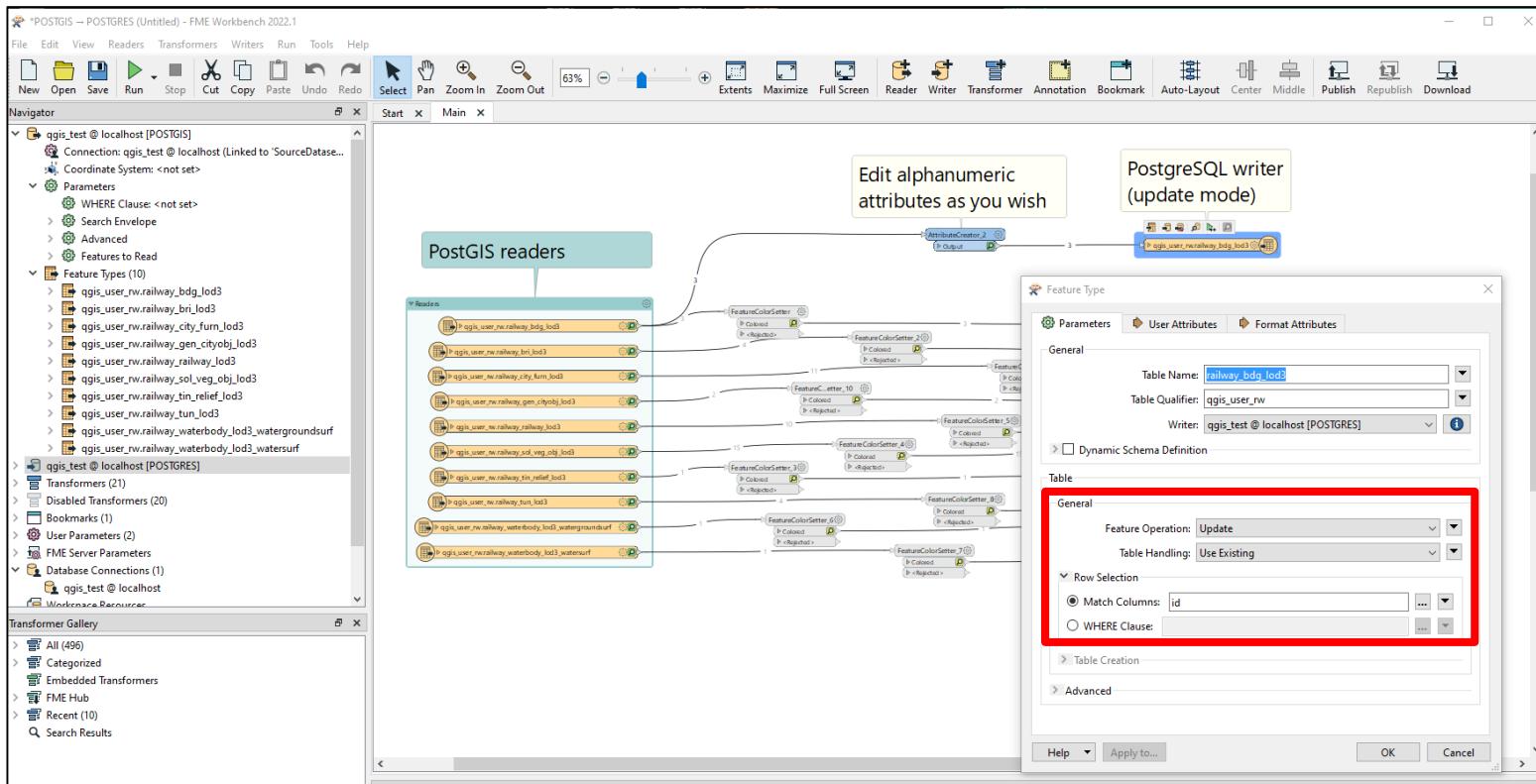
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# QGIS Package via FME

- Remember: alphanumeric attributes in the views are updatable!! 😊
- You will need a PostgreSQL writer in *update mode*

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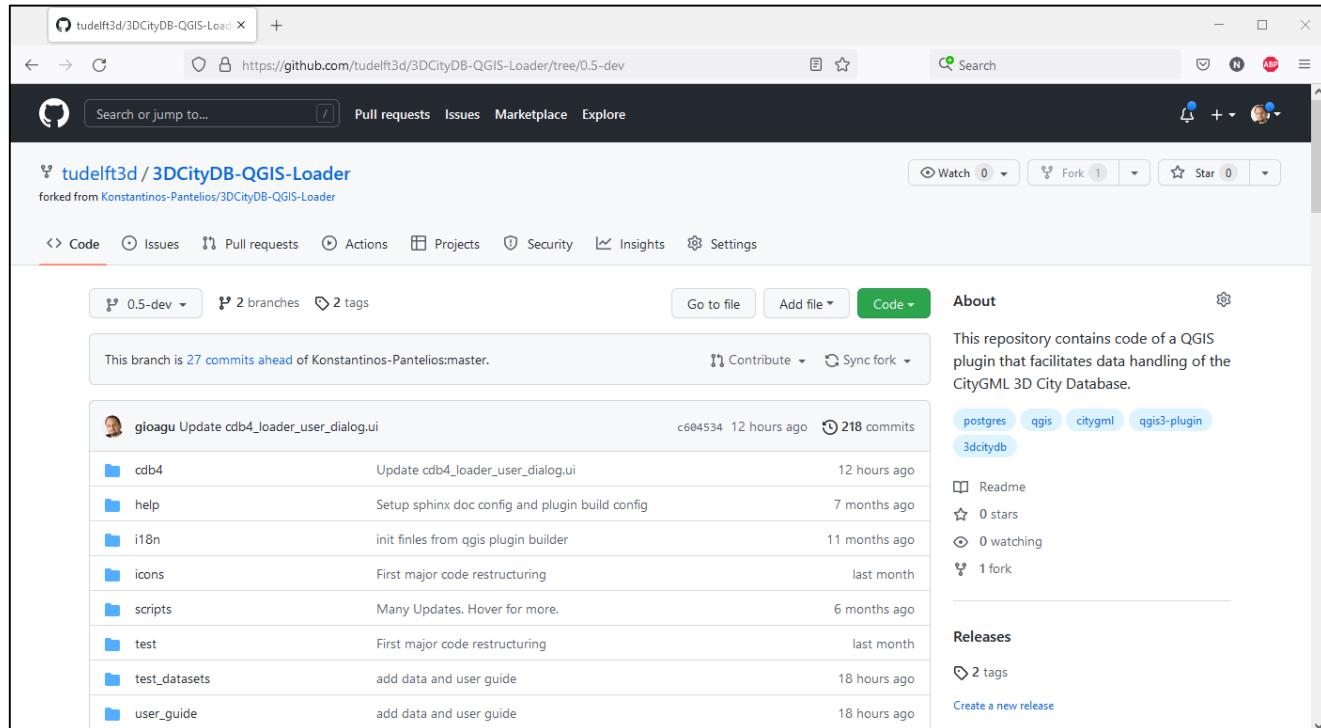


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## Source code and GitHub repository

- GitHub: <https://github.com/tudelft3d/3DCityDB-QGIS-Loader>



The screenshot shows the GitHub repository page for `tudelft3d / 3DCityDB-QGIS-Loader`. The repository was forked from `Konstantinos-Pantelios/3DCityDB-QGIS-Loader`. The main branch is `0.5-dev`, which is 27 commits ahead of the `master` branch. The repository has 2 branches and 2 tags. The last commit was made 12 hours ago by `gioagu`, updating the `cdb4_loader_user_dialog.ui` file. Other recent commits include updates to `help`, `i18n`, `icons`, `scripts`, `test`, `test_datasets`, and `user_guide`. The repository has 0 stars, 0 watching, and 1 fork. It includes tags for `postgres`, `qgis`, `citygml`, `qgis3-plugin`, and `3dcitydb`. The `About` section describes it as a QGIS plugin for CityGML 3D City Database.

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## Test datasets

- In the QGIS plugin folder, you will find 3 test datasets that you can import into the 3DCityDB (using the Importer/Exporter) to test the 3DCityDB-Loader plugin. They are located in subfolder \test\_datasets
- The test datasets are:
  - CityGML\_2.0\_Test\_Dataset\_2022-03-11.zip (aka "Railway")
  - FZK-Haus-LoD-all-KIT-IAI-KHH-B36-V1.zip (aka "Kit House")
  - DenHaag\_bdg\_lod2
- You can find links to lots of additional free and open datasets at:
  - Awesome CityGML: <https://github.com/OloOcki/awesome-citygml>
  - 3D Geoinformation group @ TU Delft: <https://3d.bk.tudelft.nl/opendata/opencities/>

# Thank you for your attention!



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