



# 3DCityDB Tools

*for*

# QGIS

## Installation and user guide

Version 0.8.4

Last update: 28 August 2023

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# Motivation

## Motivation

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### IDEA:

- **CityGML 3D City Database:** Why not letting users benefit from *directly* working with the 3DCityDB?
  - No need to work with files
  - Editing of features attributes could become way easier
  - SQL/relational model are rather well-known in and outside the GIS 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 citydb schemas in the same database instance (aka "scenarios")
- 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!)

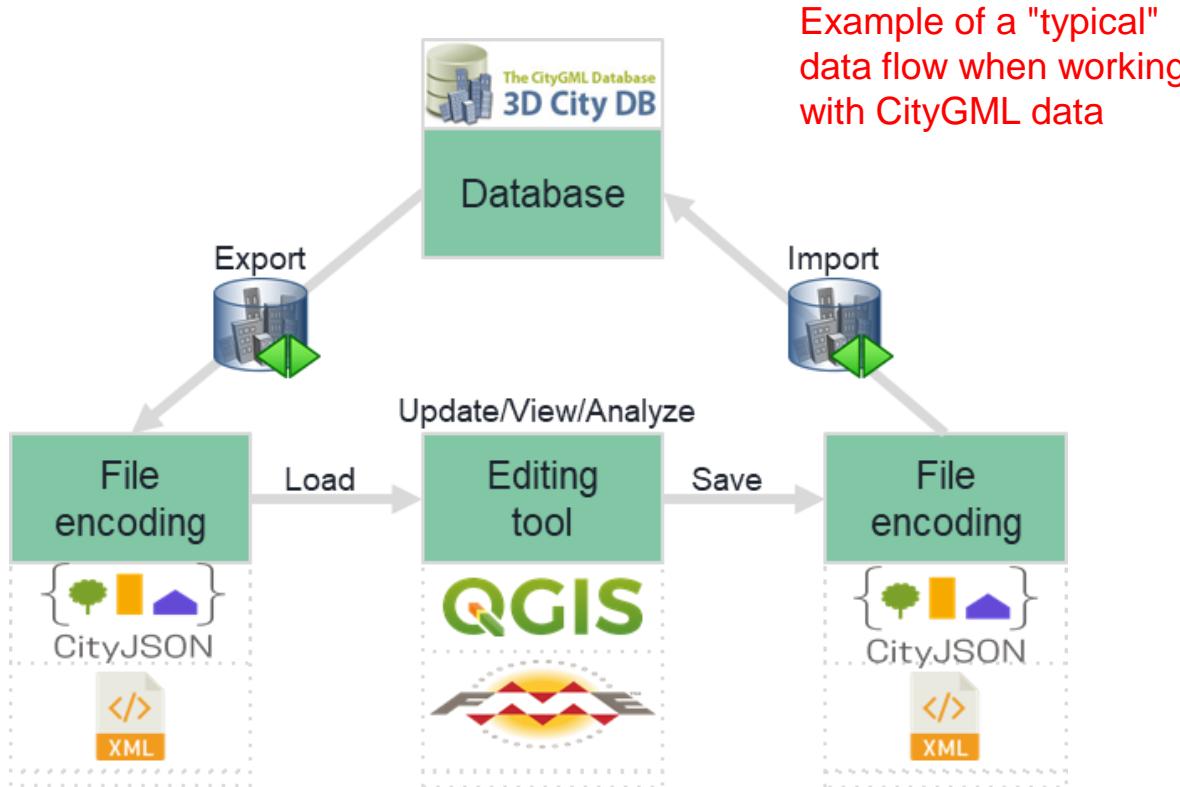
# Motivation

SO:

- Why not using **QGIS**?
  - Well-known and established open-source software
  - Rather mature, version 3.28 LTR released in autumn 2022, well documented
  - Native support for PostgreSQL/PostGIS, and for Oracle Spatial
  - Has strong 2D and some (less mature) 3D visualisation functionalities
  - Can be extended with Python-based plugins

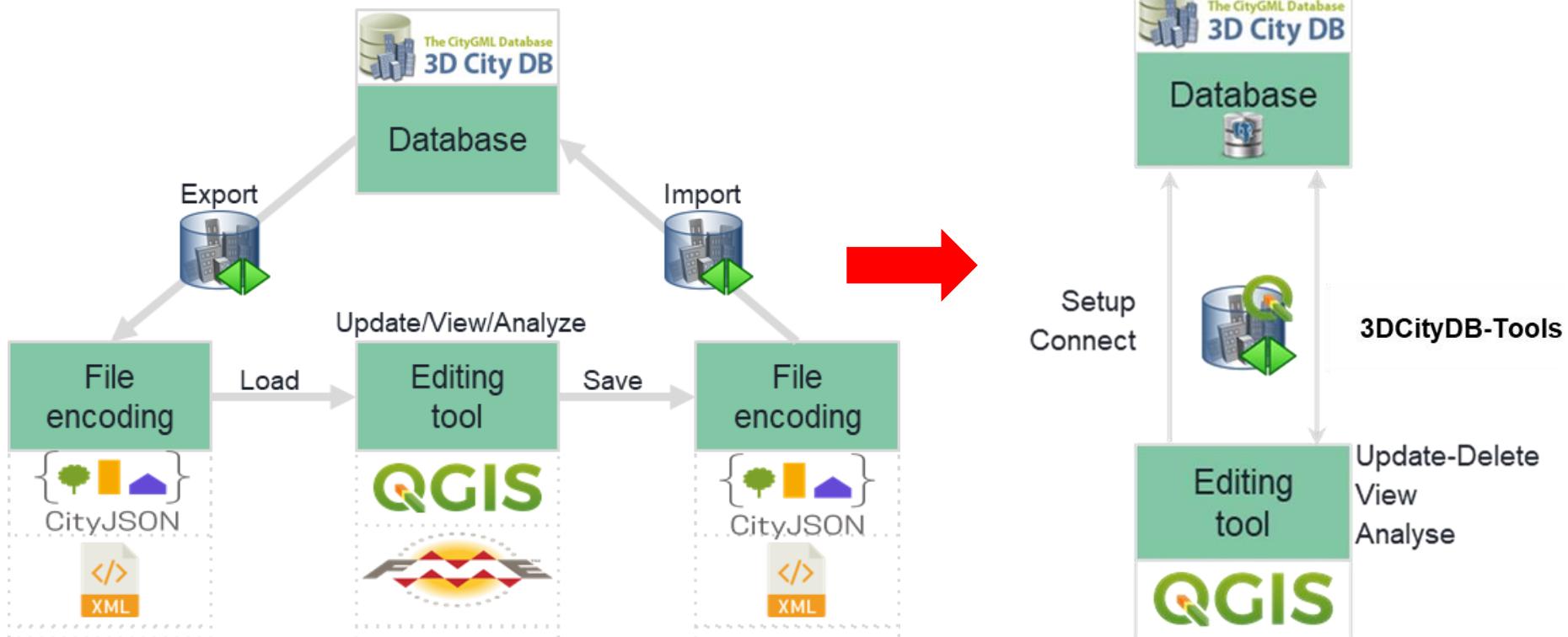


# Motivation



# Motivation

Vision / goal of the plugin



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# Plugin overview

## Main functionalities

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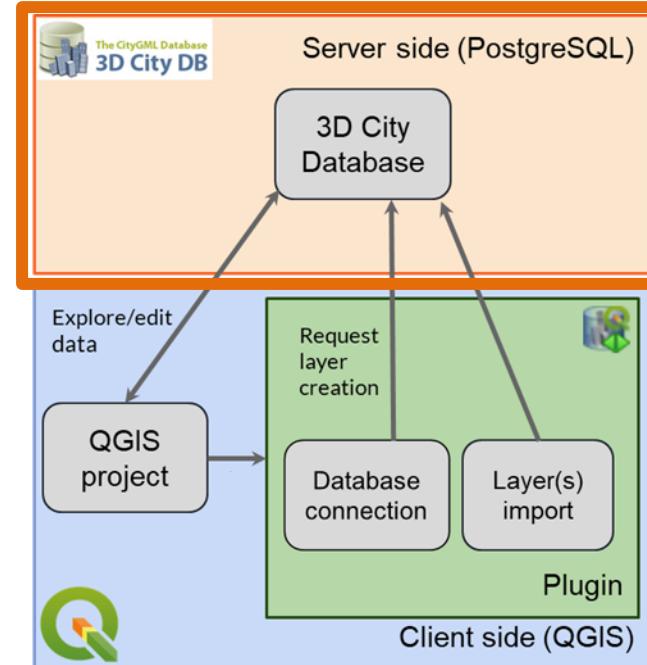
- Create "**SFS-like layers**" to hide 3DCityDB complexity when interacting with data
  - Deal efficiently with multi-LoD / different geometries / implicit representations
    - Up to ≈600 possible combinations in CityGML!
  - Merge all standard attributes of a CityObject into a single "table"
- **Deal with the possibly huge size of city models** stored in a database
- Support for **multiple citydb schemas** in the same 3DCityDB instance
- 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

# Plugin overview

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## Server-side PostgreSQL "QGIS Package"

- Creates and manages layers as views (for attributes) linked to materialized views (for geometry) following the SFS model
- Manages
  - users and privileges
  - multiple citydb schemas
- Adds default users with ro & rw privileges



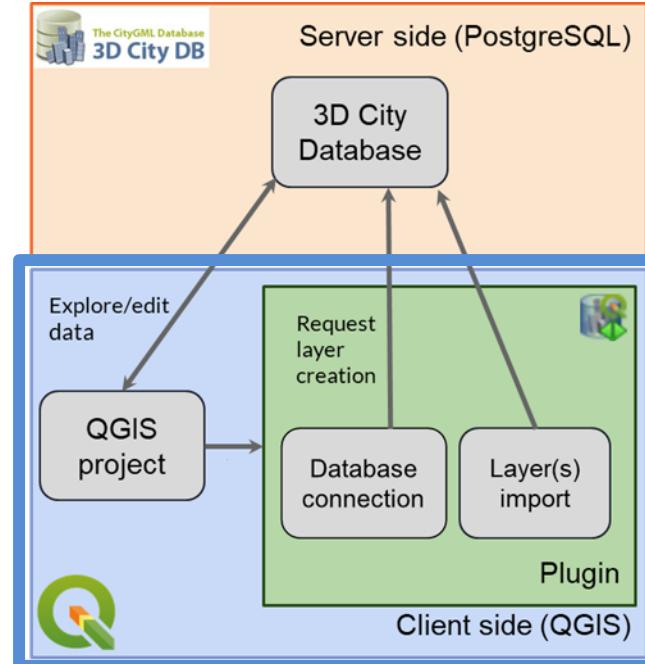
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## Client-side

### QGIS plugin “3DCityDB-Tools”

- Manages database connections + installation of the **QGIS Package**
- Allows for GUI-based
  - layer creation and management
  - management of multiple citydb schemas
  - editing of feature attributes
- GUI includes
  - support for children tables (e.g. generic attributes)
  - CityGML enumerations
  - Codelists
- Creates a hierarchical Table of Contents



# IMPORTANT NOTICE

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

In particular you should:

- 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:

- Refer to the slides in "**3DCityDB\_Suite\_QuickInstall.pdf**" (also in the same folder of this file) and/or
- Follow the tutorial: <https://github.com/3dcitydb/tutorials>

Last but not least...

- You may profit from a basic knowledge of the main CityGML concepts 😊
- Otherwise, here a crash course for free: <http://www.urbangeobigdata.it/?p=195>

# Installation

## Software requirements

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- CityGML 3D City Database **v. 4.x** for PostgreSQL
  - <https://github.com/3dcitydb/3dcitydb-suite/releases>
  - <https://3dcitydb-docs.readthedocs.io/en/latest/>
  - **BEWARE:** 3DCityDB v. 3.x and older are NOT supported!
- PostgreSQL **v. 10 or higher**, PostGIS **v. 2.0 or higher**
  - <https://www.postgresql.org/download/>
  - **BEWARE:** NOT compatible with older versions
- QGIS **v. 3.22 LTR or v. 3.28 LTR**
  - <https://qgis.org/en/site/forusers/download.html>
  - **BEWARE:** Not tested/not supported with other versions
- PgAdmin (suggested, not required)
  - <https://www.pgadmin.org/download/>

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## Compatibility matrix

QGIS version	3DCityDB-Tools works?	Comments
QGIS 3.30, 3.32	✓	Should work, but not supported
<b>QGIS 3.28 LTR</b>	✓	<b>Works</b>
QGIS 3.26, 3.24	✓	Should work, but not supported
<b>QGIS 3.22 LTR</b>	✓	<b>Works. Reference version used for development</b>
QGIS 3.20	✗	May work, but not supported
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

Machines used for development and testing:

OS	Processor(s)	HD	RAM	PostgreSQL	PostGIS
Windows 10 21H2 64bit	Core i7-8650U 1.7 GHz	SSD 2 TB	32 GB	14, 64bit	3.2
Ubuntu 20.04.3 LTS 64bit	Intel i7-7500U (4) 3.500GHz	SSD 250 GB	8 GB	12, 64bit	3.1
Mac OS (11.6.2 64bit)	Core i9-9980HK	HDD 1TB	32 GB	14, 64bit	3.1
Ubuntu 18.4 LTS 64bit	Virtual Machine	HDD 2 TB	16 GB	10, 64bit	3.0
Windows 10 22H2 64bit	Core i7-8565U 1.8 GHz	SSD 250GB + HDD 1 TB	16 GB	15, 64 bit	3.1
Ubuntu 22.04 LTS 64bit	Virtual Machine	100 GB	8 GB	14, 64 bit	3.2

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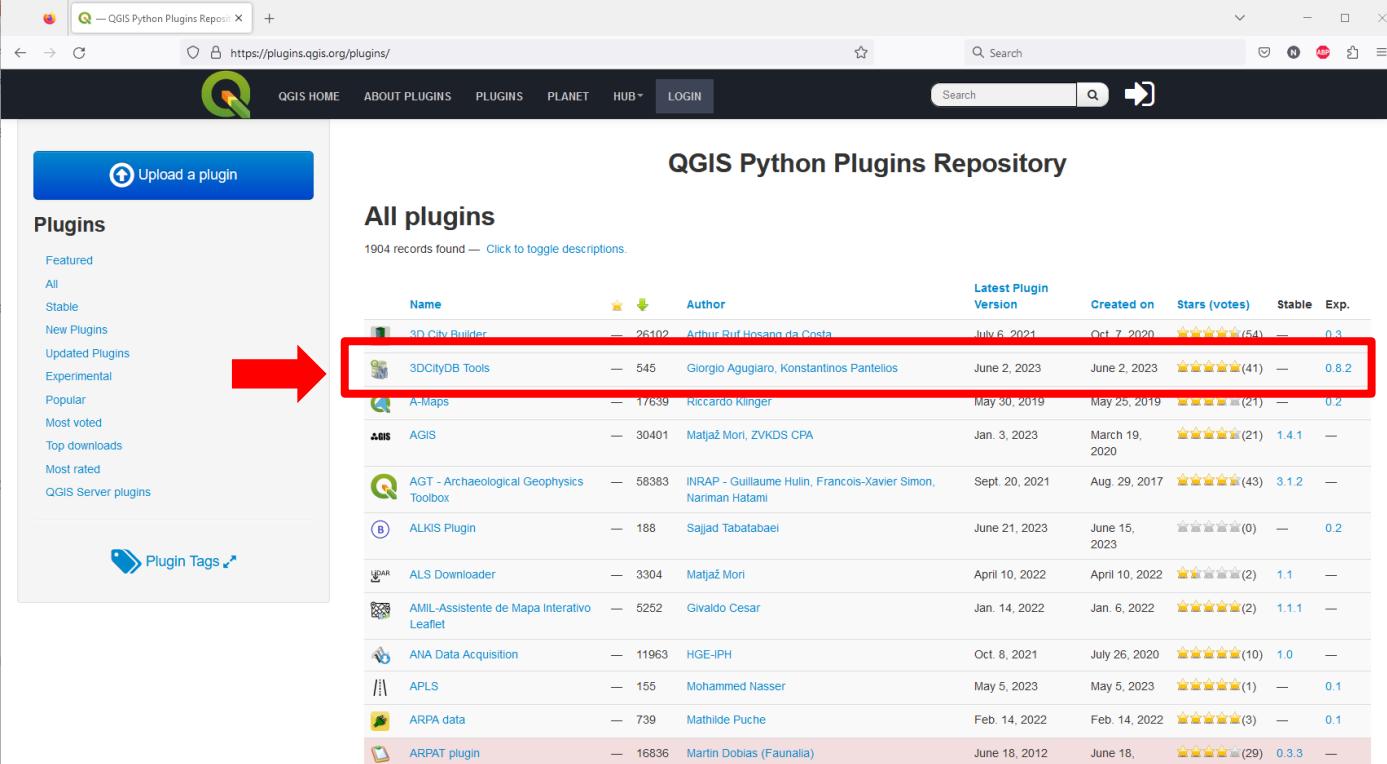
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# Installation via QGIS Plugins repository

Since version 0.8.2, the plugin is available also via the **QGIS Plugins repository**. This is the preferred (and easiest!) way to install it! Link: <https://plugins.qgis.org/plugins/>

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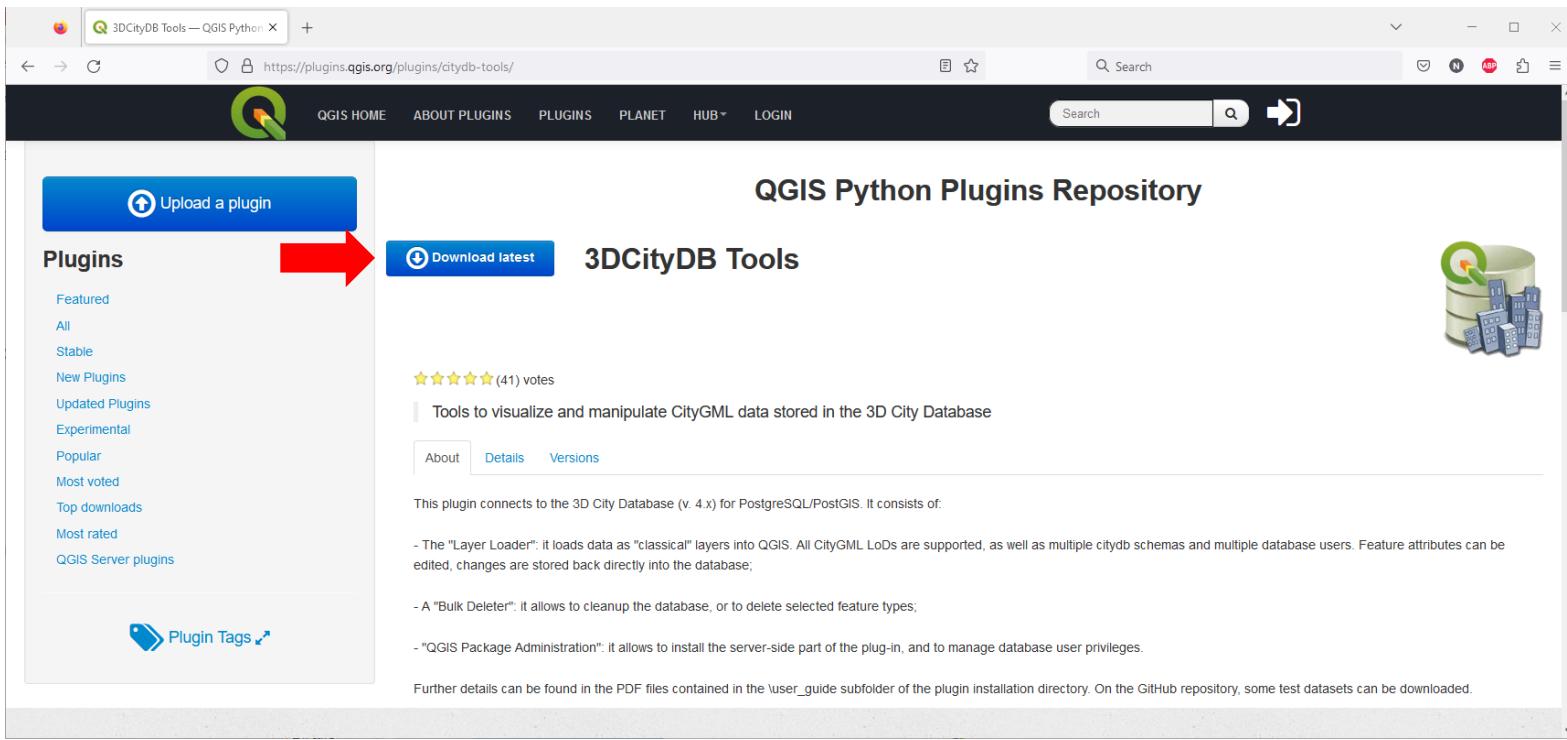


The screenshot shows the QGIS Python Plugins Repository website. On the left, there's a sidebar with a 'Upload a plugin' button and a 'Plugins' section containing various filter options like 'Featured', 'All', 'Stable', 'New Plugins', etc. Below that is a 'Plugin Tags' section. On the right, the main content area is titled 'QGIS Python Plugins Repository' and shows a table of 'All plugins'. The table has columns for Name, Author, Latest Plugin Version, Created on, Stars (votes), Stable, and Exp. A red arrow points from the sidebar towards the plugin list, and a red box highlights the '3DCityDB Tools' plugin, which has a red circle around it. The '3DCityDB Tools' row shows 545 downloads, was created on June 2, 2023, and has a rating of 4.8 stars.

Name	Author	Latest Plugin Version	Created on	Stars (votes)	Stable	Exp.
3DCityDB Tools	Giorgio Agugiaro, Konstantinos Pantelios	June 2, 2023	June 2, 2023	4.8 (41)	—	0.8.2
A-Maps	Riccardo Klinger	May 30, 2019	May 25, 2019	4.0 (21)	—	0.2
AGIS	Matjaž Mori, ZVKDS CPA	Jan. 3, 2023	March 19, 2020	4.5 (21)	1.4.1	—
AGT - Archaeological Geophysics Toolbox	INRAP - Guillaume Hulin, Francois-Xavier Simon, Naiman Hatami	Sept. 20, 2021	Aug. 29, 2017	4.5 (43)	3.1.2	—
ALKIS Plugin	Sajjad Tabatabaei	June 21, 2023	June 15, 2023	4.0 (0)	—	0.2
ALS Downloader	Matjaž Mori	April 10, 2022	April 10, 2022	4.0 (2)	1.1	—
AMIL-Assistente de Mapa Interativo Leaflet	Givaldo Cesar	Jan. 14, 2022	Jan. 6, 2022	4.0 (2)	1.1.1	—
ANA Data Acquisition	HGE-IPH	Oct. 8, 2021	July 26, 2020	4.5 (10)	1.0	—
APLS	Mohammed Nasser	May 5, 2023	May 5, 2023	5.0 (1)	—	0.1
ARPA data	Mathilde Puche	Feb. 14, 2022	Feb. 14, 2022	4.5 (3)	—	0.1
ARPAT plugin	Marlin Dobias (Faunalia)	June 18, 2012	June 18, 2012	4.5 (29)	0.3.3	—

# Installation via QGIS Plugins repository

Simply select it, and download it. If QGIS is already installed, it will be loaded automatically to the right folder. Done! ☺



The screenshot shows a web browser window displaying the QGIS Python Plugins Repository at <https://plugins.qgis.org/plugins/citydb-tools/>. The page features a sidebar on the left with a 'Plugins' section containing various filter options like 'Featured', 'All', 'Stable', etc. A red arrow points from the 'Plugins' section towards the central content area. The main content area is titled 'QGIS Python Plugins Repository' and displays the '3DCityDB Tools' plugin. It includes a thumbnail icon of a green cylinder with buildings, a rating of 4.1 stars, and a brief description: 'Tools to visualize and manipulate CityGML data stored in the 3D City Database'. Below the description are tabs for 'About', 'Details', and 'Versions'. The 'Details' tab is selected. The page also contains a list of bullet points detailing the plugin's features, such as connecting to the 3D City Database and supporting PostgreSQL/PostGIS. At the bottom, there is a note about PDF files and GitHub datasets.

Simply select it, and download it. If QGIS is already installed, it will be loaded automatically to the right folder. Done! ☺

Upload a plugin

Plugins

Download latest

QGIS Python Plugins Repository

3DCityDB Tools

4.1 (41) votes

Tools to visualize and manipulate CityGML data stored in the 3D City Database

About Details Versions

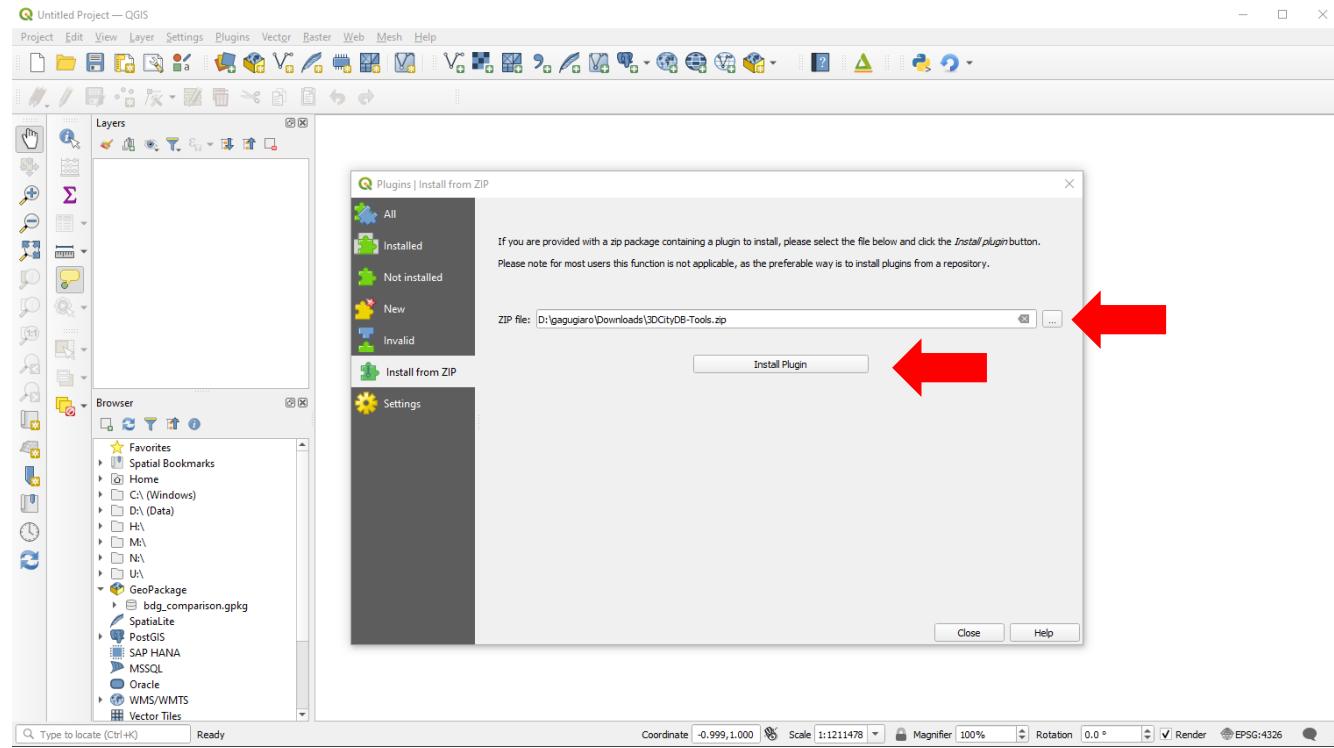
This plugin connects to the 3D City Database (v. 4.x) for PostgreSQL/PostGIS. It consists of:

- The "Layer Loader": it loads data as "classical" layers into QGIS. All CityGML LoDs are supported, as well as multiple citydb schemas and multiple database users. Feature attributes can be edited, changes are stored back directly into the database;
- A "Bulk Deleter": it allows to cleanup the database, or to delete selected feature types;
- "QGIS Package Administration": it allows to install the server-side part of the plug-in, and to manage database user privileges.

Further details can be found in the PDF files contained in the `user_guide` subfolder of the plugin installation directory. On the GitHub repository, some test datasets can be downloaded.

# Manual installation

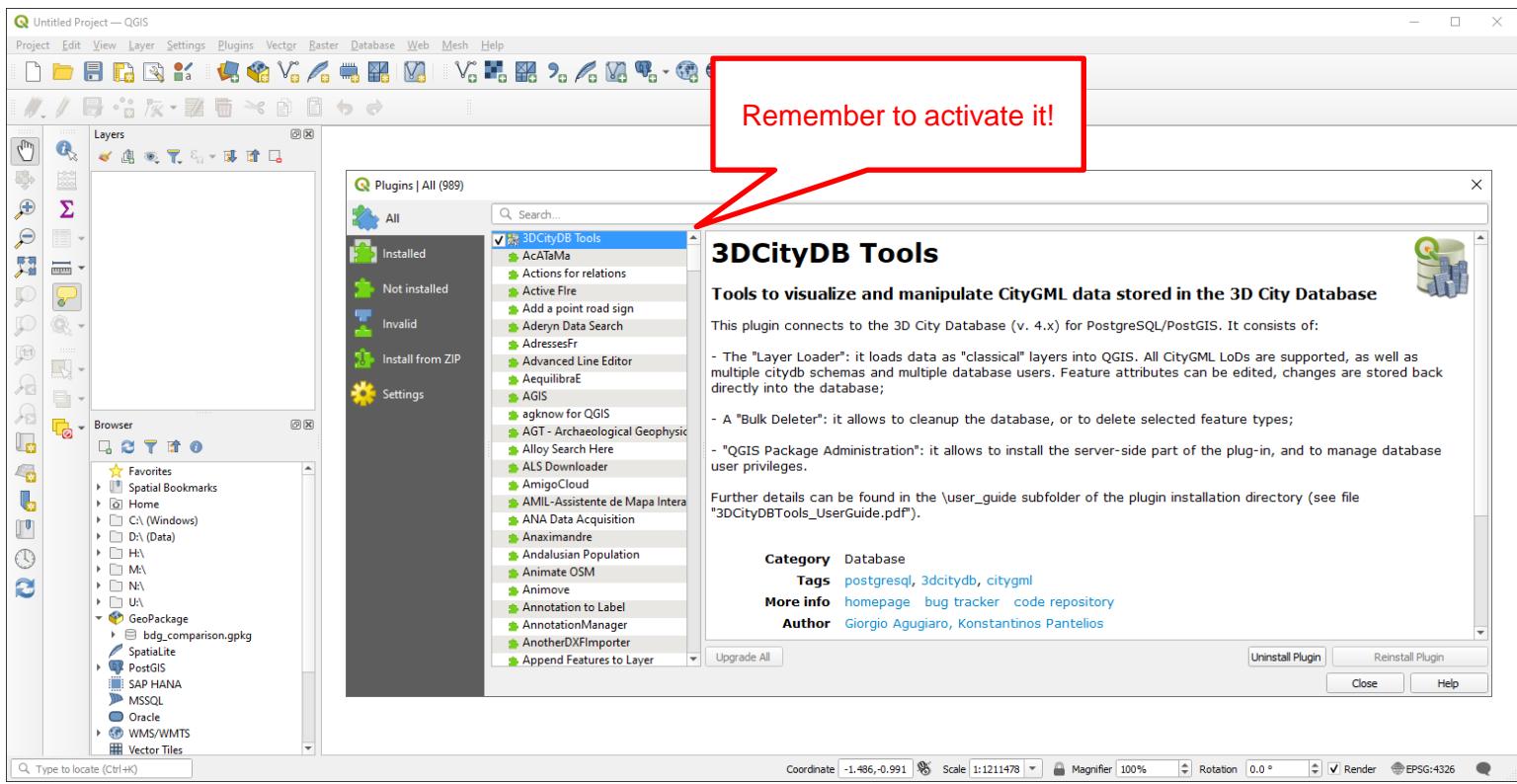
- The plugin is available also as **zip file** from the **GitHub repository**
- In QGIS, open the Plugins\Manage and install plugins window, and choose "Install from ZIP". Select the zip file and click the "Install Plugin" button



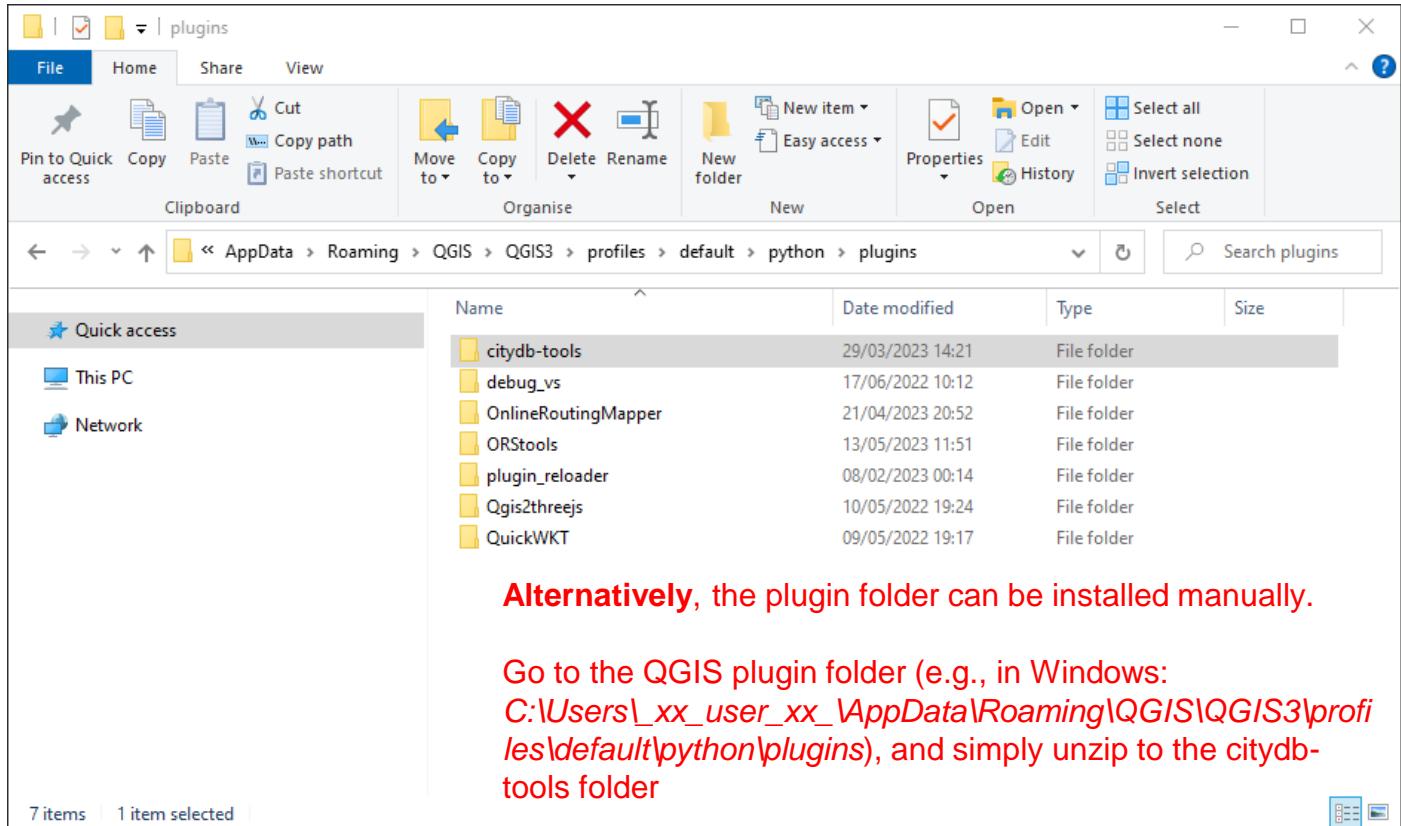
# Manual installation

- Upon installation, you must activate the plugin

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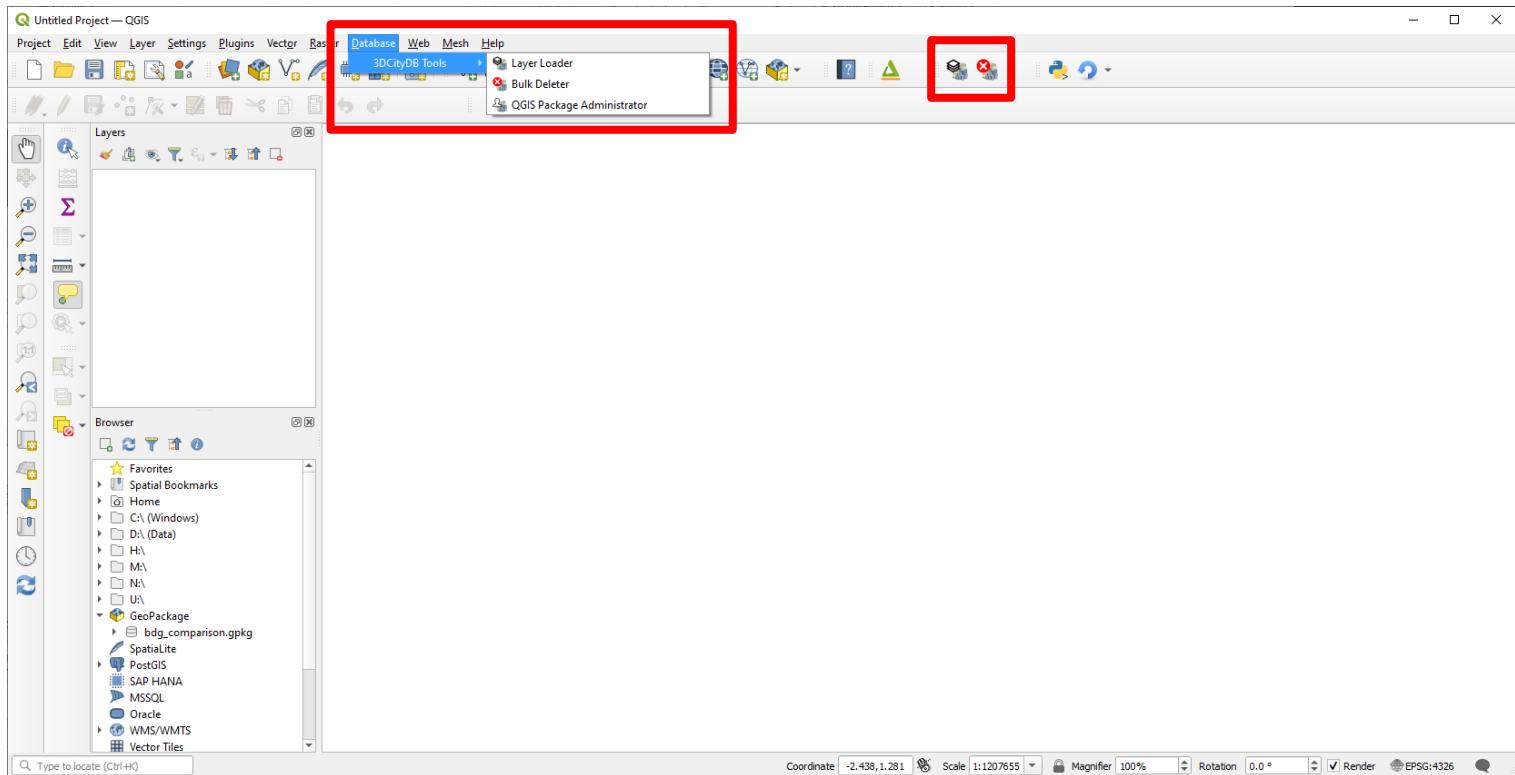


# Manual installation



# Front-end installation

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



# Back-end installation

The back-end installation consists in installing the **QGIS Package** into a 3DCityDB instance. It can be carried out using the "QGIS Package Administrator" GUI of the front-end. The **database administrator** is responsible for setting up in advance the server-side for *any* database user.

In general, **4 steps** are necessary:

- a) Installation of the QGIS Package (i.e. the "qgis\_pkg" schema)
- b) Selection of the database users (e.g. "giorgio")
- c) Creation of a user schema for each selected user (e.g. "qgis\_giorgio")
- d) Definition of the database privileges for each user and for each citydb schema (i.e. "read-only", "read & write", "none")

It is possible to perform:

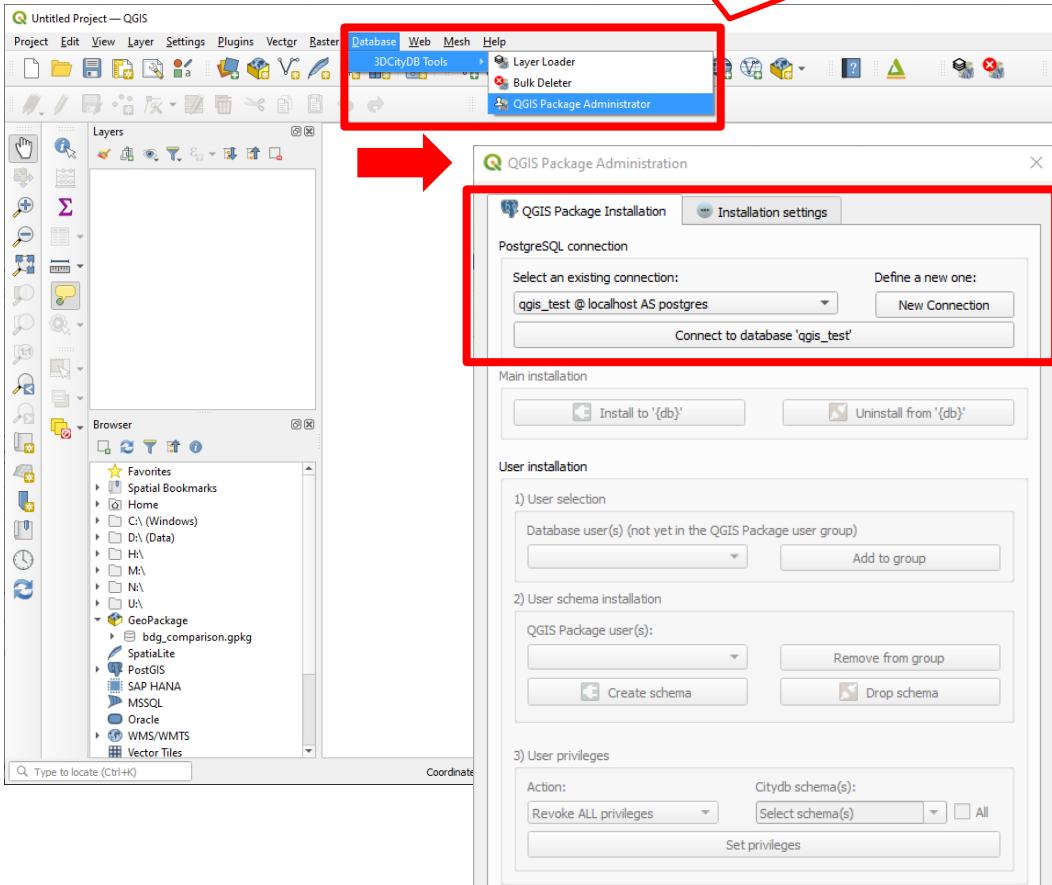
- A "**simplified installation**", which carries out all 4 operation at once and automatically installs 2 default users
- A "**normal installation**", where the administrator has complete control over each step

# Back-end installation

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As **database administrator**  
(e.g. "postgres"):

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



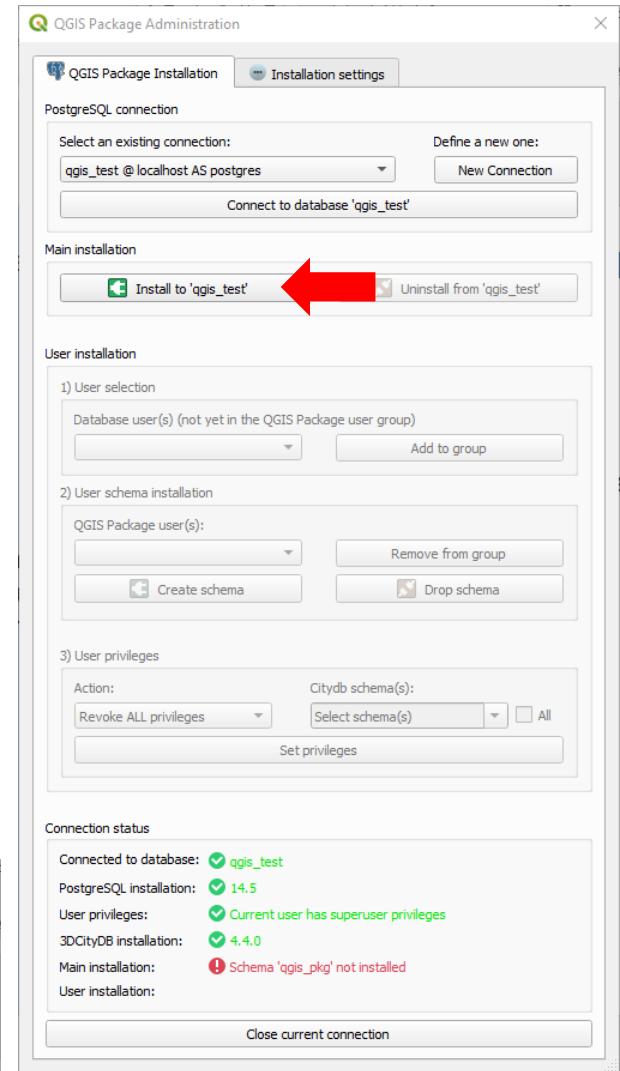
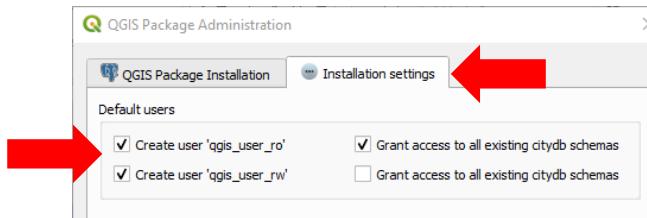
# Back-end installation

## 2.1) "Simplified" installation

The QGIS Package and up to two default users are installed at once:

- User "`qgis_user_ro`" with read-only privileges
- User "`qgis_user_rw`" with read & write privileges
- Both users have access to all citydb schemas in the database at the moment of the installation
- **Note bene:** Their privileges and access rules can be changed at *any* time after installation. See later the "normal"-installation slides

Before clicking the Install button, go to the "Installation settings" tab and check the desired options

A screenshot of the QGIS Package Administration dialog. The 'QGIS Package Installation' tab is selected. In the 'Main installation' section, there are two buttons: 'Install to 'qgis\_test'' (with a green arrow icon) and 'Uninstall from 'qgis\_test''. A red arrow points to the 'Install to' button. Below this, under 'User installation', there are sections for 'User selection', 'User schema installation', and 'User privileges'. At the bottom, the 'Connection status' section shows 'Connected to database: qgis\_test' and other status indicators.

# Back-end installation

## 2.1) "Simplified" installation

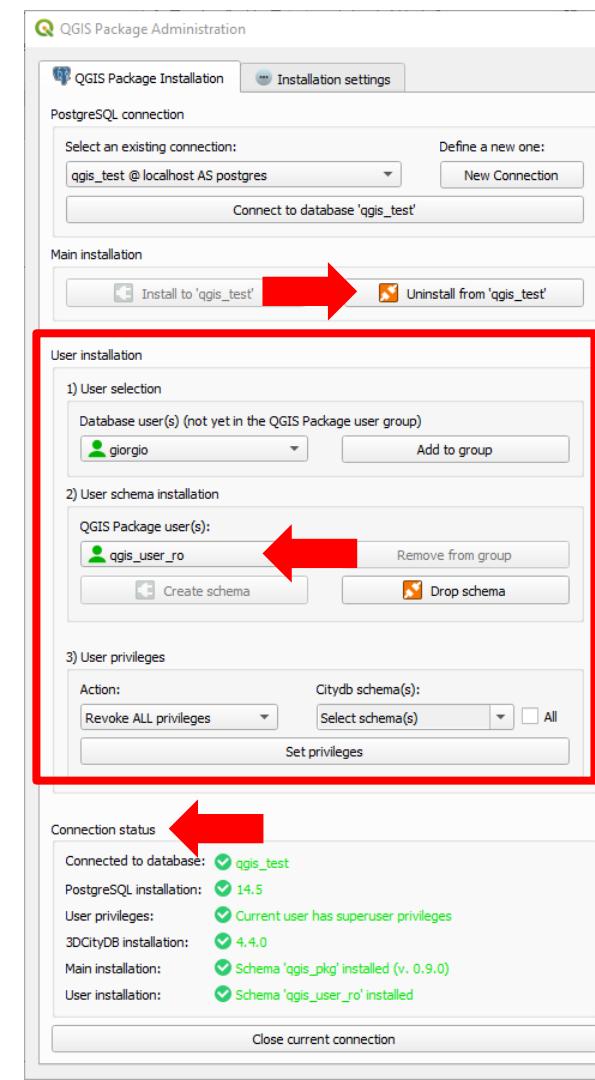
Upon successful installation:

- The **Uninstall button** is activated (in case you want to uninstall the QGIS Package)
- The **User Installation box** is activated
- You are notified in the **Connection status**

**Done!** 😊 Close the "QGIS Package Administration" GUI. You can now start using the plugin (e.g. the "Layer Loader" or the "Bulk Deleter") using the credentials of one of the default users

Please observe that:

- The default user(s) are automatically added to the **QGIS Package user(s)**
- You can edit the privileges in the **User privileges box**, or leave them as they are



# Back-end installation

## 2.1) "Simplified" installation

In the 3DCityDB, the **qgis\_pkg** schema is added and, depending on the chosen options, the **qgis\_user\_ro** and/or the **qgis\_usr\_rw** schemas are created, too

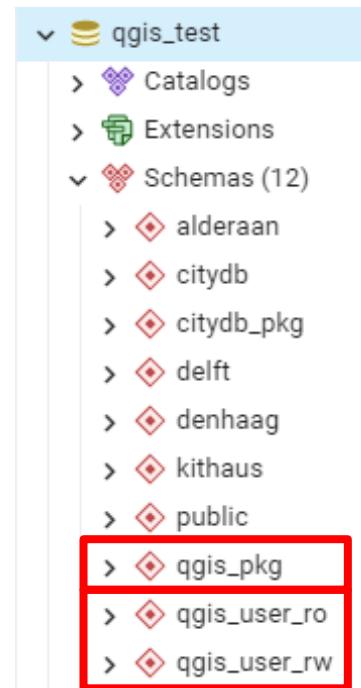
The credentials for the default users are:

### User "qgis\_user\_ro":

- user name: **qgis\_user\_ro**
- password: **qgis\_user\_ro**

### User "qgis\_user\_rw":

- user name: **qgis\_user\_rw**
- password: **qgis\_user\_rw**



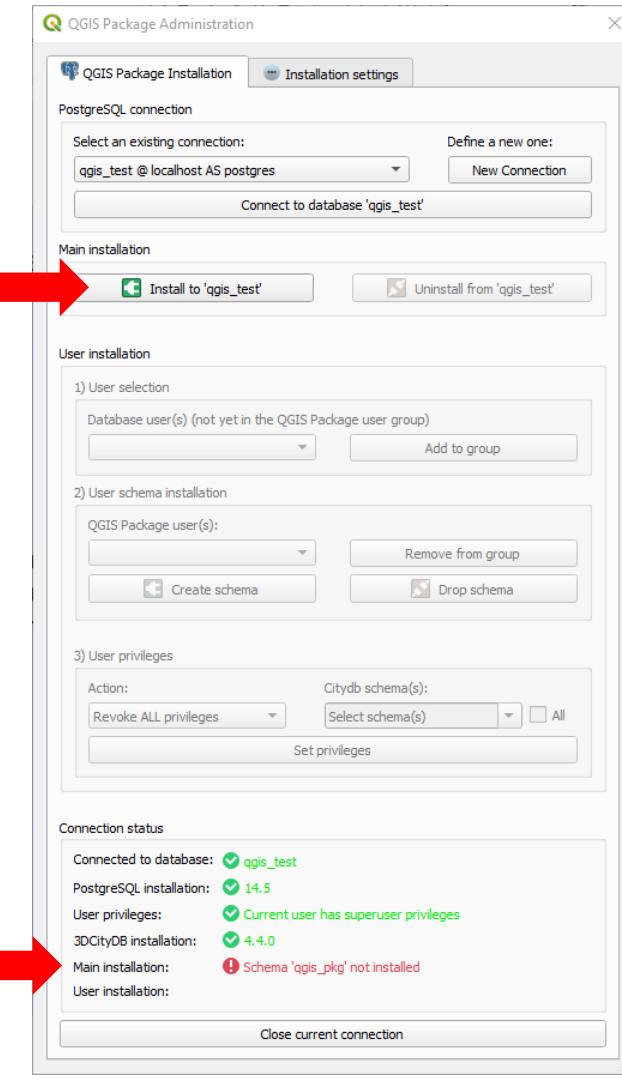
# Back-end installation

## 2.2) "Normal" installation

Using the "normal" installation, the administrator has complete control over each one of the 4 required installation steps

**Step a)** To install the GIS Package, click the **Install button** (here: install to database "qgis\_test")

The **Connection status box** in the lower part of the dialog will keep you informed.



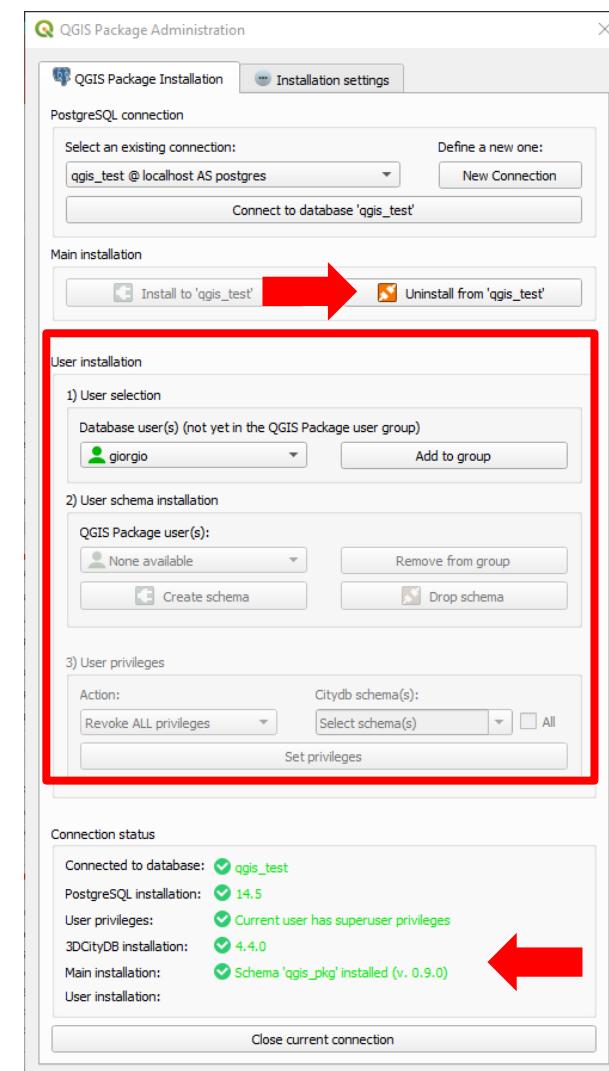
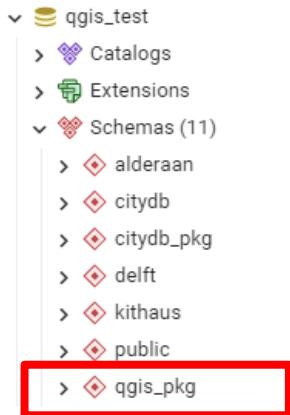
# Back-end installation

## 2.2) "Normal" installation

Upon successful installation:

- The **Uninstall button** is activated (in case you want to immediately uninstall)
- The **User Installation box** is activated
- You are notified in the **Connection status box**

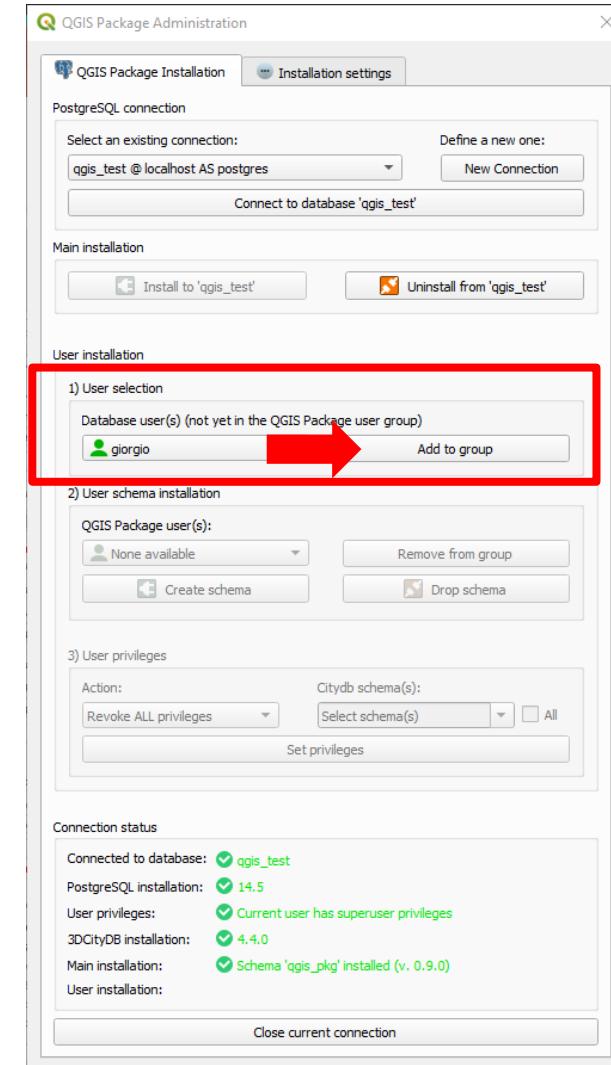
The "**qgis\_pkg**" schema is created in the the selected current database



# Back-end installation

## 2.2) "Normal" installation

**Step b)** Choose from all database users the one(s) to add to the QGIS Package user group. Click the **Add to group** button



The screenshot shows the 'QGIS Package Administration' window. In the 'User selection' section, there is a list of 'Database user(s) (not yet in the QGIS Package user group)' with 'giorgio' selected. A red arrow points to the 'Add to group' button next to it. The window also includes sections for 'Main installation' (with 'Install to' and 'Uninstall from' buttons), 'User schema installation' (with 'None available' dropdown and 'Create schema'/'Drop schema' buttons), and 'User privileges' (with 'Action' dropdown set to 'Revoke ALL privileges', 'Citydb schema(s)' dropdown, and 'Set privileges' button). At the bottom, there's a 'Connection status' section with various status indicators.

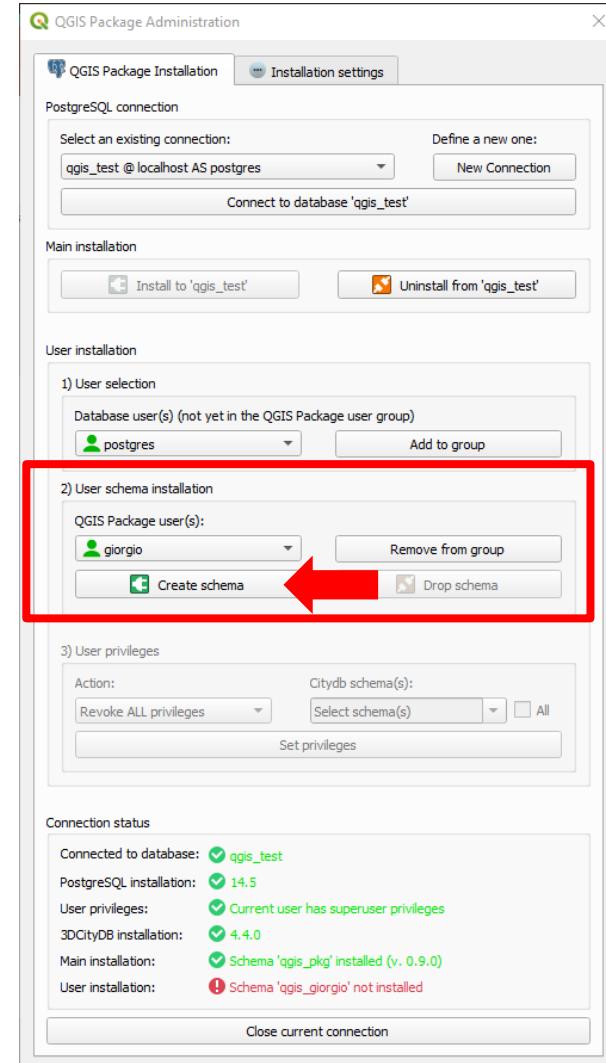
For each 3DCityDB there group named "**qgis\_pkg\_usrgroup\_**" + **database name** is created. It contains those users that will be allowed to interact with the database from the front-end.  
Example: for database "qgis\_test" there is a group called "qgis\_pkg\_usrgroup\_qgis\_test".

# Back-end installation

## 2.2) "Normal" installation

**Step c)** Create the user schema for the selected user(s) belonging to the group

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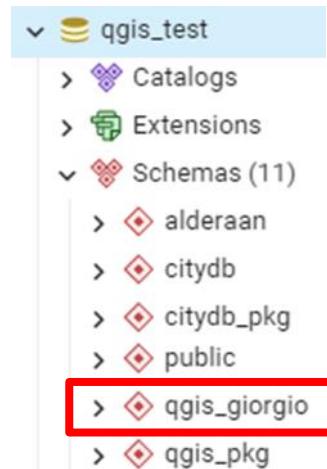


# Back-end installation

## 2.2) "Normal" installation

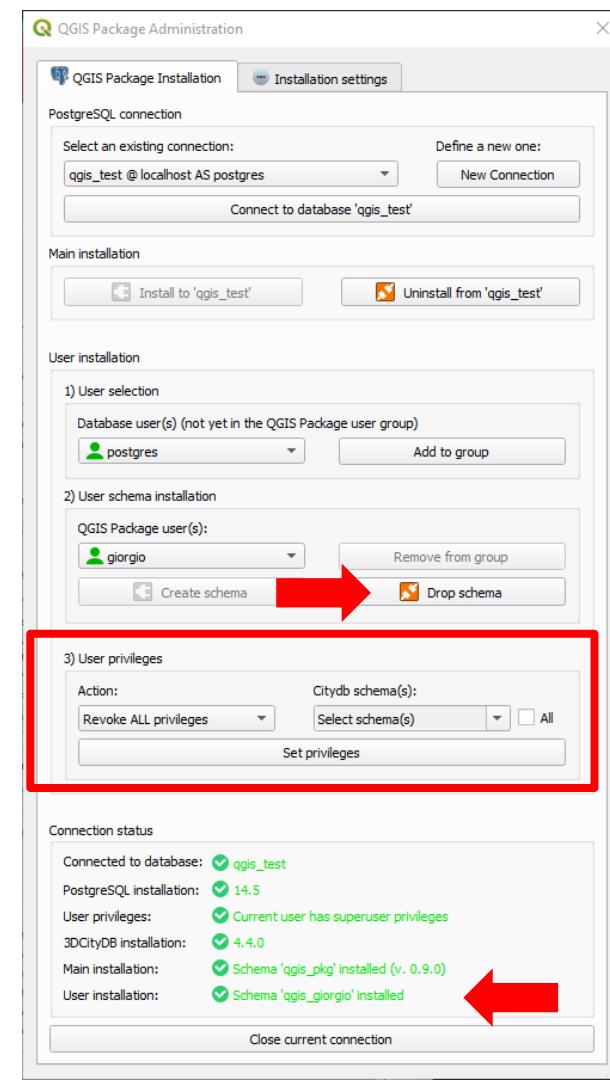
Upon successful creation of the user schema:

- The **Drop schema** button is activated (in case you want to drop the schema you just created)
- the **User privileges box** is activated
- You are notified in the **Connection status box**



A schema named "**qgis\_**" + **user name** is created.

Example: for user "giorgio", schema "qgis\_giorgio" will be created.



**QGIS Package Administration**

**QGIS Package Installation** **Installation settings**

PostgreSQL connection  
Select an existing connection: qgis\_test @ localhost AS postgres Define a new one: New Connection Connect to database 'qgis\_test'

Main installation  
**Install to 'qgis\_test'** **Uninstall from 'qgis\_test'**

User installation

- 1) User selection  
Database user(s) (not yet in the QGIS Package user group): postres Add to group
- 2) User schema installation  
QGIS Package user(s): giorgio Remove from group  
**Create schema** **Drop schema**
- 3) User privileges  
Action: Revoke ALL privileges Select schema(s) All Set privileges

Connection status  
Connected to database: qgis\_test  
PostgreSQL installation: 14.5  
User privileges: Current user has superuser privileges  
3DCityDB installation: 4.4.0  
Main installation: Schema 'qgis\_pkg' installed (v. 0.9.0)  
User installation: Schema 'qgis\_giorgio' installed

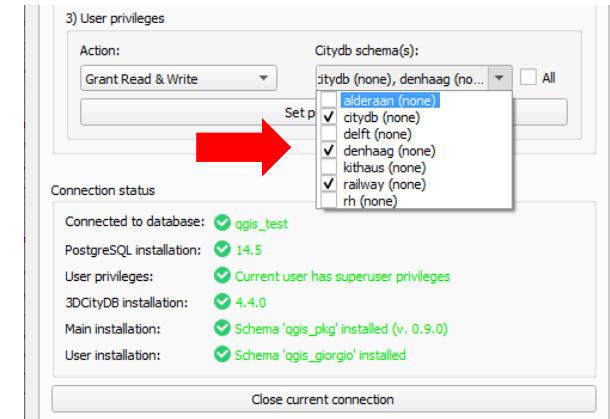
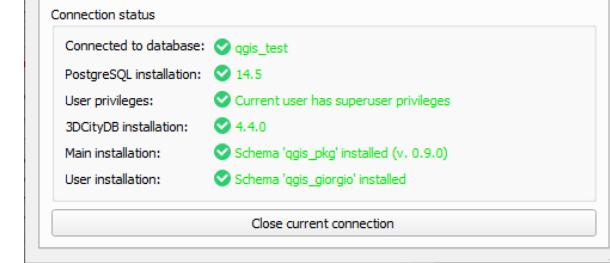
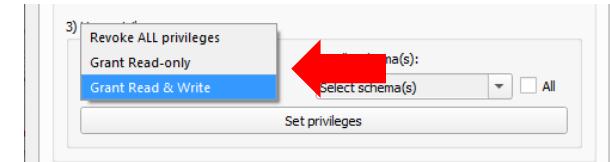
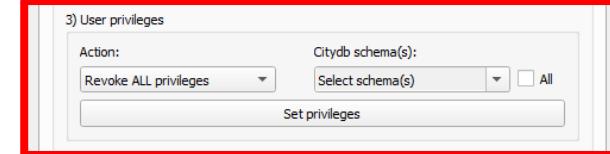
# Back-end installation

## 2.2) "Normal" installation

**Step d)** For the selected user, set the database privileges ("read-only", "read & write", "none") for each of the existing citydb schemas

You can assign different privileges to different citydb schemas – or revoke them.

Click the **Set privileges** button to apply the settings. The privileges status in the drop down menu will be updated accordingly.



# Back-end installation

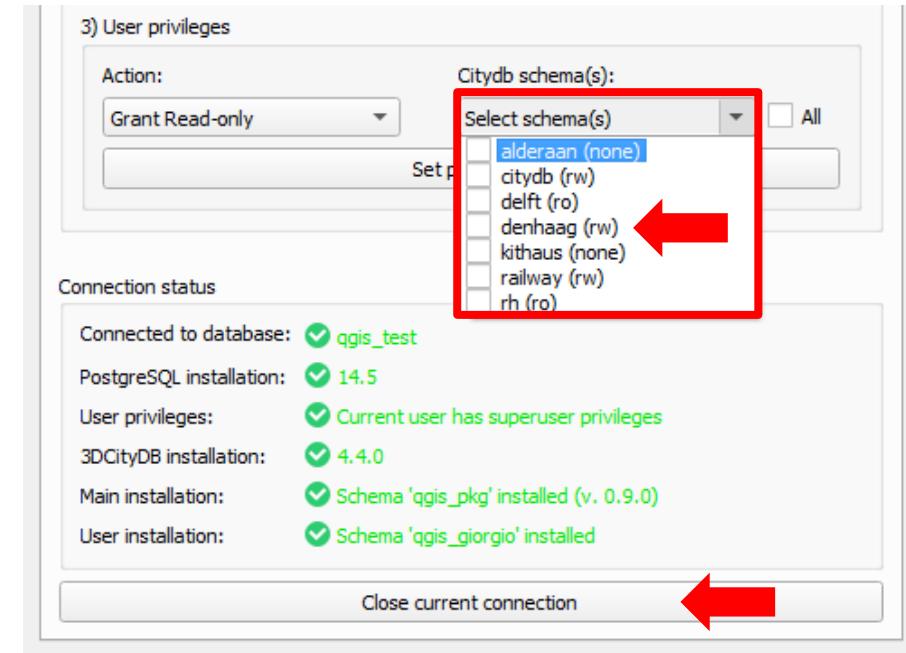
## 2.2) "Normal" installation

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Every time new privileges are set, the status in the drop down menu is updated with "ro" (read-only), "rw" (read & write) or "none".

Once you are done, you can click the **Close the current connection** button

You can now use the "Layer Loader" or the "Bulk Deleter"



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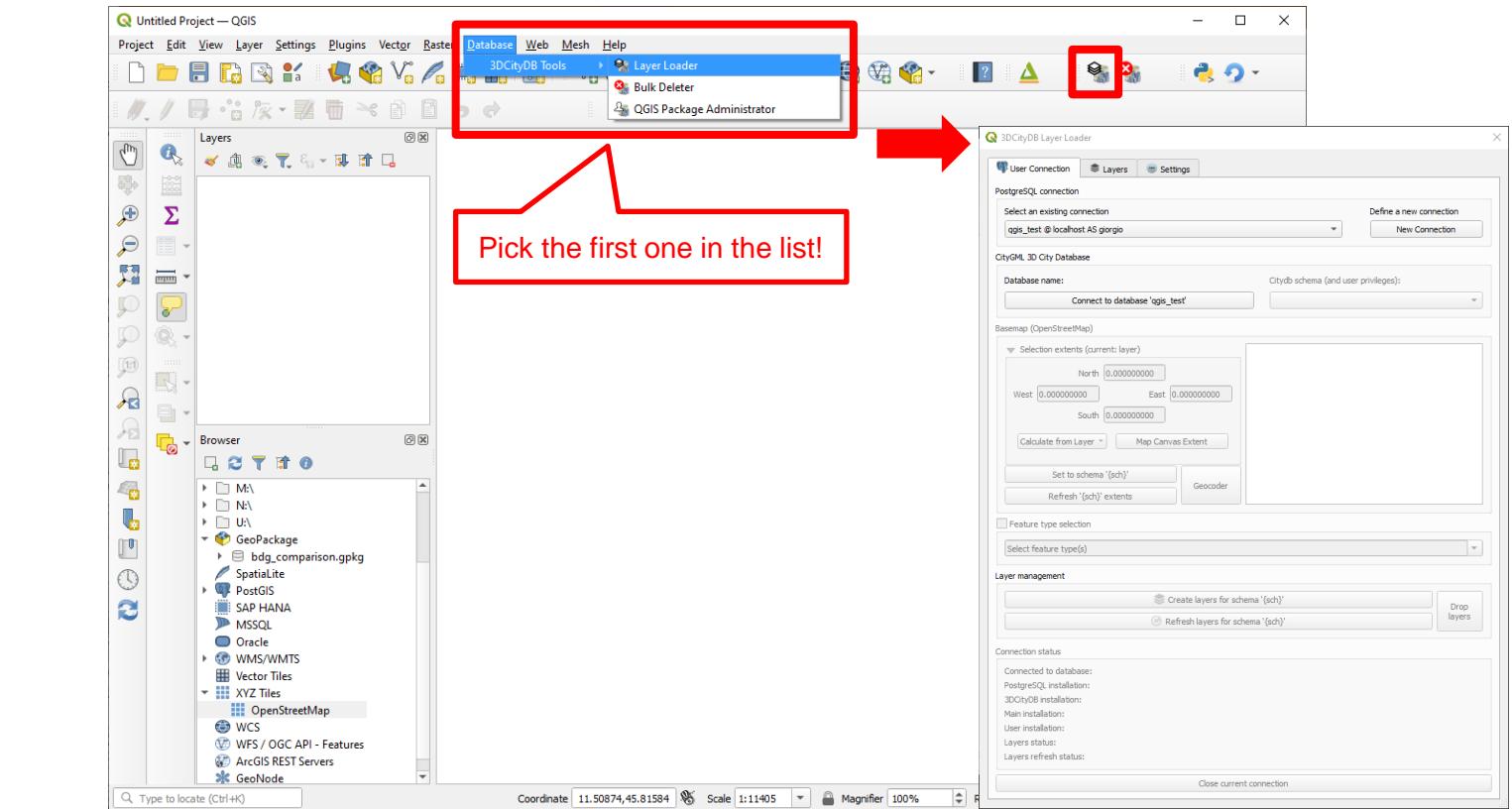
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# Layer Loader



Open the **Layer Loader** from the menu or by clicking on the corresponding icon



The screenshot shows the QGIS application interface. The top menu bar is visible with options like Project, Edit, View, Layer, Settings, Plugins, Vector, Raster, Database, Web, Mesh, and Help. A red box highlights the 'Database' menu item, which is currently selected. Below the menu is a toolbar with various icons. To the right of the toolbar, a red box highlights the '3DCityDB Layer Loader' icon, which is also highlighted in the status bar. A large red arrow points from the 'Layer Loader' menu item towards the open plugin window. Another red box highlights the text 'Pick the first one in the list!' inside the plugin window. The main QGIS interface shows the 'Layers' panel on the left and the 'Browser' panel below it, both displaying a list of available data sources. The '3DCityDB Layer Loader' window is open on the right, showing configuration options for connecting to a PostgreSQL database and managing layers.

Pick the first one in the list!

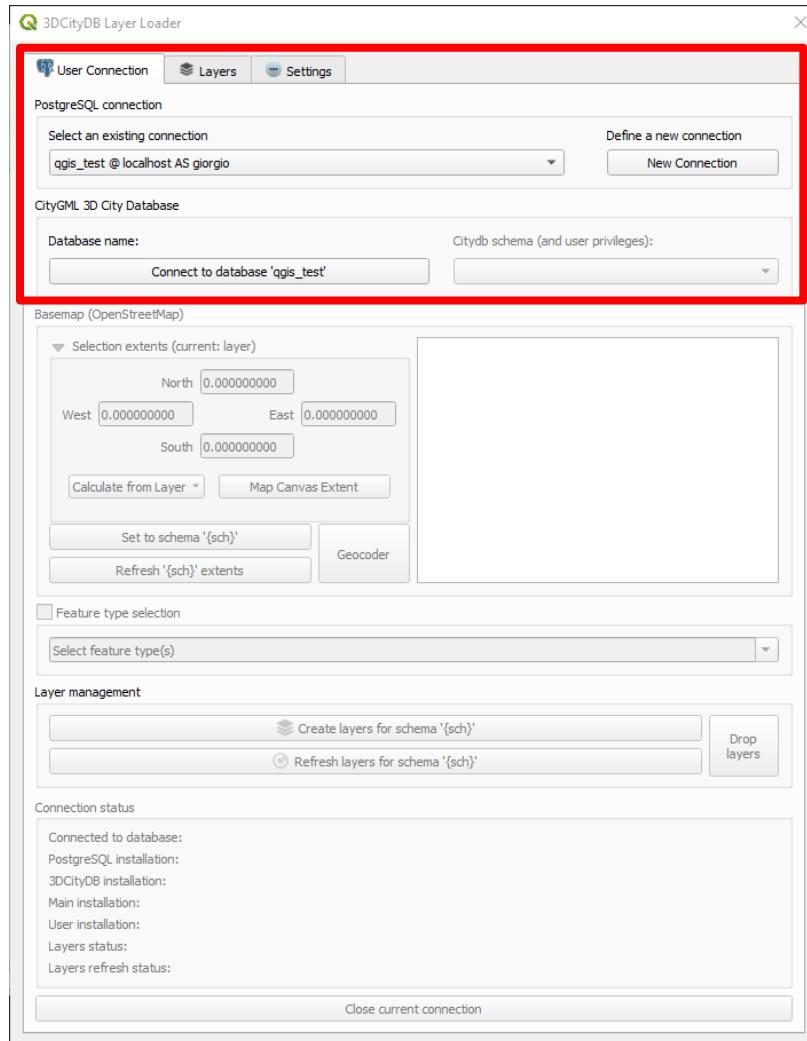
# Layer Loader

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** or **qgis\_user\_rw** (if previously installed)
- Your own credentials (if the administrator has set up your *usr\_schema* before)



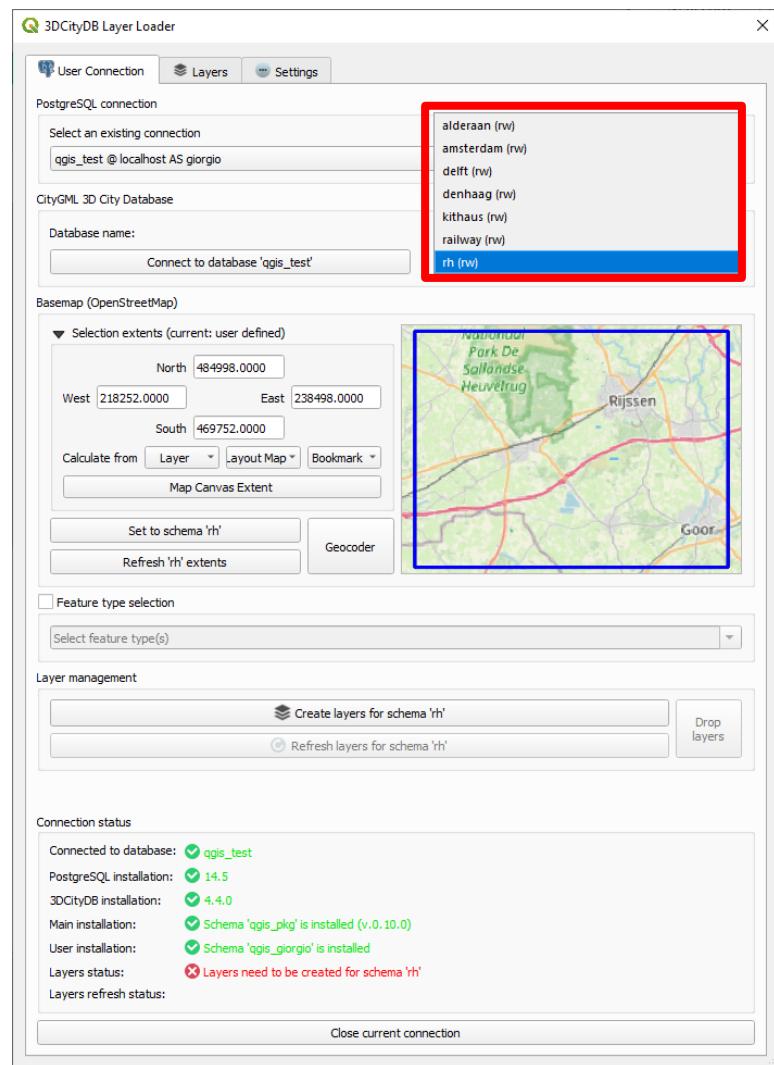
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3) Once connected, choose one of the existing citydb schemas. If they contain CityGML data, they will be listed.  
 You will also see your privileges for that citydb schema ("ro" or "rw").

**Nota bene:** Generally, "**citydb**" is the default, and, very often, the only one citydb schema! Nevertheless, 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>



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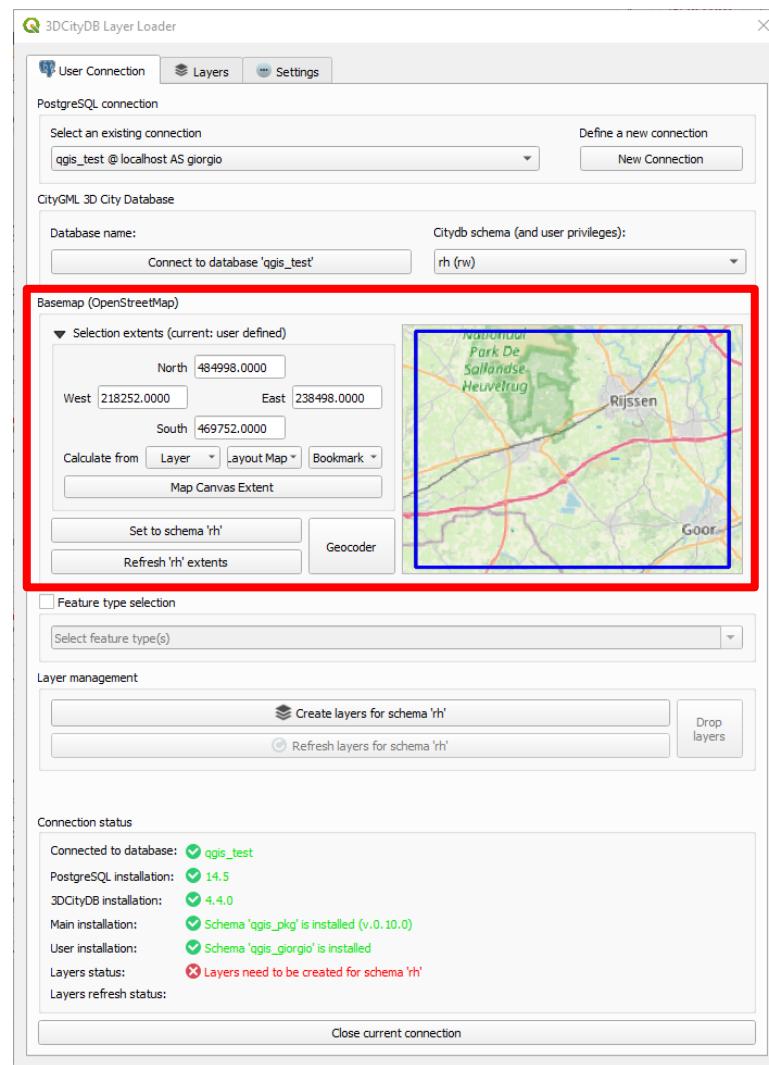
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4a) Upon selection of the citydb schema, you will see the extents of the dataset. They correspond to the extents of all currently loaded data in the selected citydb schema (here, for example, schema "rh")

**Please note:** the very first time you load a citydb schema, and depending on the size of the city model, it might take a while to load as the bounding boxes are being computed. From the second time onwards, it will load nearly instantly.

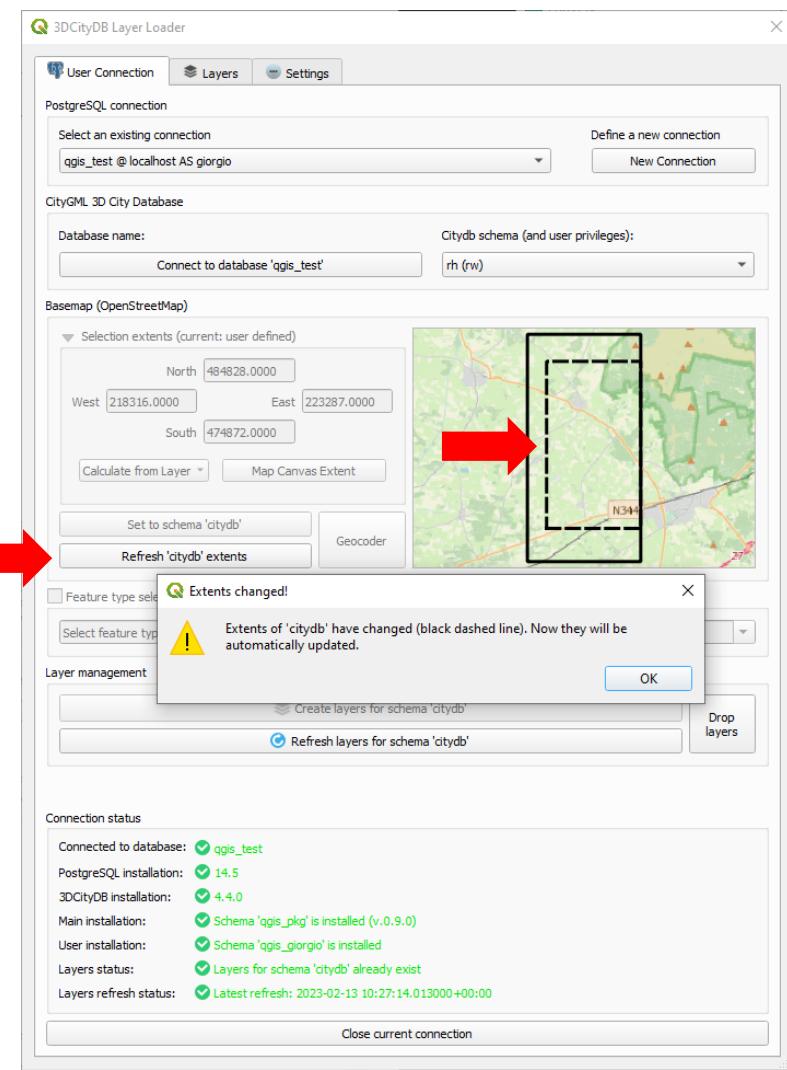


# Layer Loader

4b) If data has been added or removed in the current citydb schema, you can refresh the extents by pressing the **Refresh {cdb\_schema} extents** button.

The new extents will be temporarily shown with a **black dashed line**, before being updated.

**Note bene:** Depending on how the extents have changed, you may have to recreate, refresh and reload the layers in QGIS (see next slides)



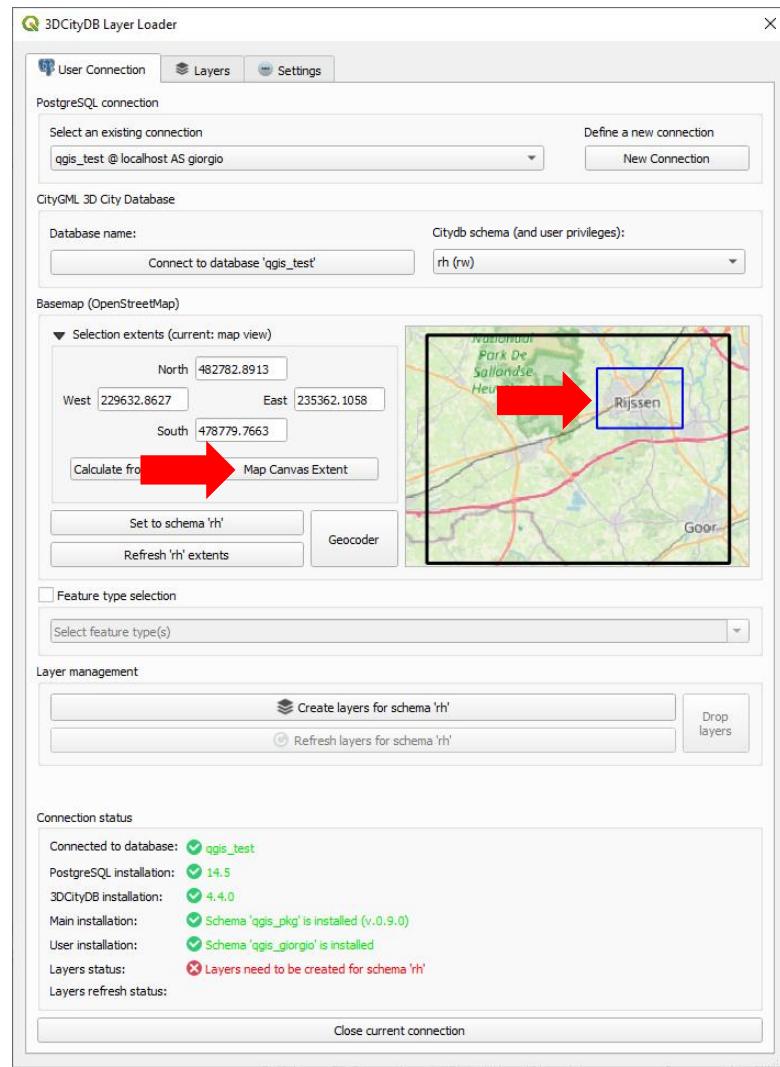
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5) Depending on your needs, you can set the spatial extents of the study area for which the layers will be created

- Default: same size of the whole dataset
- Otherwise: zoom in the map and choose your own area by clicking the **Map Canvas Extent button**. The **blue bounding box** shows the layers extents.

**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)!



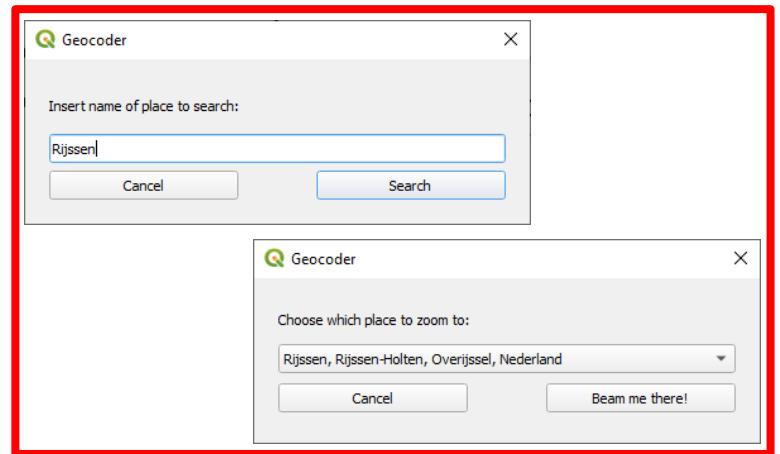
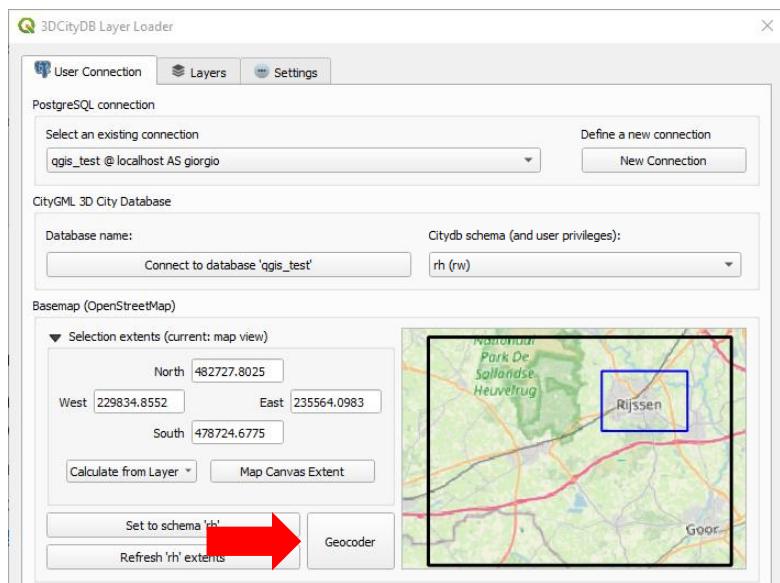
# Layer Loader

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 by clicking the **Map Canvas Extent button**. The **blue bounding box** shows the layers extents.

If you are looking for a specific place inside the citydb extents, you can also use the Geocoder that will zoom you directly there.

Simply click the **Geocoder button**.



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

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

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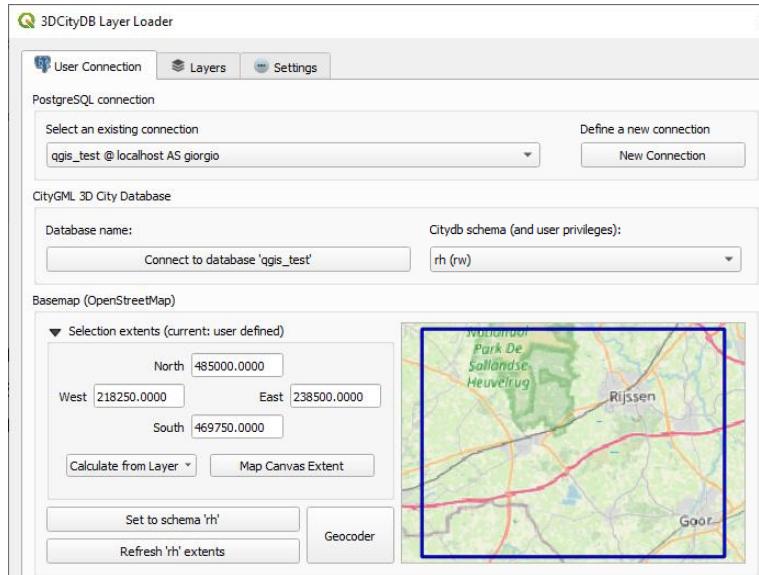
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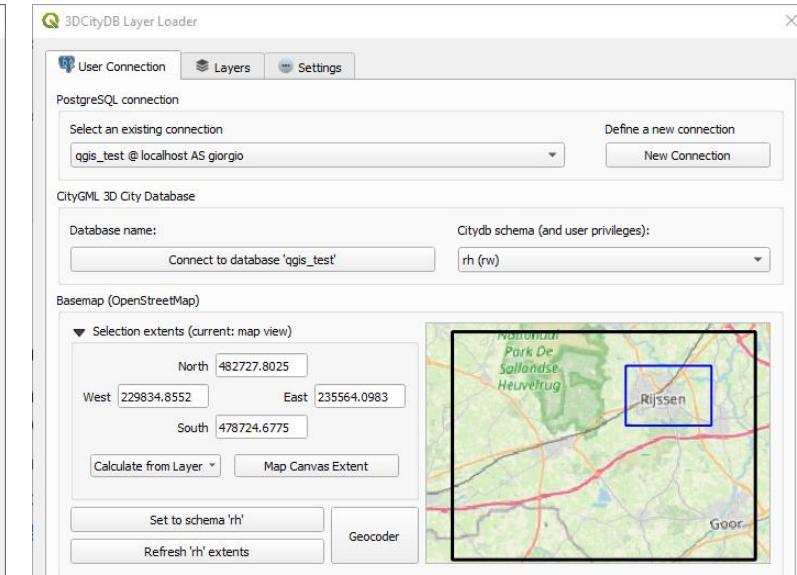
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Both areas coincide (default)



User-selected layers extents

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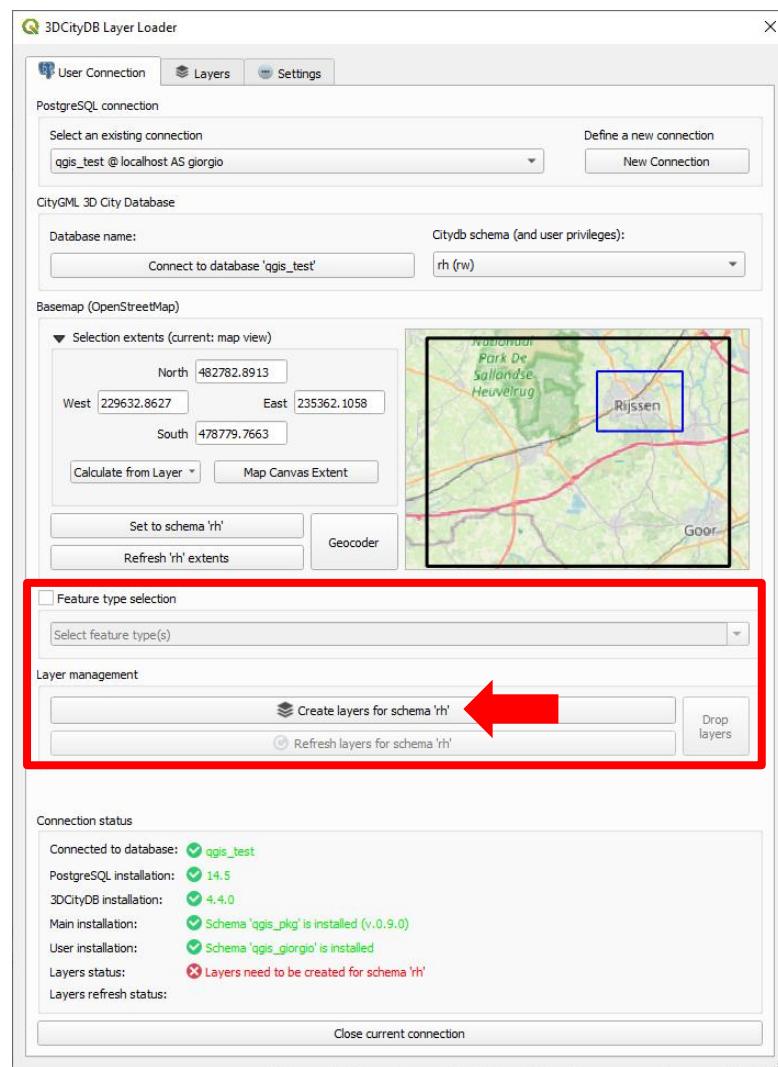
# Layer Loader

## 6a) Create the layers

Layers for all CityObjects available  
within the Layer extents will be created

**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.



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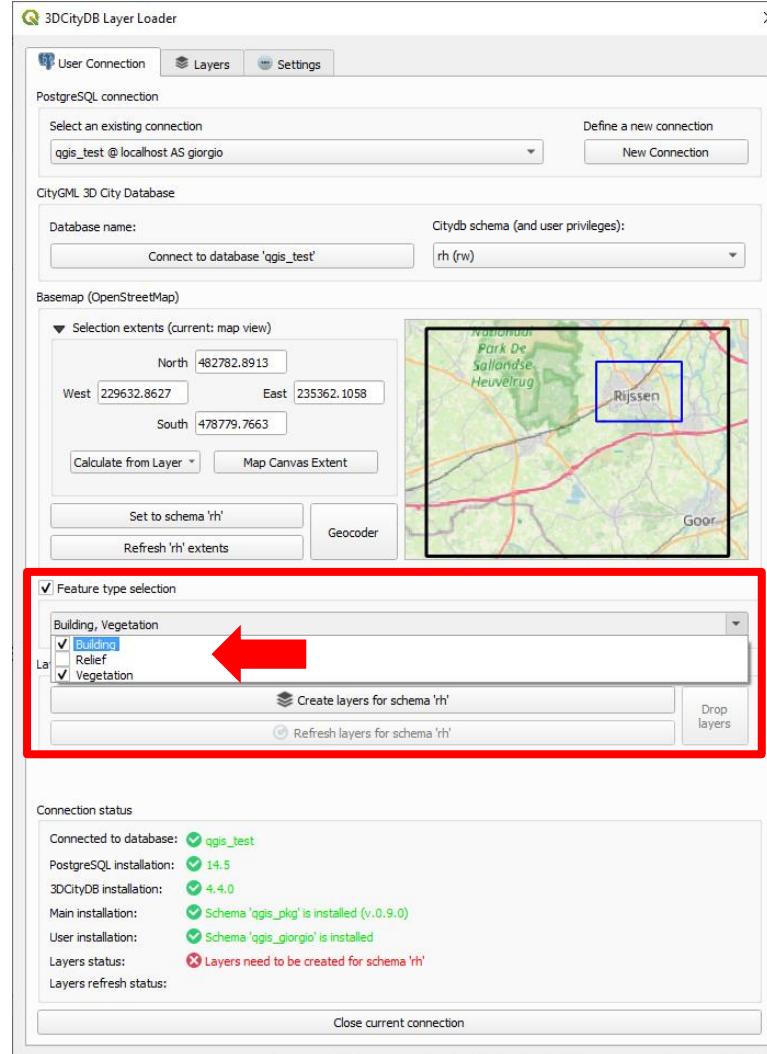
# Layer Loader

## 6a) Create the layers

Layers for all CityObjects available within the Layer extents will be created.

Optionally, you can further refine your selection and choose for which Feature Types the layers will be generated. Open the **Feature type selection box** and check the desired Feature types.

**Note bene:** Feature Types correspond to the CityGML modules (Building, Vegetation, Transportation, LandUse, Relief, etc.)

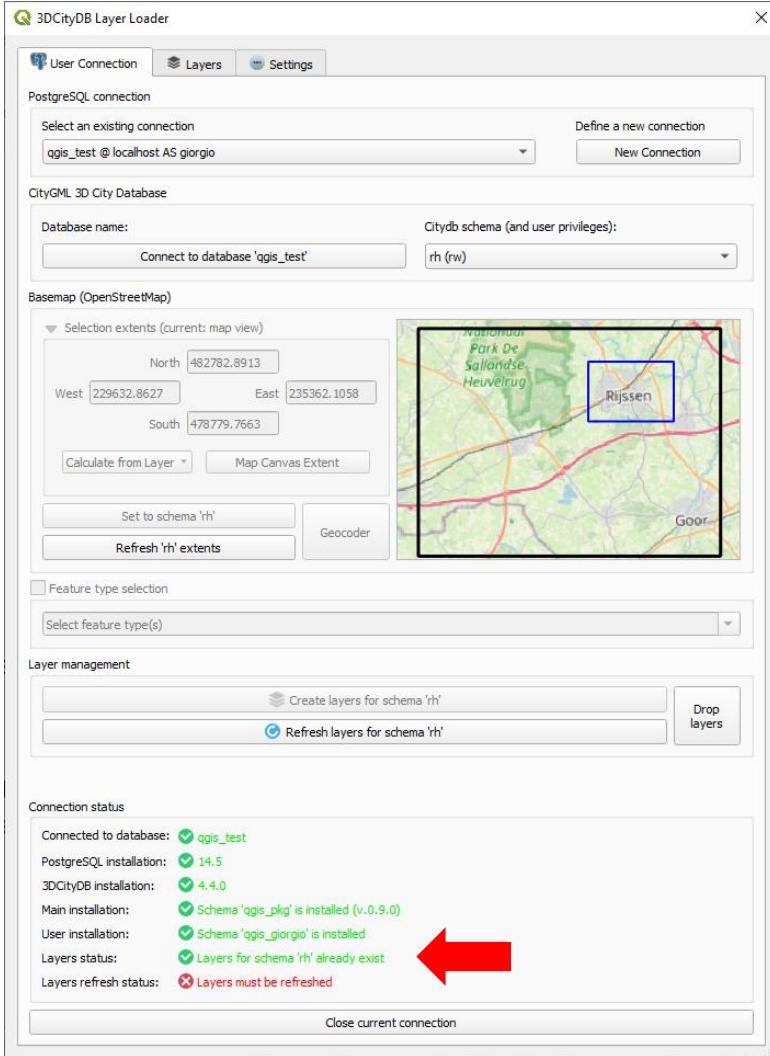


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## 6b) Create the layers

Upon successful creation of the layers,  
you will be notified in the **Connection  
Status box**



The screenshot shows the 3DCityDB Layer Loader interface. At the top, there are tabs for User Connection, Layers, and Settings. Under User Connection, it says "PostgreSQL connection" and "Select an existing connection: qgis\_test @ localhost AS giorgio". There are buttons for "Define a new connection" and "New Connection".

In the main area, under "CityGML 3D City Database", the "Database name:" is set to "qgis\_test" and the "Citydb schema (and user privileges):" is set to "rh (rw)".

Under "Basemap (OpenStreetMap)", there is a map view showing a region in the Netherlands with a blue rectangle highlighting a specific area. Below the map are buttons for "Selection extents (current: map view)", "Calculate from Layer", "Map Canvas Extent", "Set to schema 'rh'", "Refresh 'rh' extents", and "Geocoder".

Under "Feature type selection", there is a dropdown menu labeled "Select feature type(s)".

Under "Layer management", there are buttons for "Create layers for schema 'rh'" and "Refresh layers for schema 'rh'".

At the bottom, the "Connection status" section shows the following status items:

- Connected to database: ✓ qgis\_test
- PostgreSQL installation: ✓ 14.5
- 3DCityDB installation: ✓ 4.4.0
- Main installation: ✓ Schema 'qgis\_pk' is installed (v.0.9.0)
- User installation: ✓ Schema 'qgis\_giorgio' is installed
- Layers status: ✓ Layers for schema 'rh' already exist
- Layers refresh status: ✗ Layers must be refreshed

A large red arrow points to the "Layers refresh status" item.

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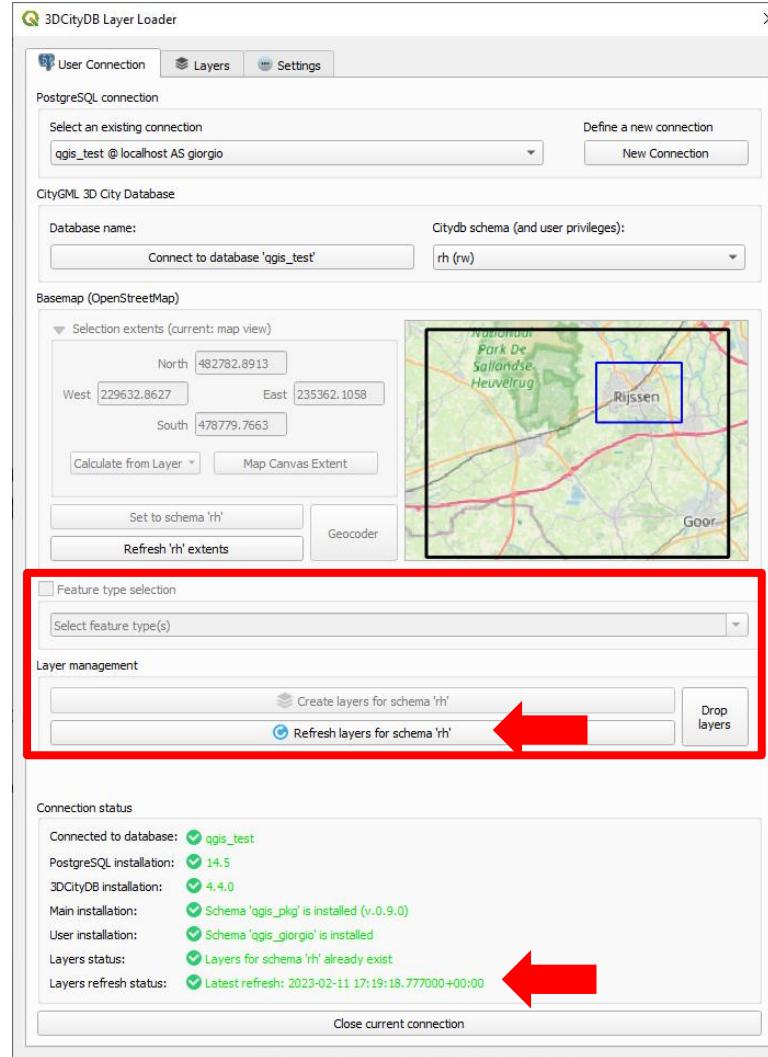
## 7) Populate/refresh the layers

Click on the **Refresh layers button**. Once the operation is complete, you will be notified in the **Connection status box**.

The following "Layers" tab is now activated and you can open it.

Alternatively, layers created in a previous session may be used (and/or refreshed again), or dropped.

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



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## Behind the scenes:

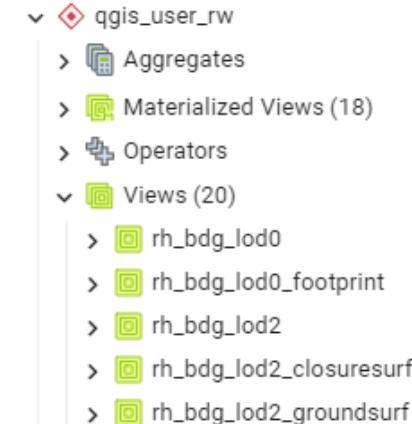
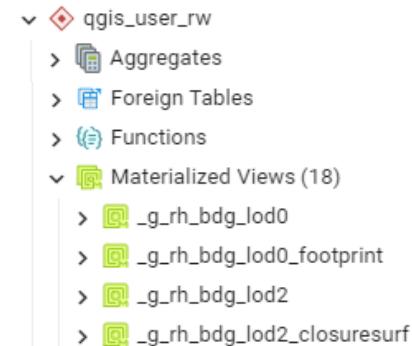
In the database user schema, both materialised views (containing the feature geometries) and the layers (as updatable views, containing the feature attributes linked to the corresponding geometries in the materialised views) can be accessed.

### Materialised views name coding:

- "\_g\_" prefix + citydb schema name + feature name + lidx + (optional) semantic details

### Views name coding:

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

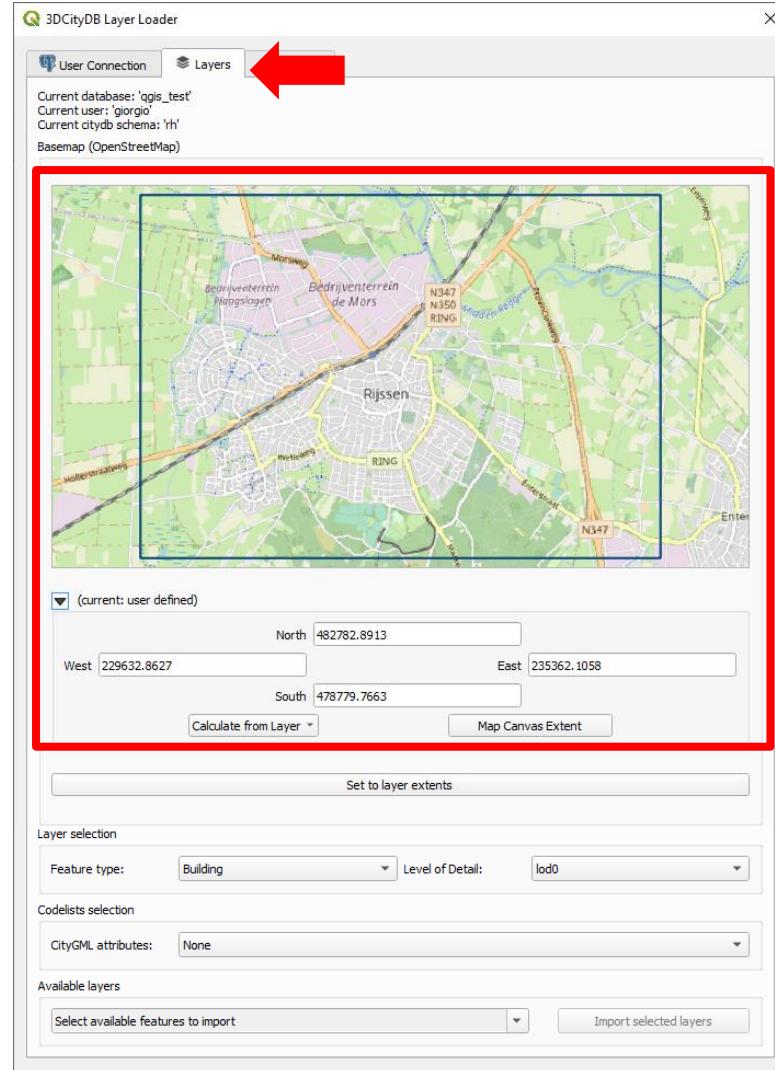


# Layer Loader

In the "Layers" tab

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8) You are now directly zoomed to the layers extents (**blue bounding box**)



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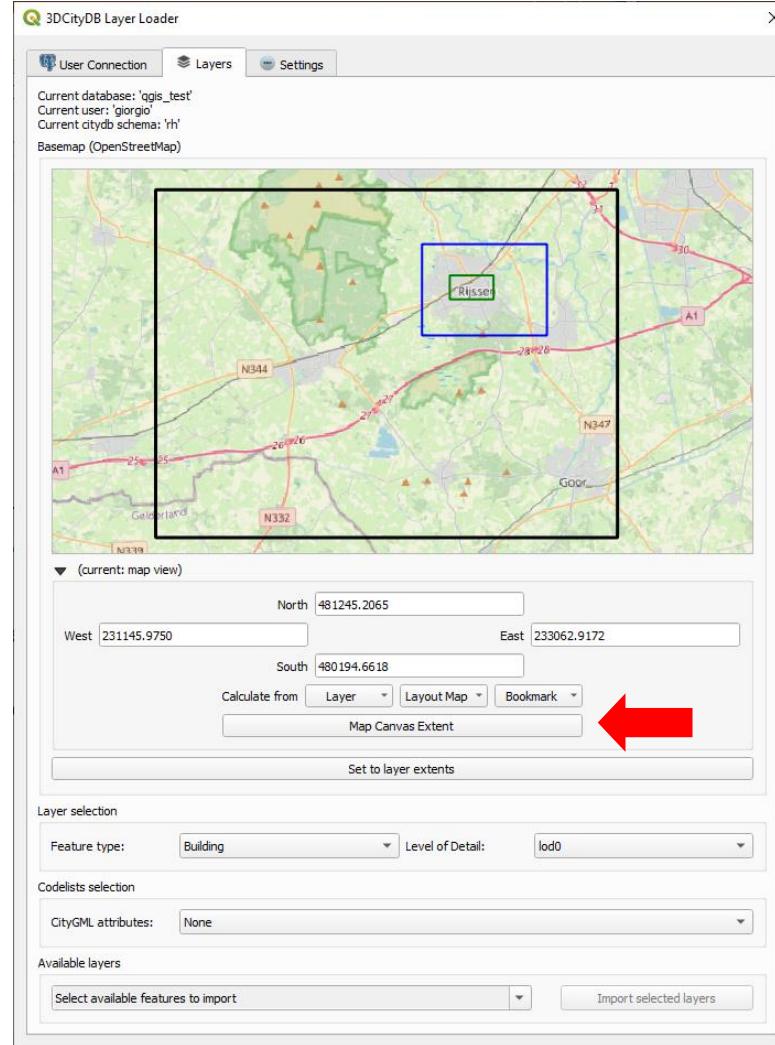
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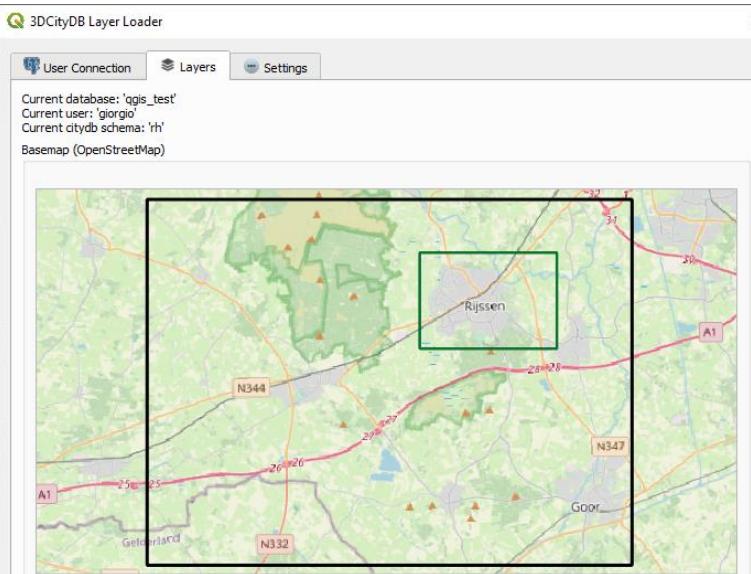
9) Depending on your needs, you can further reduce the extents of the layers to be loaded into QGIS by pressing the **Map Canvas Extent button**. The new extents are represented by the **green bounding box**.

- Default: same size of the layer extents (**blue bounding box**)
- Otherwise: zoom in and choose your own area

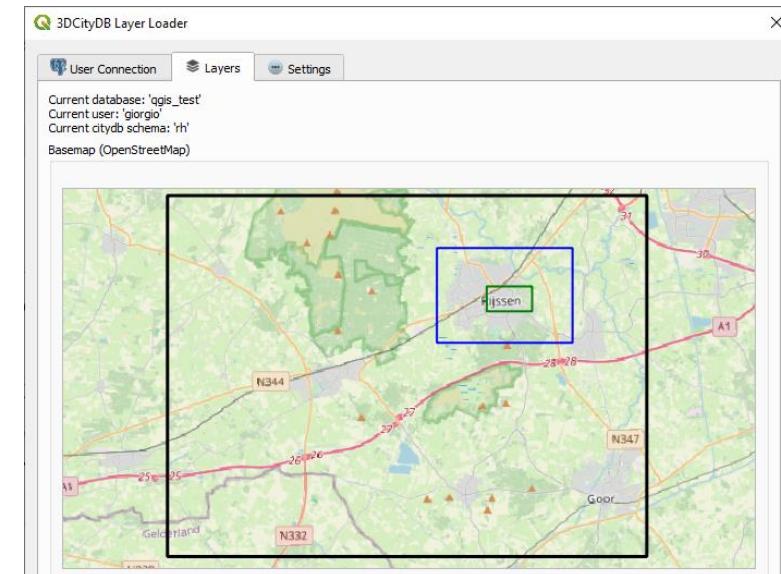


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Database- and QGIS-side extents coincide (default)



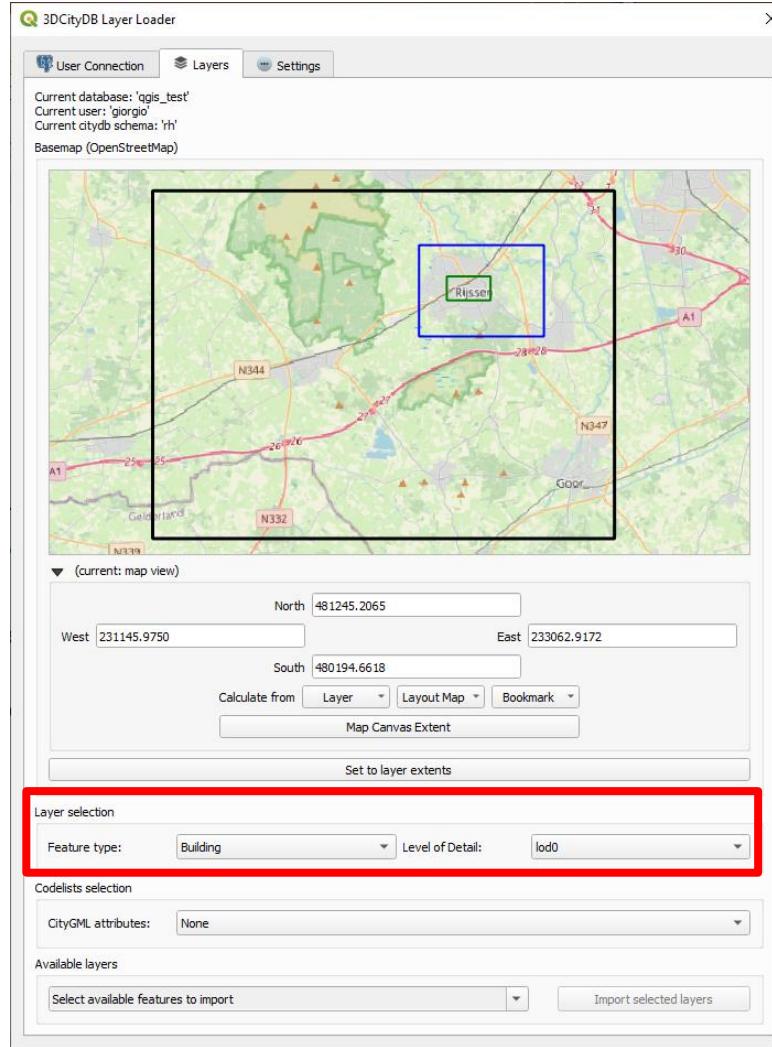
User-selected QGIS-layers extents

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- 10) Select available Feature type and LoD
- Layers are grouped according to the CityGML Feature Types (e.g. "Bridge", "Building", "Tunnel", "Relief", etc.)

**Behind the scenes:** The plugin shows only the available Feature types and LoDs of data *within* the QGIS extents (**green bounding box**).



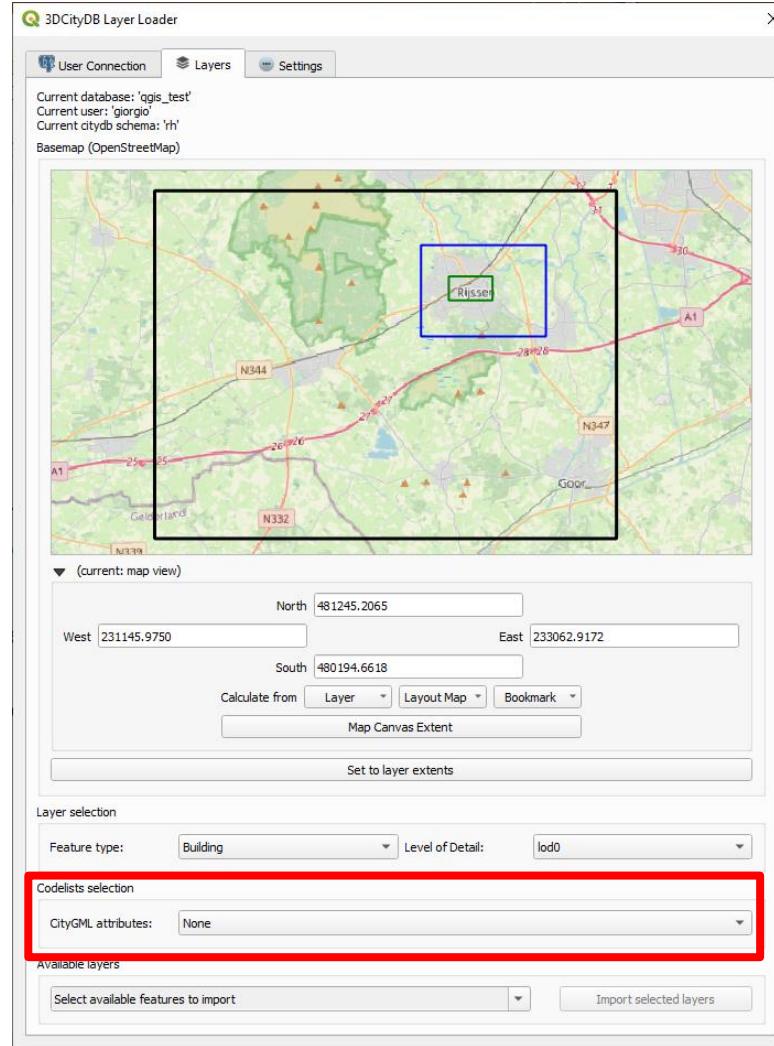
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# Layer Loader

11) The **Codelist selection** allows to optionally load codelists and set up the attribute forms accordingly (see next slides about "Use in QGIS" for more details)

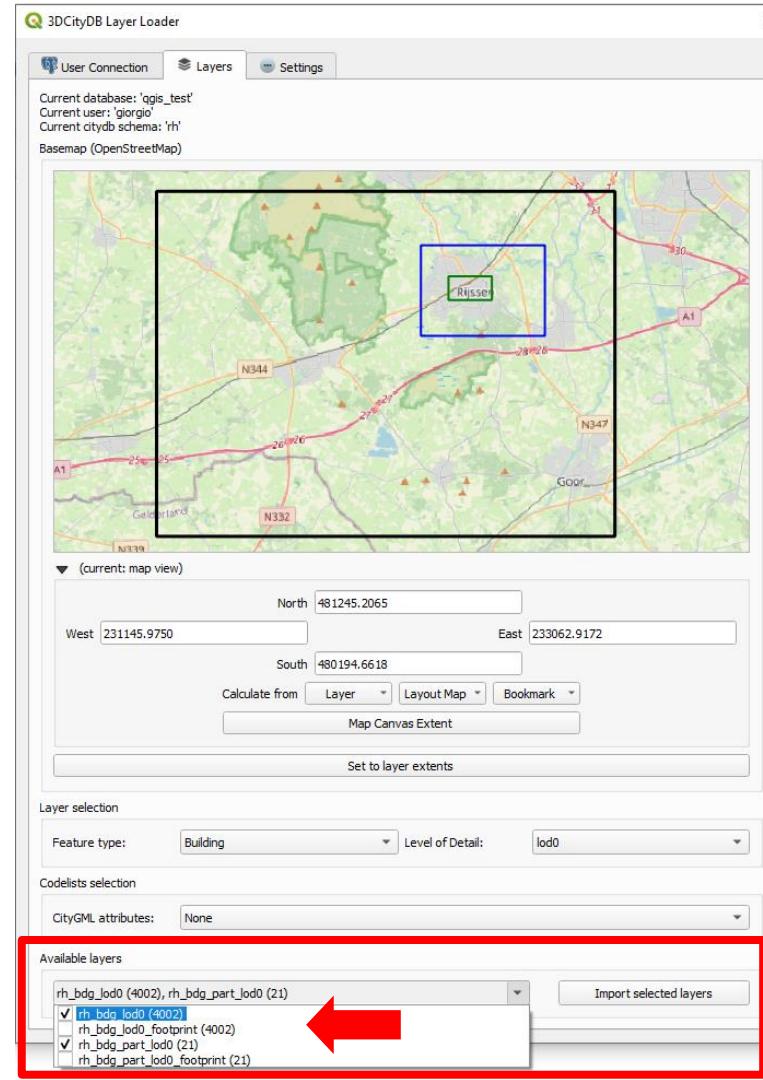


# Layer Loader

## 12) Select the layer(s) to import into QGIS

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

**Behind the scenes:** The plugin shows only the available Layers *within* the QGIS extents (**green bounding box**).

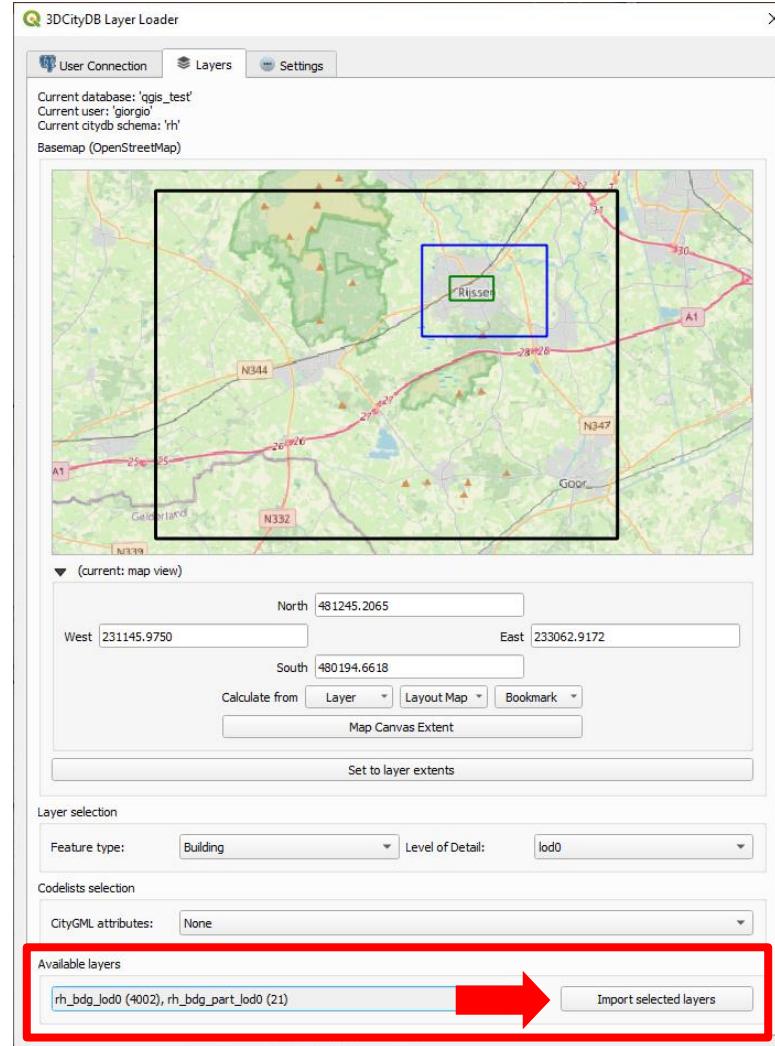


# Layer Loader

13) Import the selected layers to QGIS by clicking on the **Import selected layers** button

- The import operation can be repeated with different layers
- The layers will be automatically added to the QGIS Layers Tree / 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)

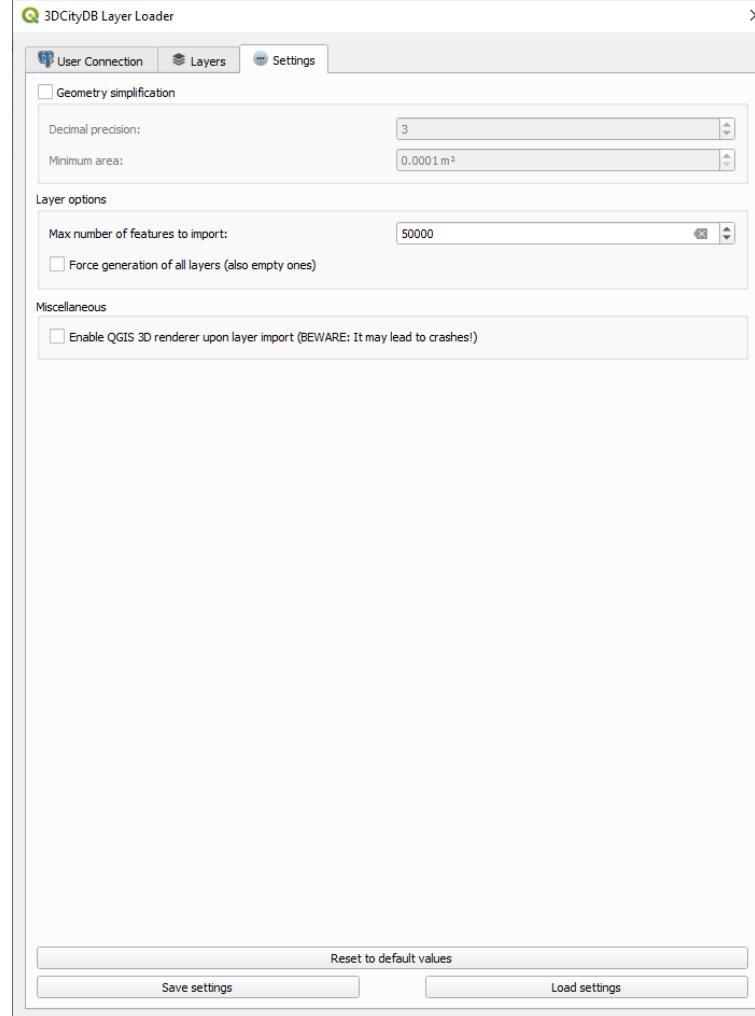
**Nota bene:** Layers that have already been loaded can be selected, but won't be loaded again



# Layer Loader

The "Settings" tab allows to enable specific options.

- The **Geometry simplification box** contains details about the coordinates precisions and the minimum area of the geometries to be generated in the materialized views
- The **Layer options box** allows to set the maximum number of features to be imported in each import action and to force the generation of the empty layers
- In the **Miscellaneous box**, the user can force the 3D rendered to be enabled upon import of the selected layers, although this might lead to instabilities (see next slides)
- Settings can be saved, (re)loaded and reset to the default values.



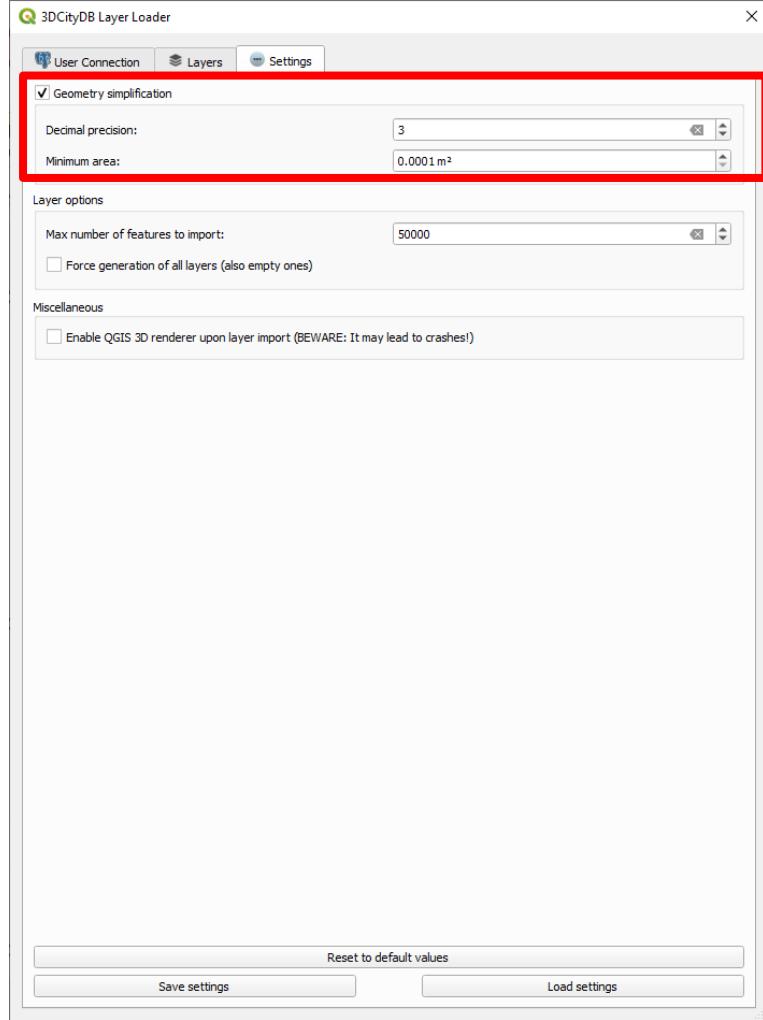
# Geometry simplification

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 layers.

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:

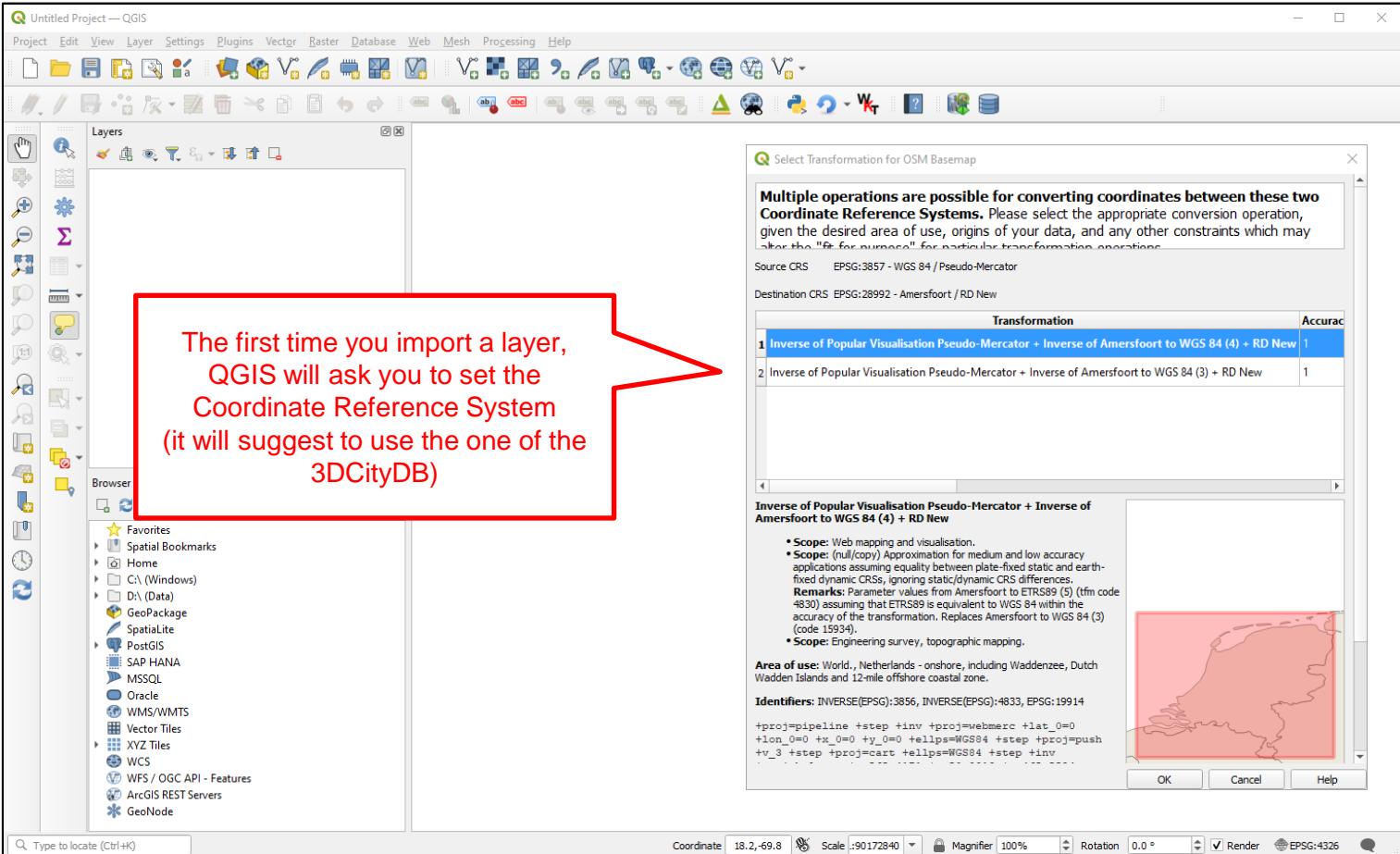
- can significantly increase the time needed to refresh the layers
- does NOT change the original data in the database!



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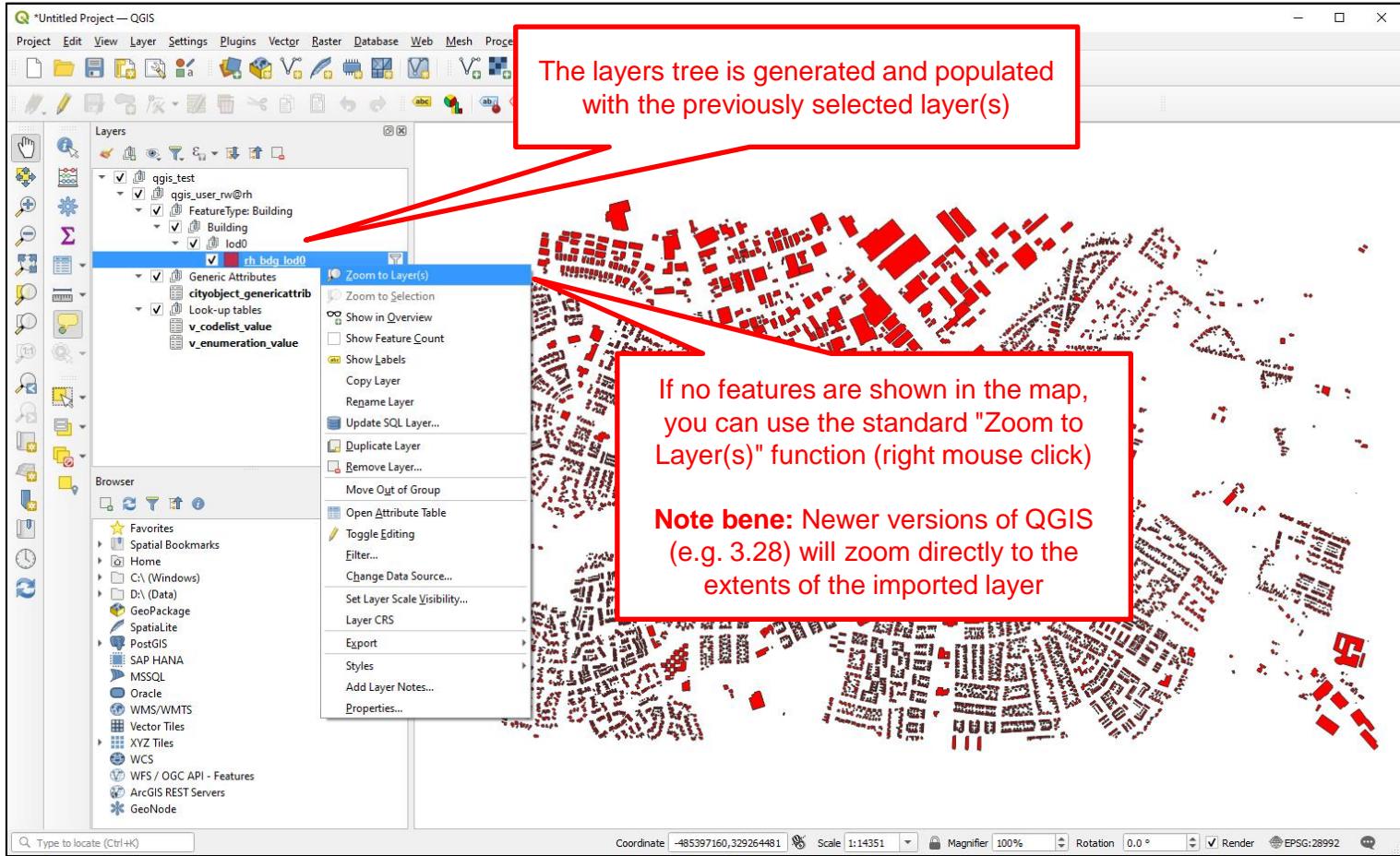
The first time you import a layer, QGIS will ask you to set the Coordinate Reference System (it will suggest to use the one of the 3DCityDB)



The screenshot shows the QGIS interface with the 'Layers' panel open on the left. A red box highlights a message in the center of the screen: "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)". To the right, a 'Select Transformation' dialog box is displayed, showing two transformation operations listed under 'Transformation': "Inverse of Popular Visualisation Pseudo-Mercator + Inverse of Amersfoort to WGS 84 (4) + RD New" and "Inverse of Popular Visualisation Pseudo-Mercator + Inverse of Amersfoort to WGS 84 (3) + RD New". The first operation is selected. The dialog also contains detailed information about the transformation, including its scope, remarks, area of use, identifiers, and a preview map.

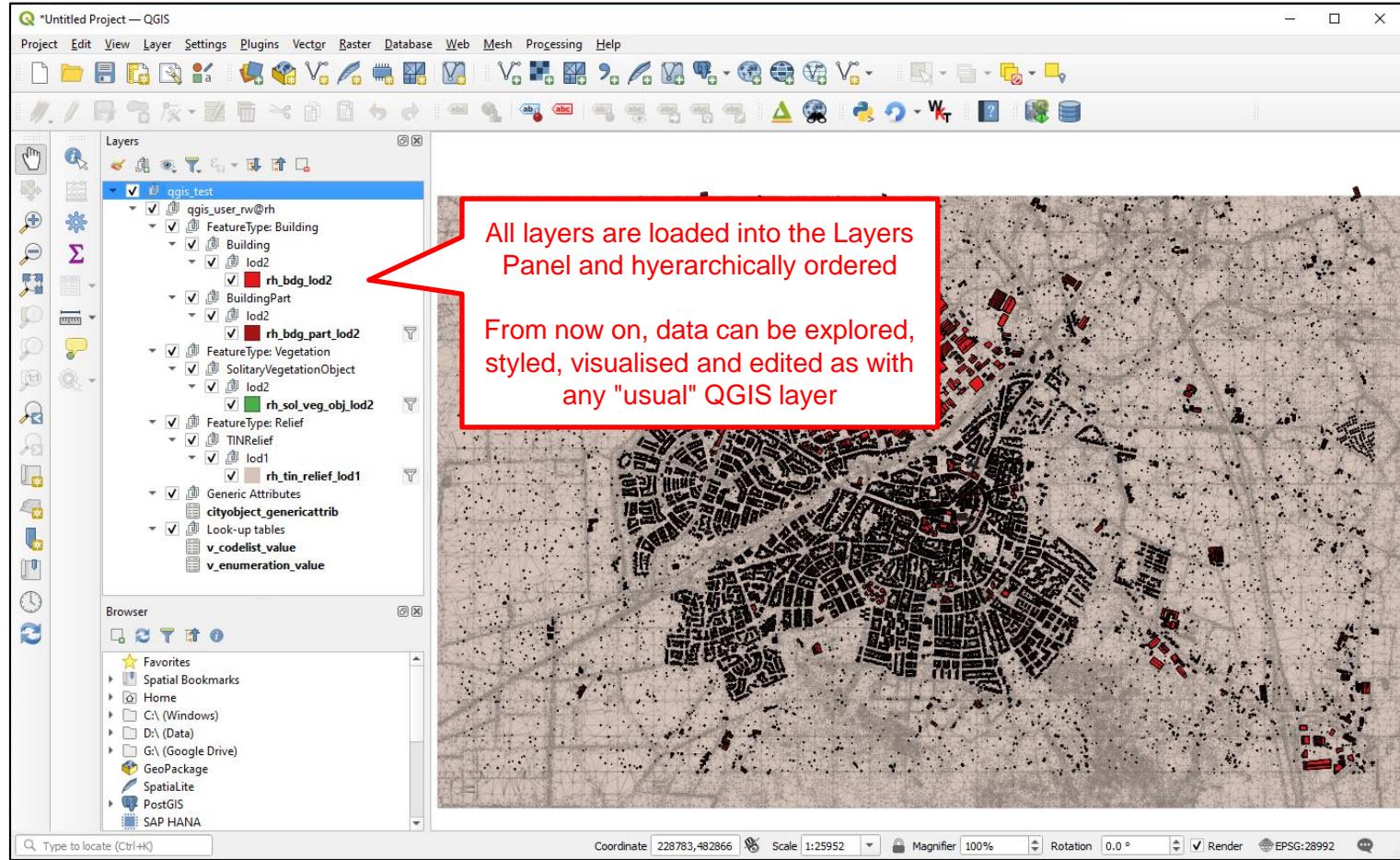
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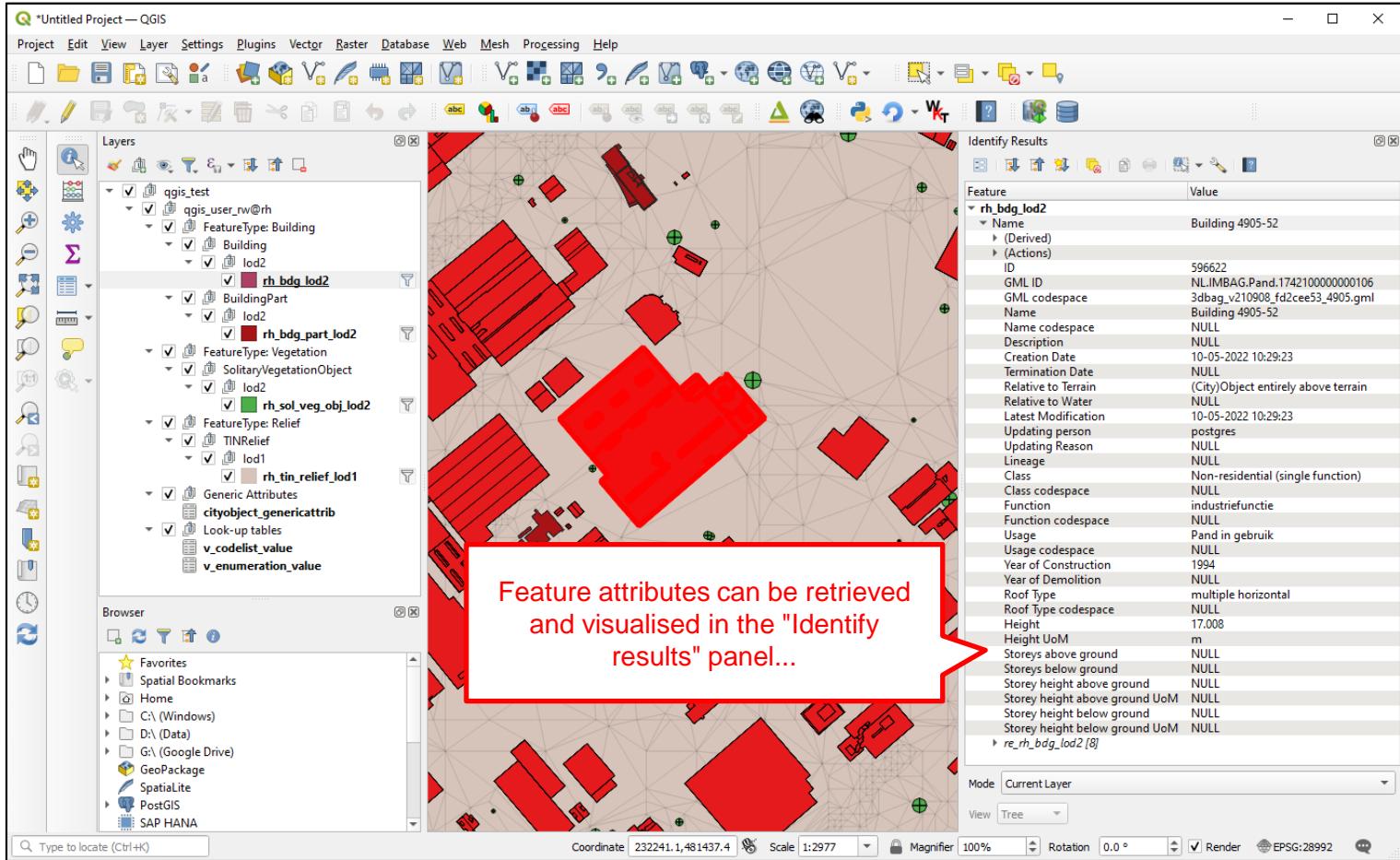
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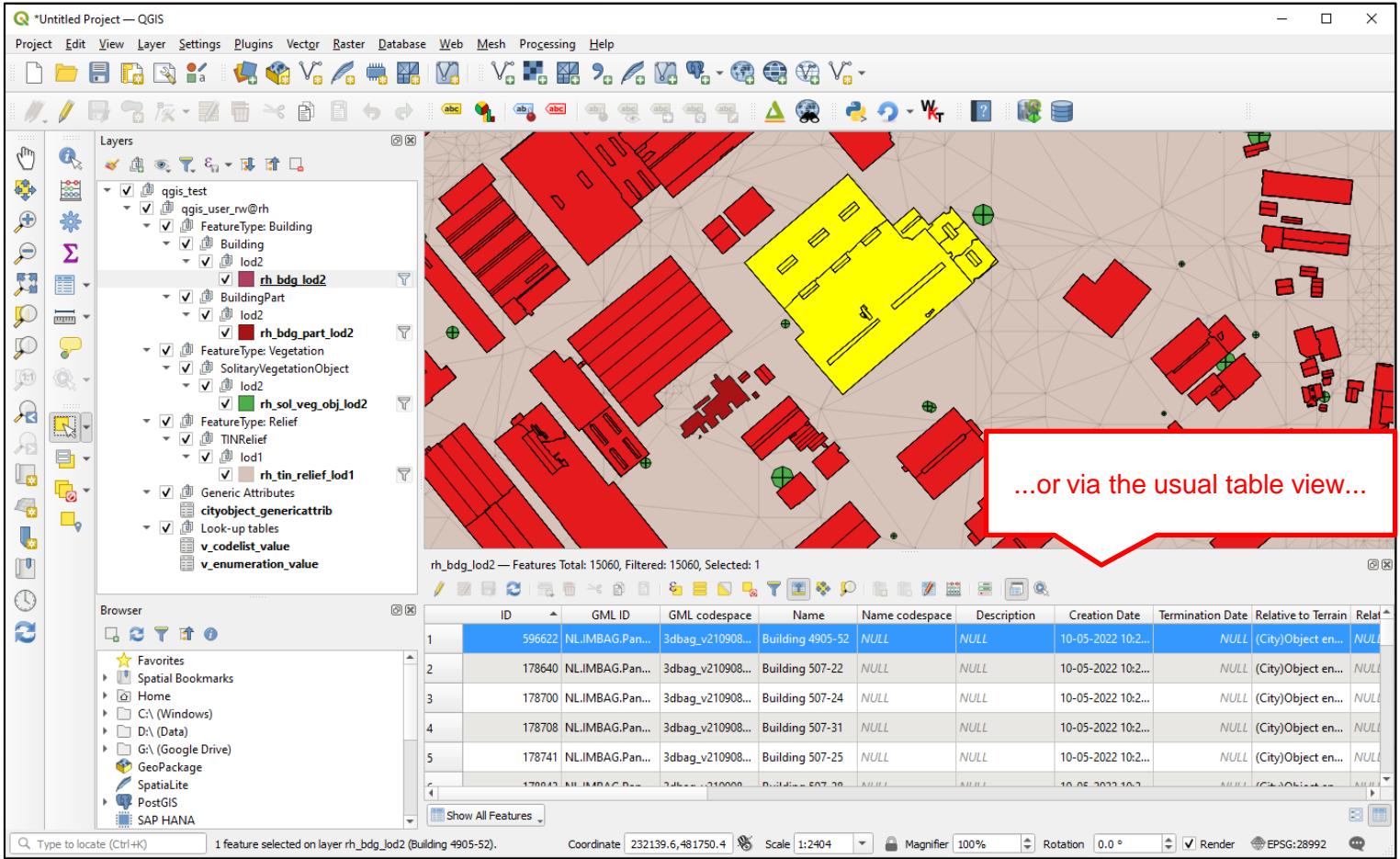
The screenshot shows the QGIS interface with a project titled "Untitled Project — QGIS". The left sidebar contains the "Layers" panel, which lists several layers including "qgis\_test", "qgis\_user\_rw@rh", "Building", "Vegetation", "Relief", and "Generic Attributes". The "Building" layer is expanded, showing sub-layers like "Building", "lod2", "rh\_bdg\_lod2", and "rh\_bdg\_part\_lod2". The main canvas displays a map with red-shaded building footprints on a grey terrain background. A callout bubble in the bottom-left corner of the canvas area contains the text: "Feature attributes can be retrieved and visualised in the \"Identify results\" panel...". The right side of the interface features the "Identify Results" panel, which is currently set to "Mode: Current Layer" and "View: Tree". This panel lists numerous attributes for the selected feature, such as Name (Building 4905-52), ID (596622), GML ID (NLIMBAG.Pand.174210000000106), and various dates and codespaces.

Feature	Value
rh_bdg_lod2	
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  
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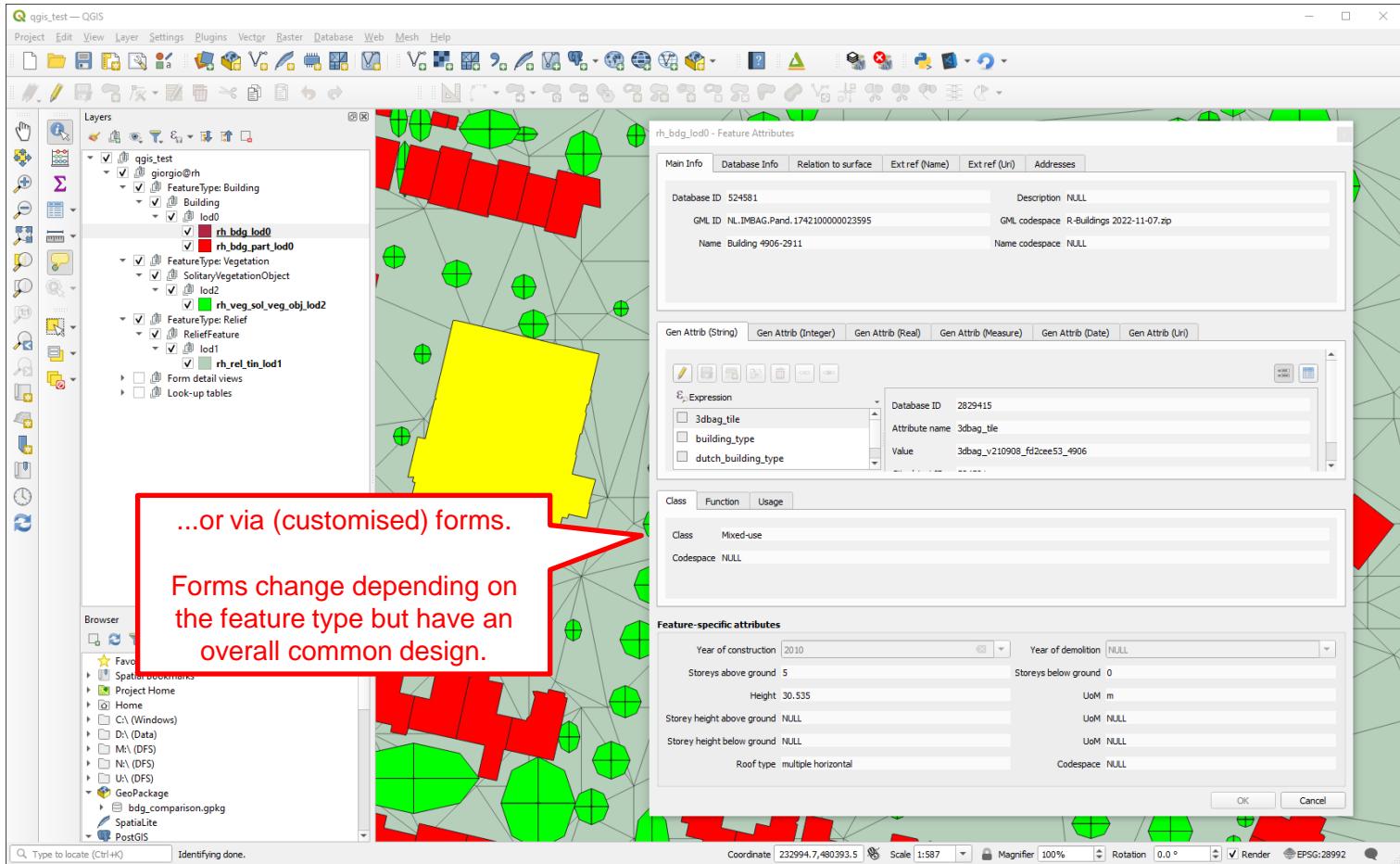
The screenshot shows a QGIS interface with a map view and a table view. In the map view, several buildings are highlighted in red, while one specific building is highlighted in yellow. A red callout box points from the text "...or via the usual table view..." to the attribute table below.

...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.2010908..	Building 4905-52	NULL	NULL	10-05-2022 10:2...	NULL	(City)Object en...	NULL
2	178640	NL.3DGeoInfo.2010908..	Building 507-22	NULL	NULL	10-05-2022 10:2...	NULL	(City)Object en...	NULL
3	178700	NL.3DGeoInfo.2010908..	Building 507-24	NULL	NULL	10-05-2022 10:2...	NULL	(City)Object en...	NULL
4	178708	NL.3DGeoInfo.2010908..	Building 507-31	NULL	NULL	10-05-2022 10:2...	NULL	(City)Object en...	NULL
5	178741	NL.3DGeoInfo.2010908..	Building 507-25	NULL	NULL	10-05-2022 10:2...	NULL	(City)Object en...	NULL
	178602	NL.3DGeoInfo.2010908..	Building 507-20	NULL	NULL	10-05-2022 10:2...	NULL	(City)Object en...	NULL

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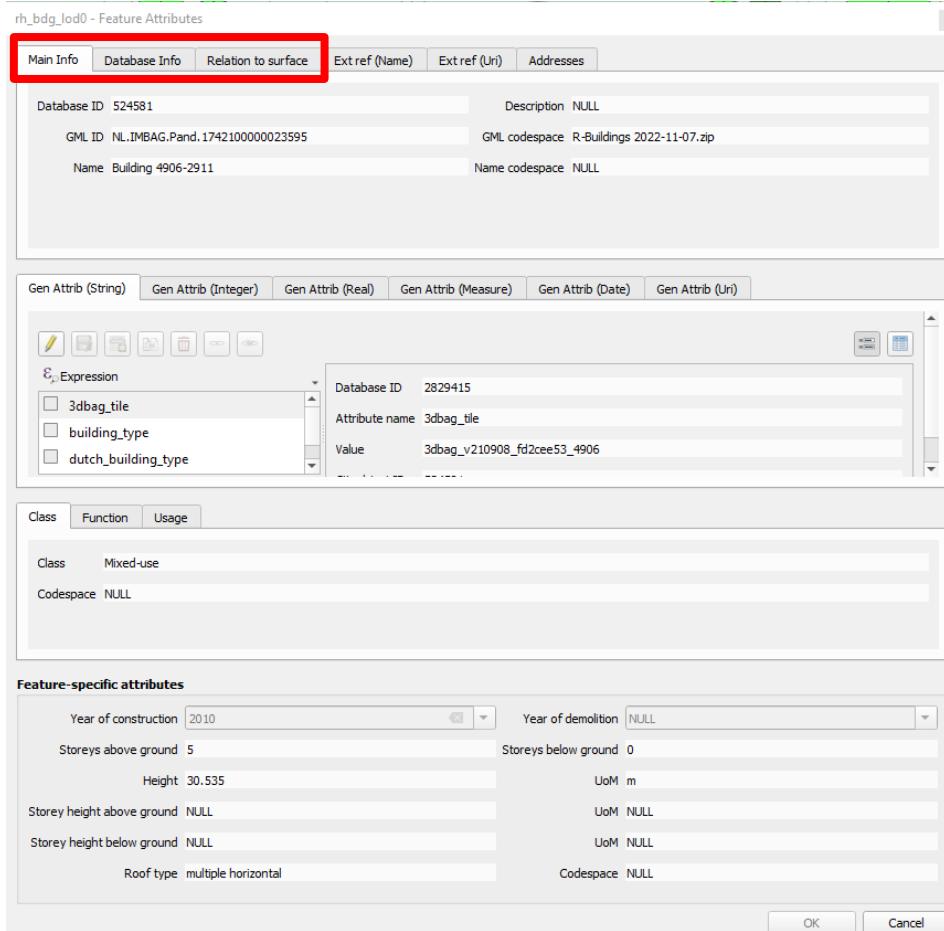
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Attributes are grouped into tabs.



The screenshot shows the QGIS Attribute Editor for a feature named "Building 4906-2911". The top tab bar includes "Main Info", "Database Info", "Relation to surface", "Ext ref (Name)", "Ext ref (Uri)", and "Addresses". The "Main Info" tab is selected. Below the tabs, there are sections for "Database ID" (524581), "GML ID" (NL.IMGAG.Pand.1742100000023595), "Description" (NULL), "Name" (Building 4906-2911), and "Name codespace" (NULL). A red box highlights the tab bar and the "Main Info" section. The "Relation to surface" tab is also visible.

Below the main info, there is a toolbar with icons for creating, deleting, and modifying attributes. A panel titled "Expression" lists attributes: "3dbag\_tile", "building\_type", and "dutch\_building\_type". To the right of the expression panel, there is a table with columns "Database ID", "Attribute name", and "Value". The table shows one row for "3dbag\_tile" with Database ID 2829415, Attribute name 3dbag\_tile, and Value 3dbag\_v210908\_fd2cee53\_4906.

The "Feature-specific attributes" section at the bottom contains fields for "Year of construction" (2010), "Year of demolition" (NULL), "Storeys above ground" (5), "Storeys below ground" (0), "Height" (30.535), "Storey height above ground" (NULL), "Storey height below ground" (NULL), "Roof type" (multiple horizontal), and "Codespace" (NULL).

At the bottom right are "OK" and "Cancel" buttons.

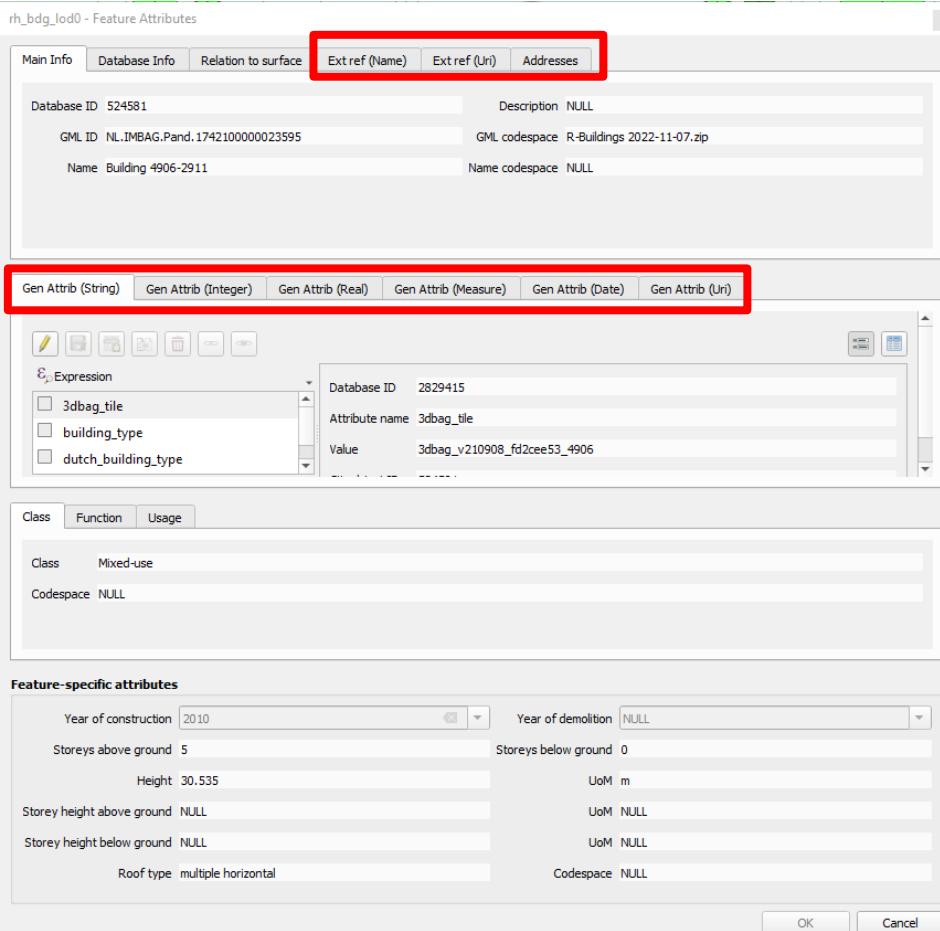
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# Use in QGIS: Attributes

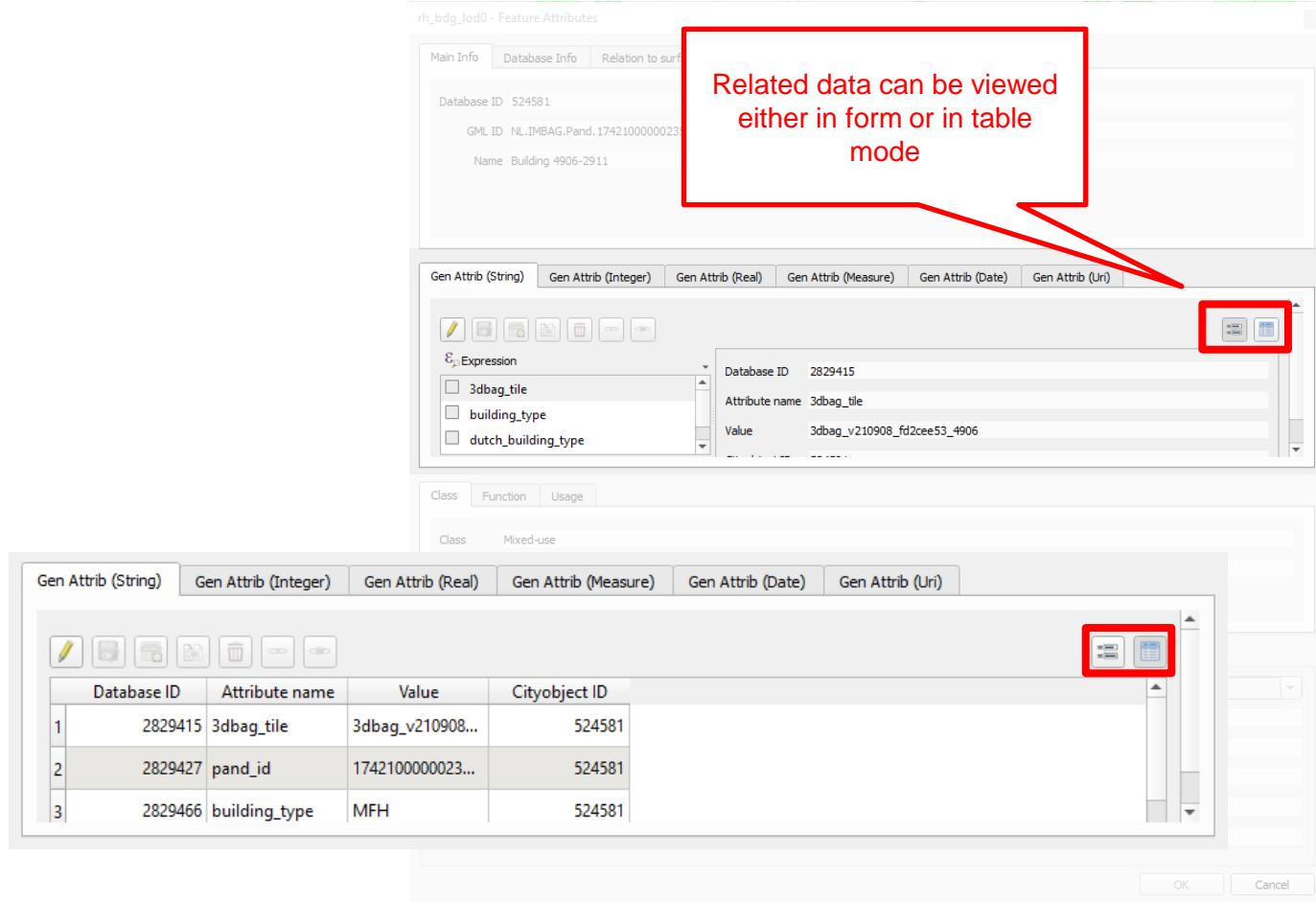
Additional related tables are connected (e.g. External References, Addresses, Generic Attributes)



The screenshot shows the 'Feature Attributes' dialog box for a building layer named 'rh\_bdg\_lod0'. The 'Ext ref (Name)' tab is highlighted with a red border. Other tabs include 'Main Info', 'Database Info', 'Relation to surface', 'Ext ref (Uri)', and 'Addresses'. Below the tabs, there are sections for 'Gen Attrib (String)', 'Gen Attrib (Integer)', 'Gen Attrib (Real)', 'Gen Attrib (Measure)', 'Gen Attrib (Date)', and 'Gen Attrib (Uri)'. A section for 'Expression' lists three items: '3dbag\_tile', 'building\_type', and 'dutch\_building\_type'. The 'Value' column for '3dbag\_tile' contains the string '3dbag\_v210908\_fd2cee53\_4906'. The 'Class' section shows 'Mixed-use' and 'Codespace NULL'. The 'Feature-specific attributes' section includes fields for 'Year of construction' (2010), 'Storeys above ground' (5), 'Height' (30.535), 'Storey height above ground' (NULL), 'Storey height below ground' (NULL), 'Roof type' (multiple horizontal), 'Year of demolition' (NULL), 'Storeys below ground' (0), 'Height UoM' (m), 'Storey height UoM' (NULL), 'Roof type UoM' (NULL), and 'Codespace' (NULL). Buttons for 'OK' and 'Cancel' are at the bottom right.

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The screenshot shows the QGIS Attribute Editor for a feature named "Building 4906-2911". The top part displays "Main Info" with fields like Database ID (524581), GML ID (NL.IMBAG.Pand.1742100000023), and Name (Building 4906-2911). A red box highlights the "Form" and "Table" buttons in the bottom right corner of this panel. The bottom part shows the "Table" mode, where attributes are listed in a table:

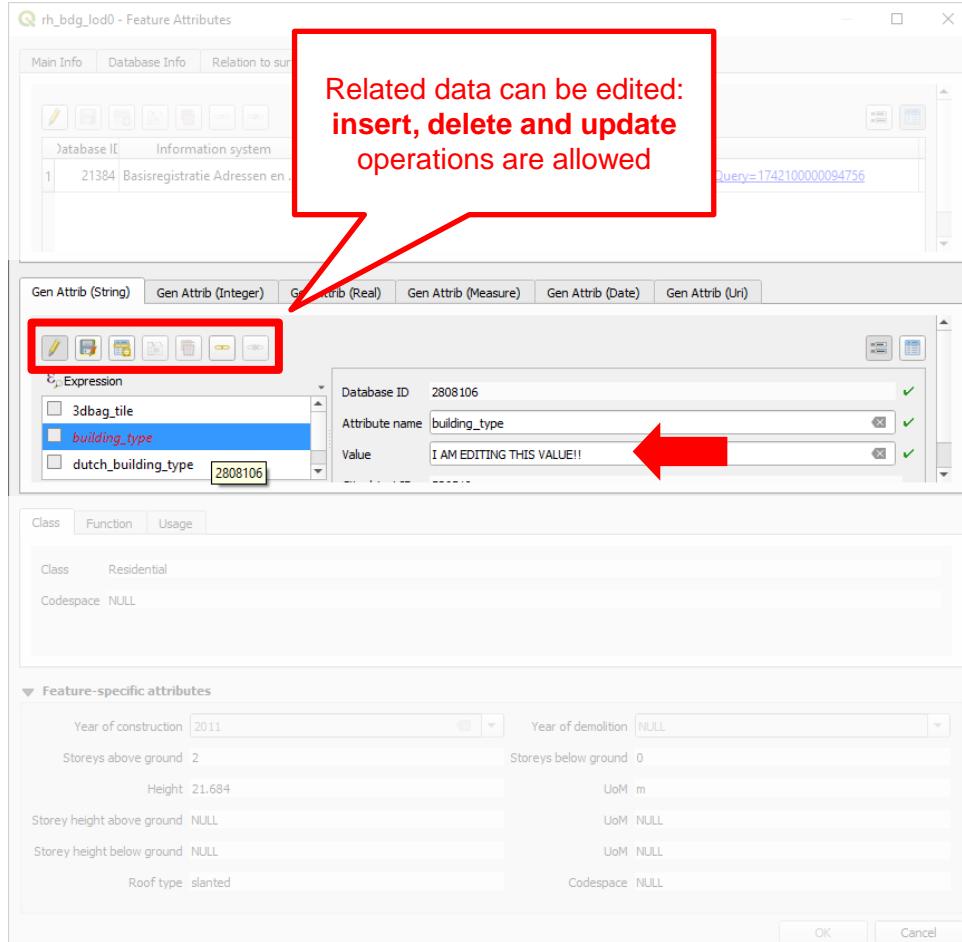
	Database ID	Attribute name	Value	Cityobject ID
1	2829415	3dbag_tile	3dbag_v210908...	524581
2	2829427	pand_id	1742100000023...	524581
3	2829466	building_type	MFH	524581

A red box highlights the "Form" and "Table" buttons in the bottom right corner of the Attribute Editor interface.

Related data can be viewed  
either in form or in table  
mode

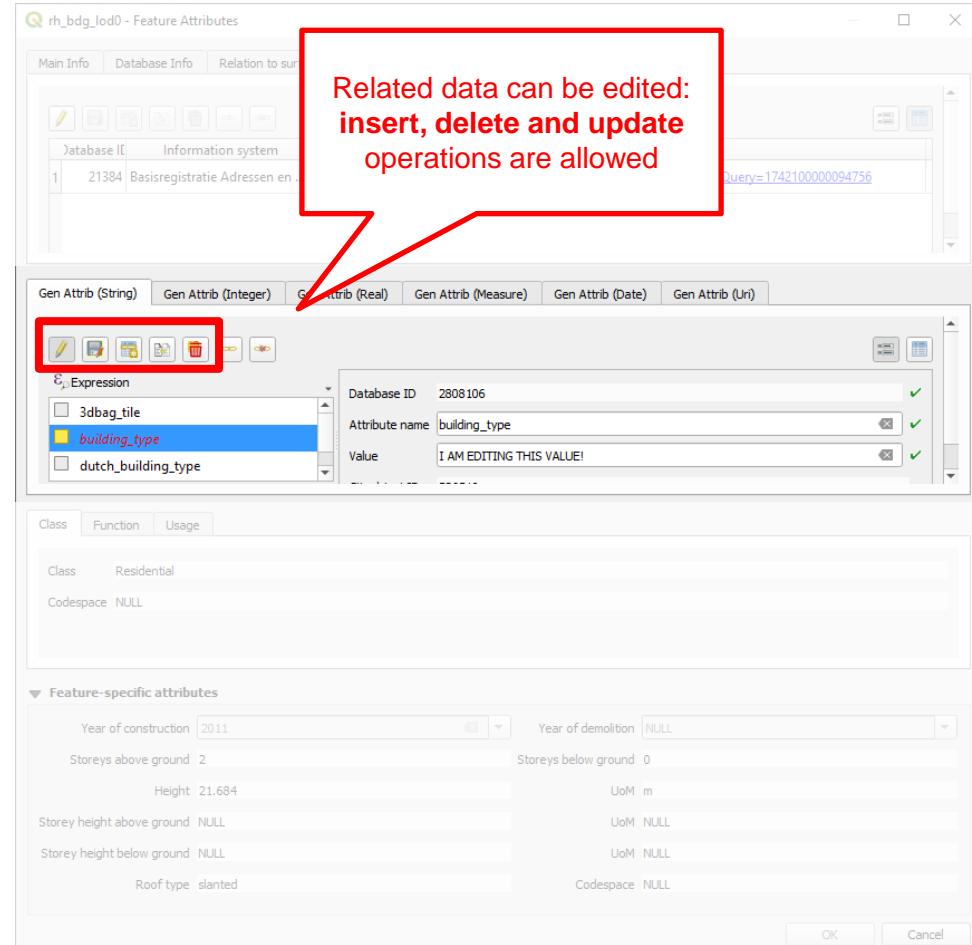
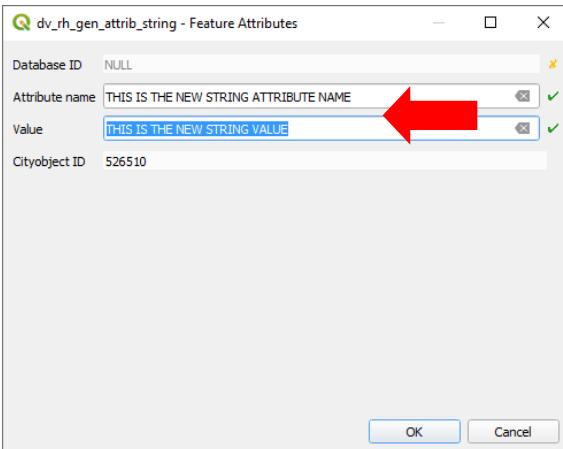
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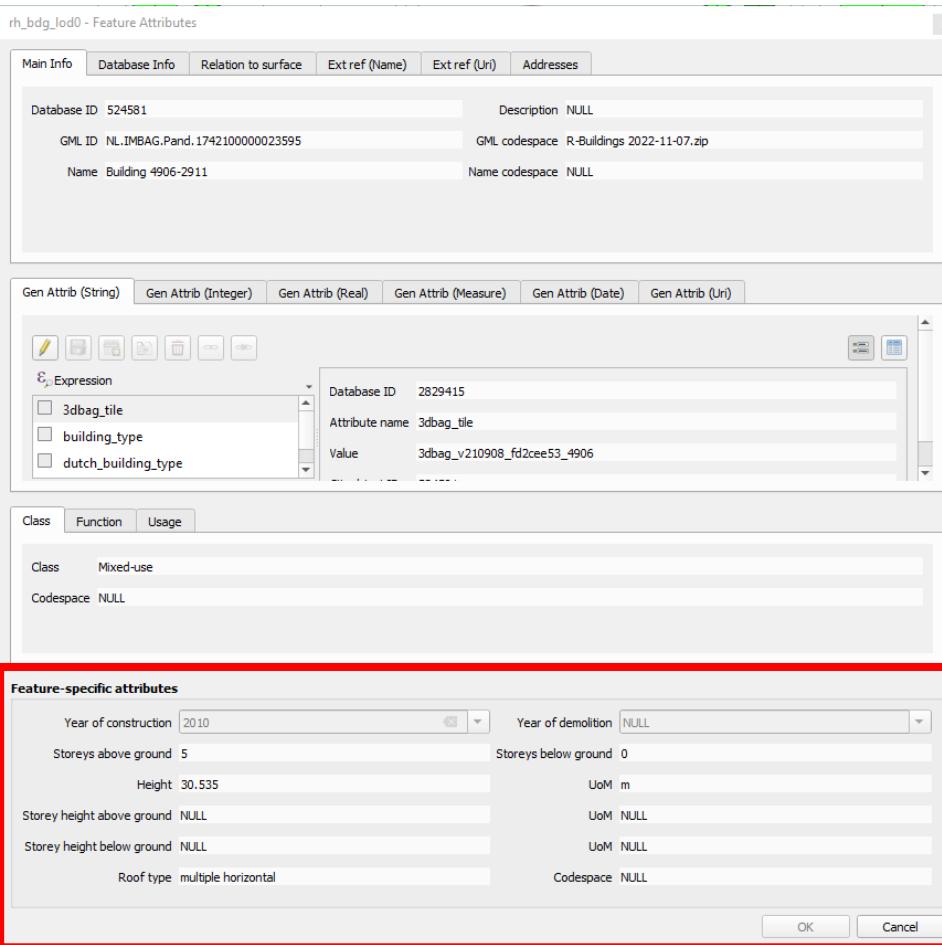


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# Use in QGIS: Attributes



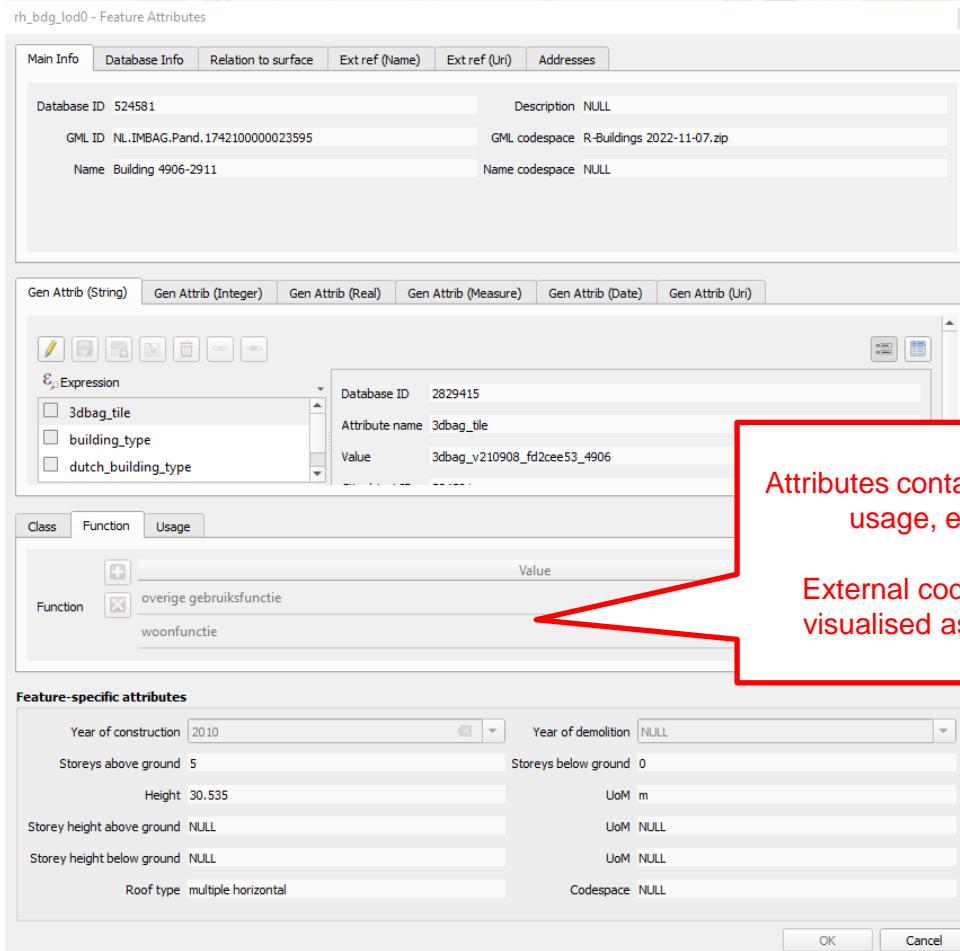
The screenshot shows the QGIS Attribute Editor for a feature named "Building 4906-2911". The top section displays general information such as Database ID (524581), GML ID (NL.IMBAG.Pand.1742100000023595), Description (NULL), and Name (Building 4906-2911). Below this, the "Gen Attrib (String)" tab is selected, showing an expression builder with three items: "3dbag\_tile", "building\_type", and "dutch\_building\_type". The value for "3dbag\_tile" is listed as "3dbag\_v210908\_fd2cee53\_4906". The bottom section, which is highlighted with a red box, contains a table titled "Feature-specific attributes" with the following data:

Attribute	Value
Year of construction	2010
Storeys above ground	5
Height	30.535
Storey height above ground	NULL
Storey height below ground	NULL
Roof type	multiple horizontal
Codespace	NULL

A red callout points from the text "Feature-specific attributes are grouped in the lower part of the form." to the "Feature-specific attributes" table.

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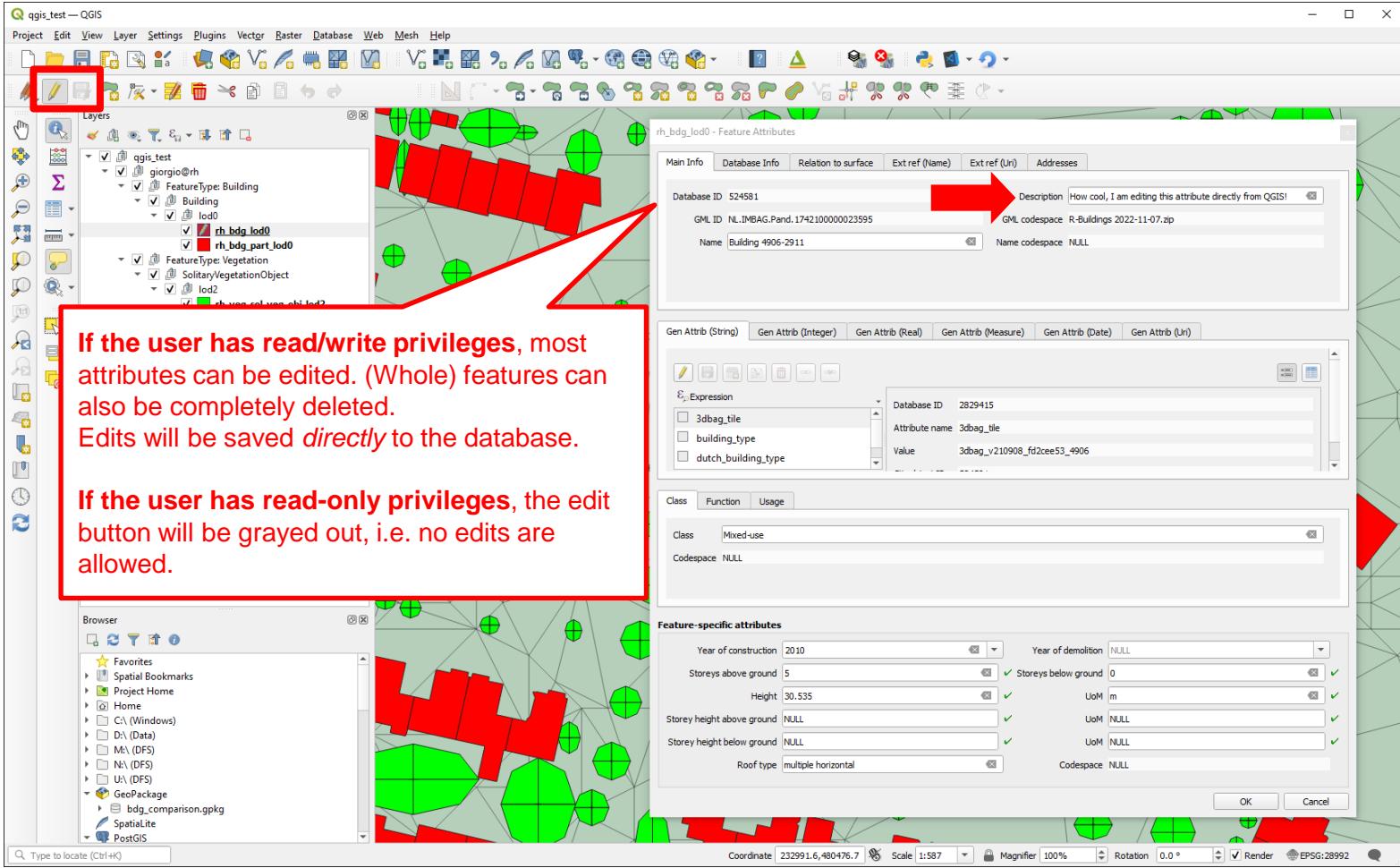


Attributes containing [0..\*] entries (e.g. function, usage, etc.) are presented as lists.

External codelists can also be loaded and visualised as look-up tables (see later on)

# Use in QGIS: Attribute editing

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The screenshot shows the QGIS interface with a building layer selected in the layers panel. A red box highlights the edit icon in the toolbar. A red arrow points from the edit icon to the 'Edit ref (Name)' tab in the 'Feature Attributes' dialog, which is open over the map canvas. The dialog shows a database ID of 524581 and a name of 'Building 4906-2911'. Another red arrow points from the 'Edit ref (Name)' tab to the 'Edit' button in the toolbar. A callout box contains two pieces of text:

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

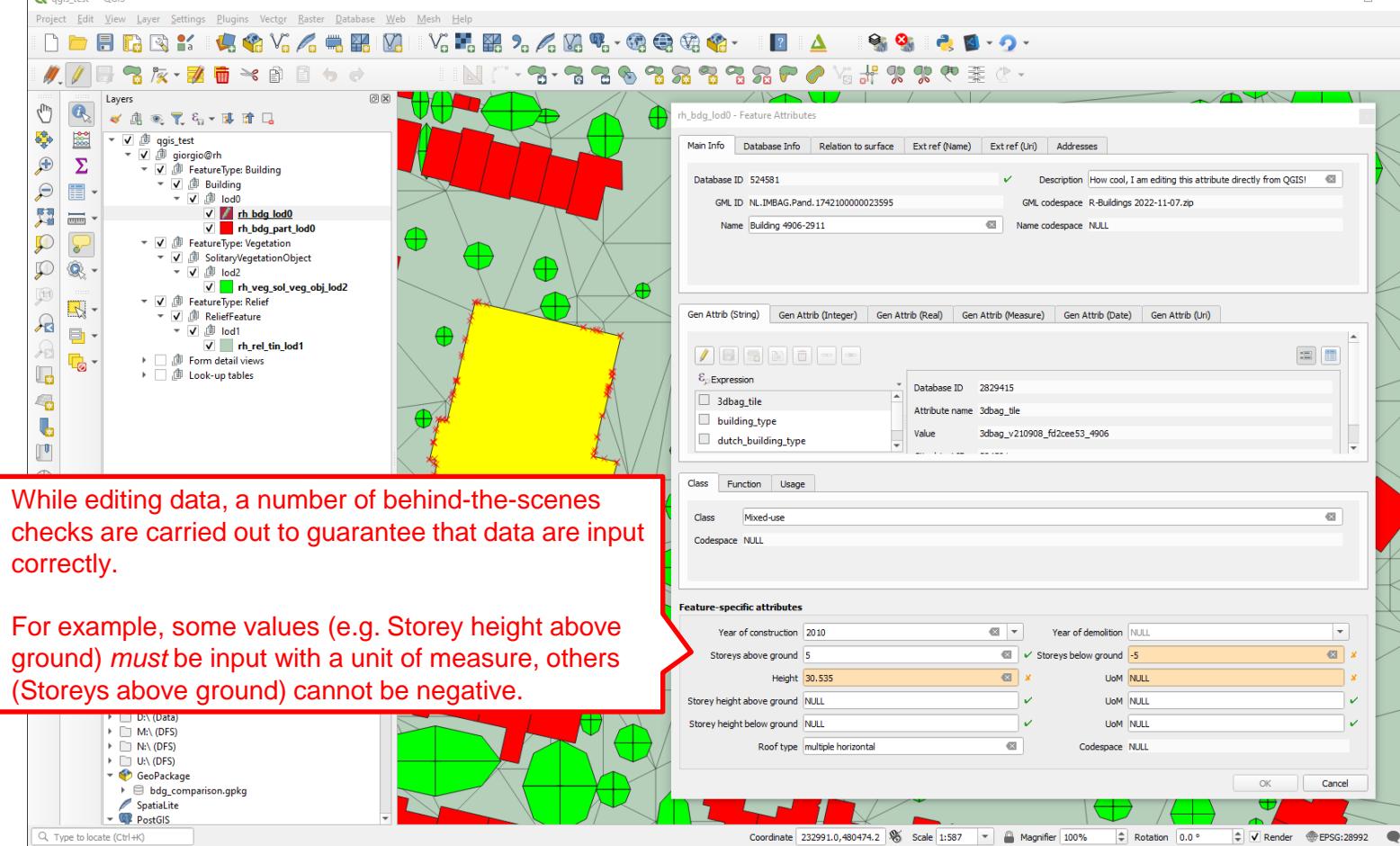
If the user has read-only privileges, the edit button will be grayed out, i.e. no edits are allowed.

The 'Feature-specific attributes' table in the dialog includes the following fields:

Attribute	Value	Unit
Year of construction	2010	
Storeys above ground	5	
Height	30.535	m
Storey height above ground	NULL	
Storey height below ground	NULL	
Roof type	multiple horizontal	
Codespace	NULL	

# Use in QGIS: Attribute editing

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The screenshot shows the QGIS interface with a project named "qgis\_test". The left panel displays a tree view of layers, including "giorgio@rh" which contains "FeatureType: Building", "FeatureType: Vegetation", and "FeatureType: Relief". A specific layer, "rh\_bdg\_lod0", is selected and highlighted in red. The main canvas shows a 3D rendering of buildings and vegetation. A context menu is open over a yellow-shaded building, showing options like "Edit feature" and "Attribute table". To the right, the "Feature Attributes" dialog is open for the selected feature. The "Main Info" tab shows the database ID (524581), GML ID (NL.IMGAG.Pand.1742100000023595), and name (Building 4906-2911). The "Gen Attrib (String)" tab shows the expression "3dbag\_tile" with a value of "3dbag\_v210908\_fd2ceef5\_4906". The "Feature-specific attributes" tab includes fields for Year of construction (2010), Storeys above ground (5), Height (30.535), and other related attributes. A red callout box points from the text below to the "Height" field.

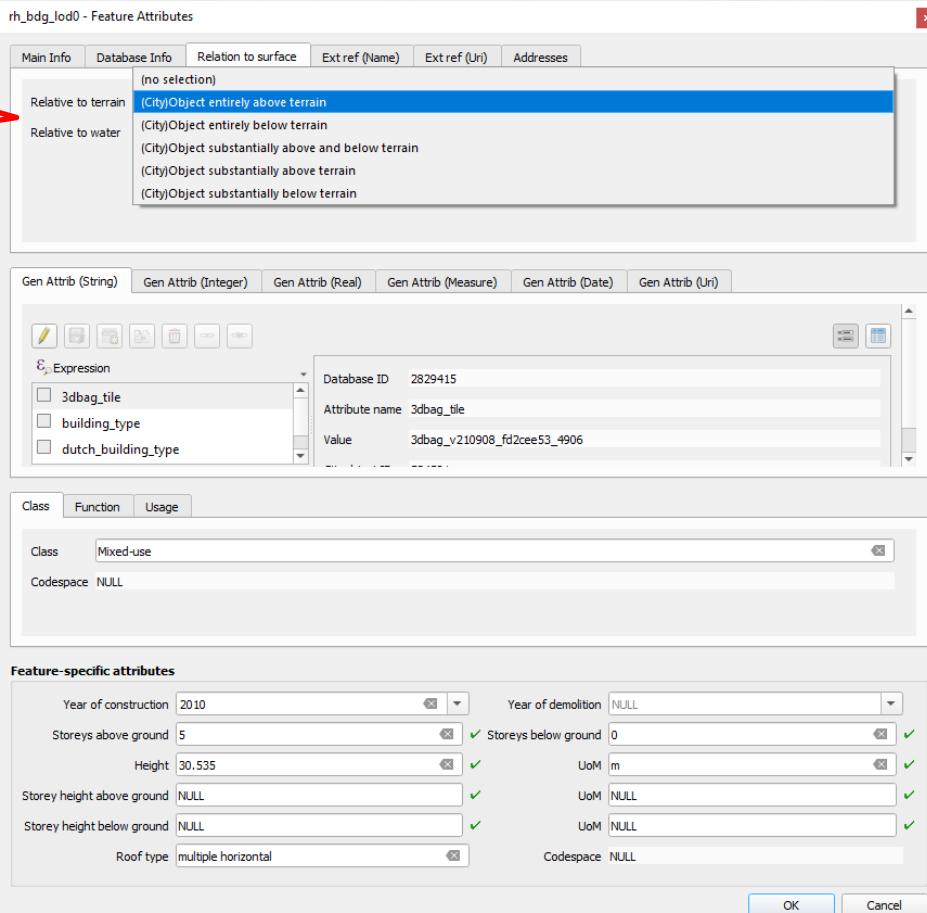
While editing data, a number of behind-the-scenes checks are carried out to guarantee that data are input correctly.

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.

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While editing data, input of enumeration values is made via drop-down lists



# Use in QGIS: Codelist support

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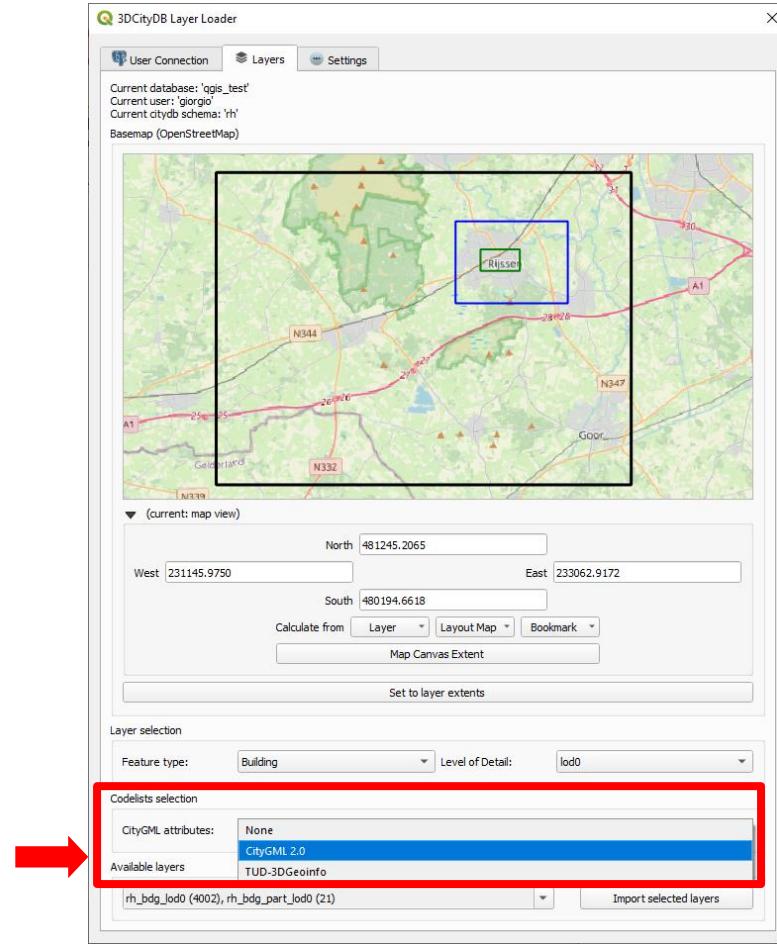
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Codelists can be selected upon layer import

The attribute forms will be formatted automatically into drop-down lists or multiple-selection lists

Codelists can be added and customised either by the database administrator or by the user (see **Advanced options**)

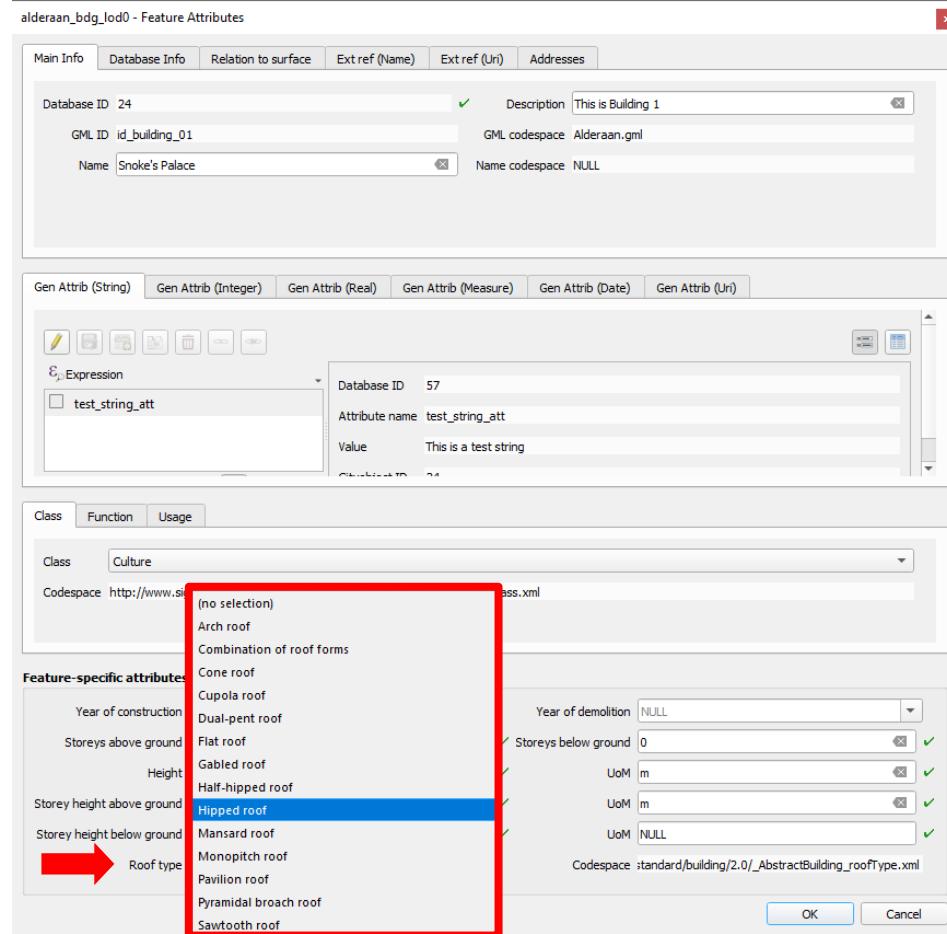


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In the case of a CityGML property with cardinality [0..1], the associated codelist values are presented as a **drop-down list**

Example: **Roof type**

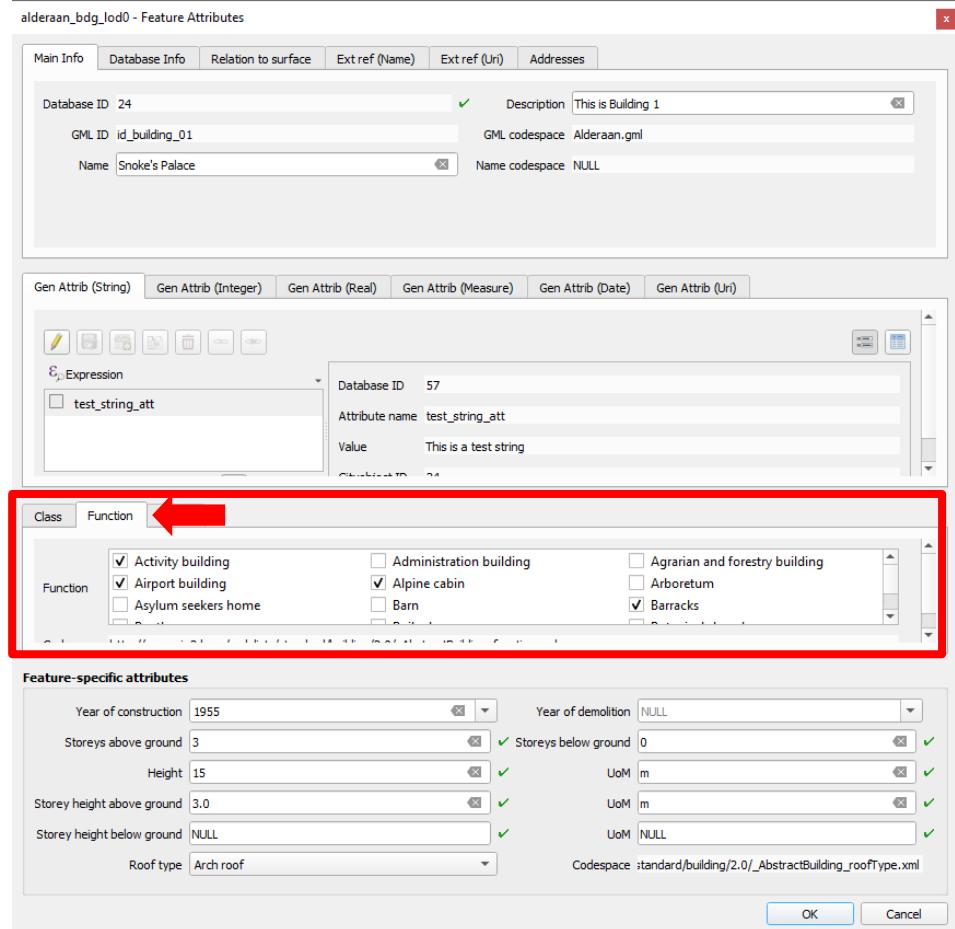


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In the case of a CityGML property with cardinality [0..\*], the associated codelist values are presented as a **multiple-selection list**

Example: property (Building) function

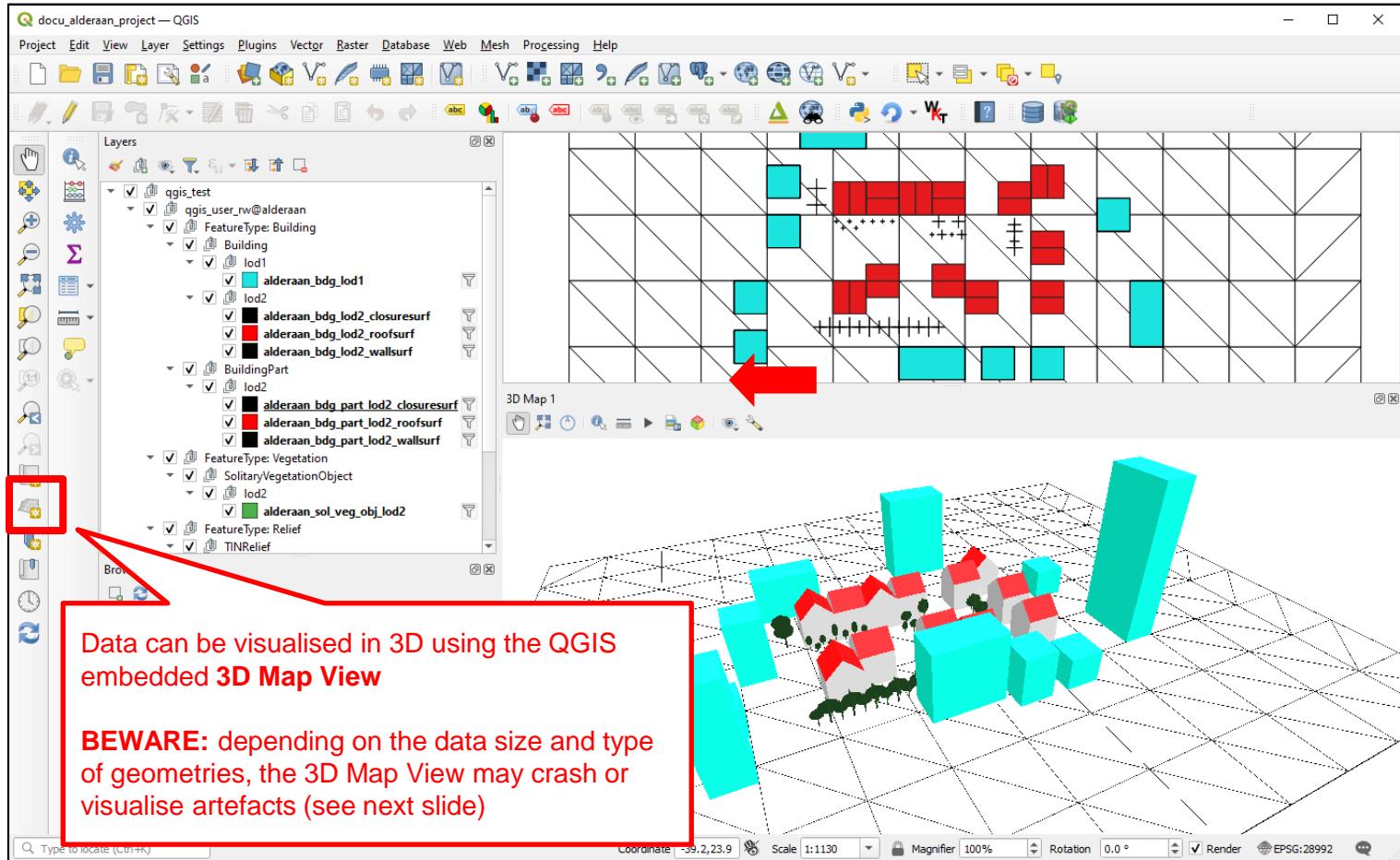


# Use in QGIS: 3D visualisation

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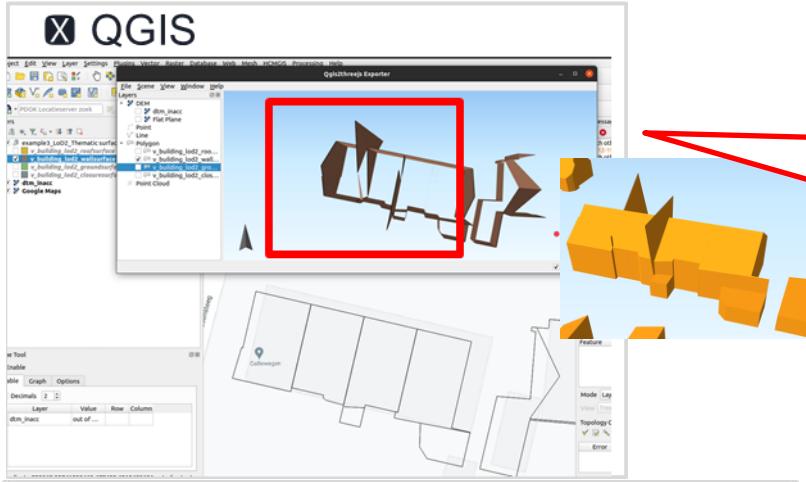
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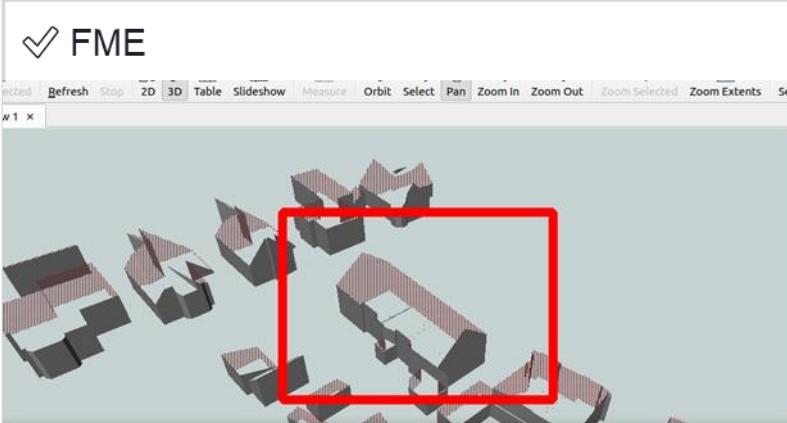


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# Use in QGIS: 3D visualisation



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.

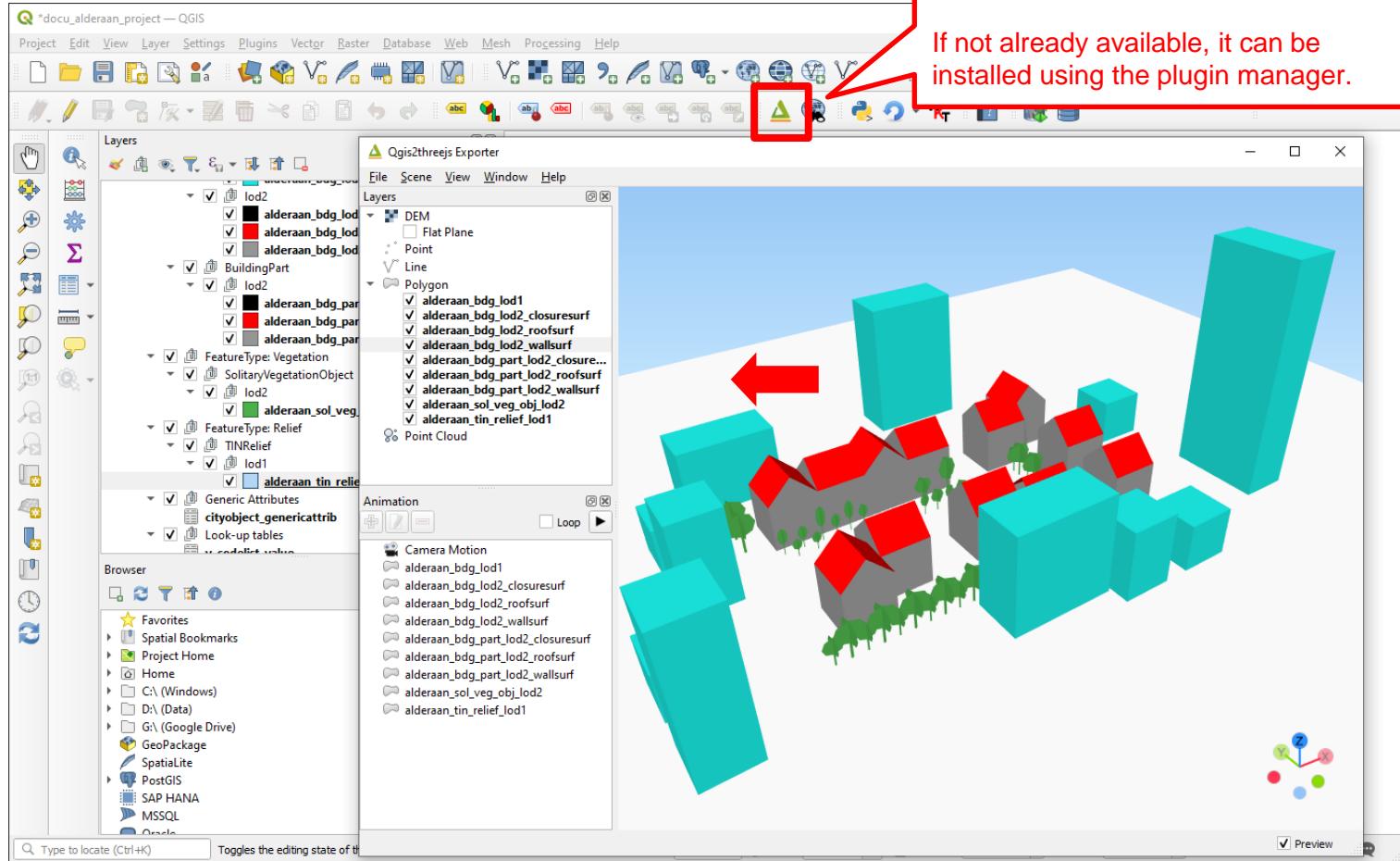


✓  
**Google earth  
 (as KML)**

# Use in QGIS: 3D visualisation

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

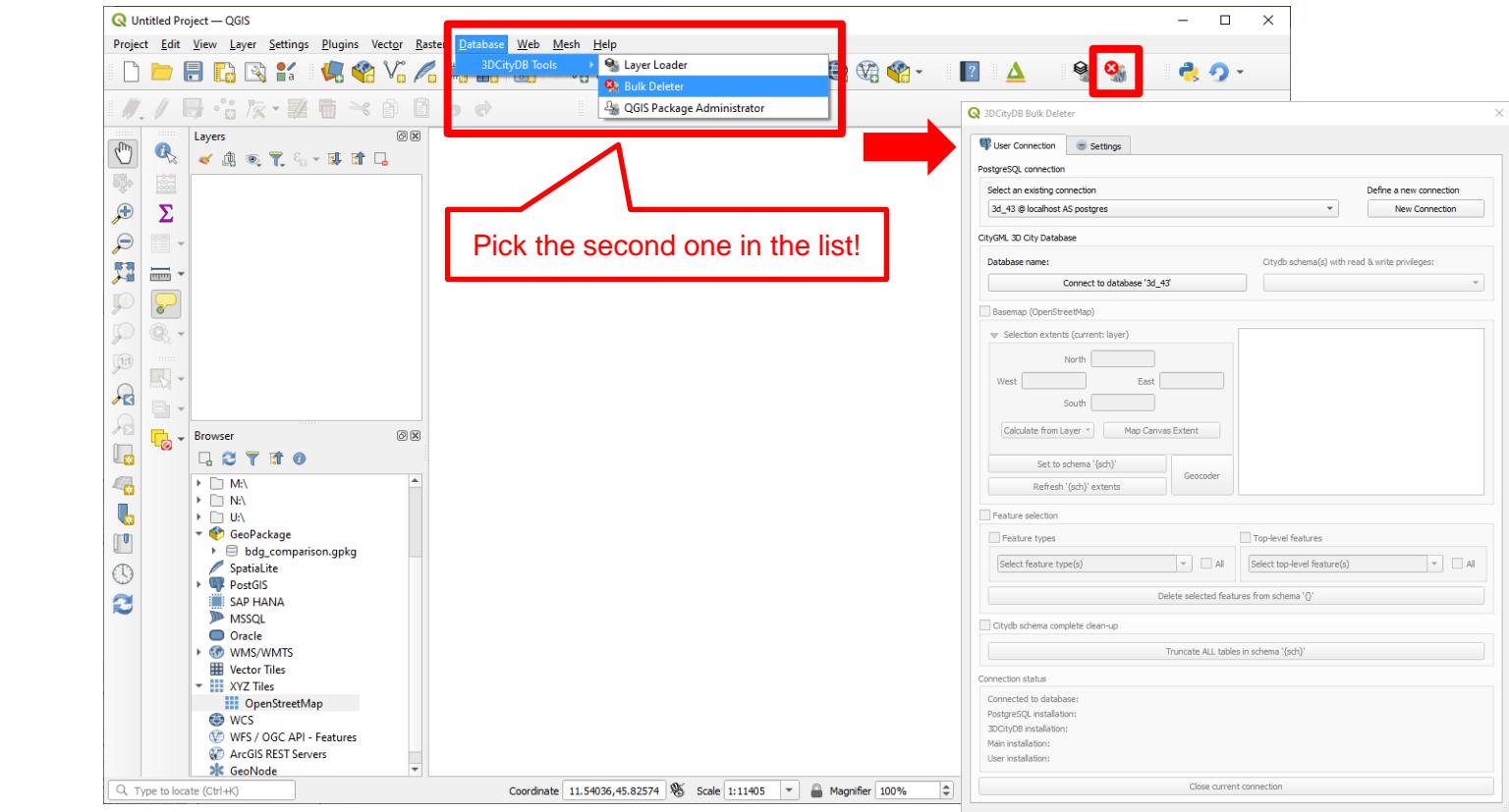
If not already available, it can be installed using the plugin manager.



# Bulk Deleter



Open the **Bulk Deleter** from the menu or by clicking on the corresponding icon



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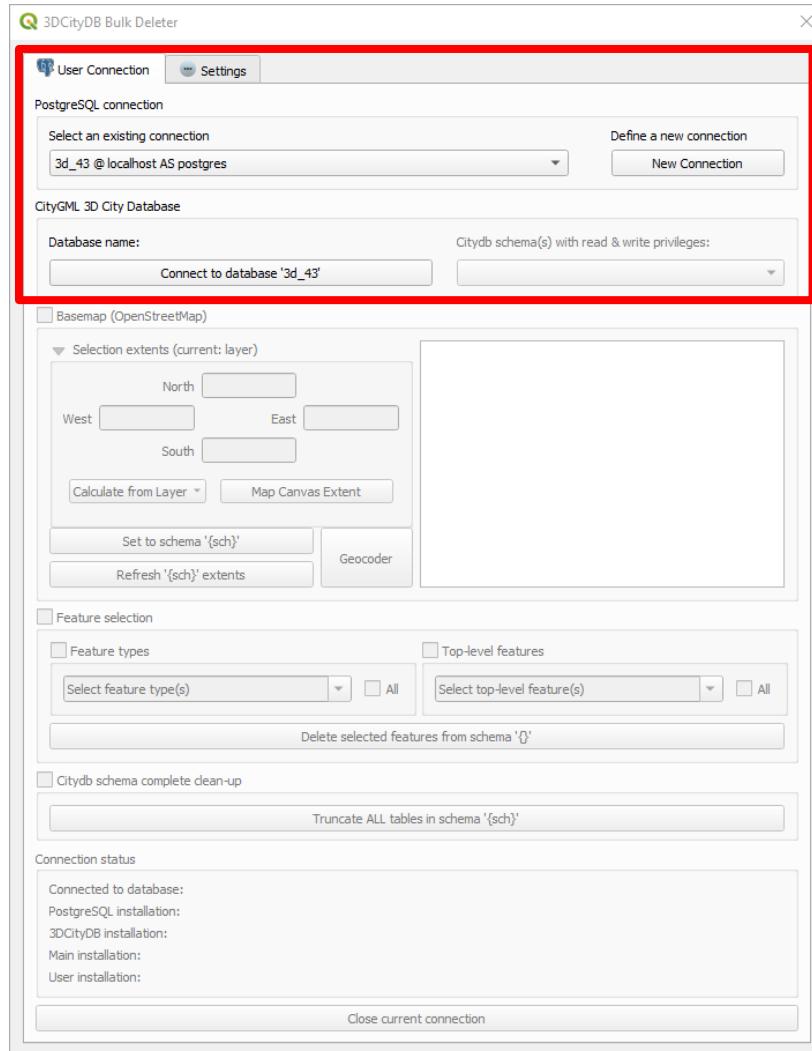
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# Bulk Deleter

In the "User Connection" tab

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

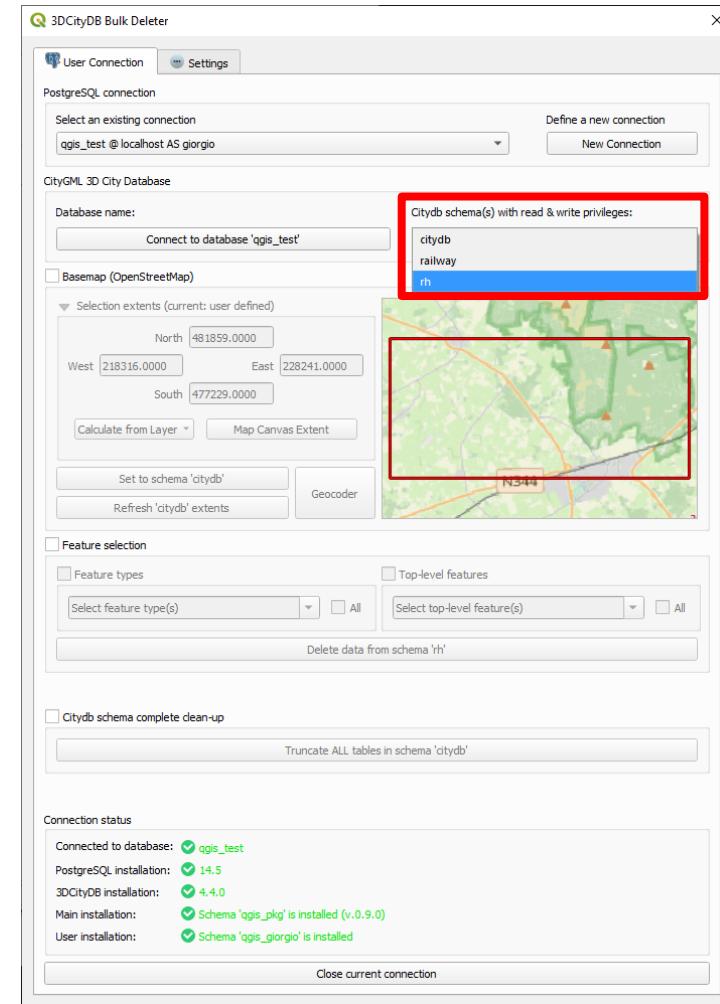
2) Connect to the chosen database



# Bulk Deleter

3) Once connected, choose one of the available citydb schemas

**Nota bene:** Only the citydb schemas for **which you have read & write ("rw") privileges** are listed

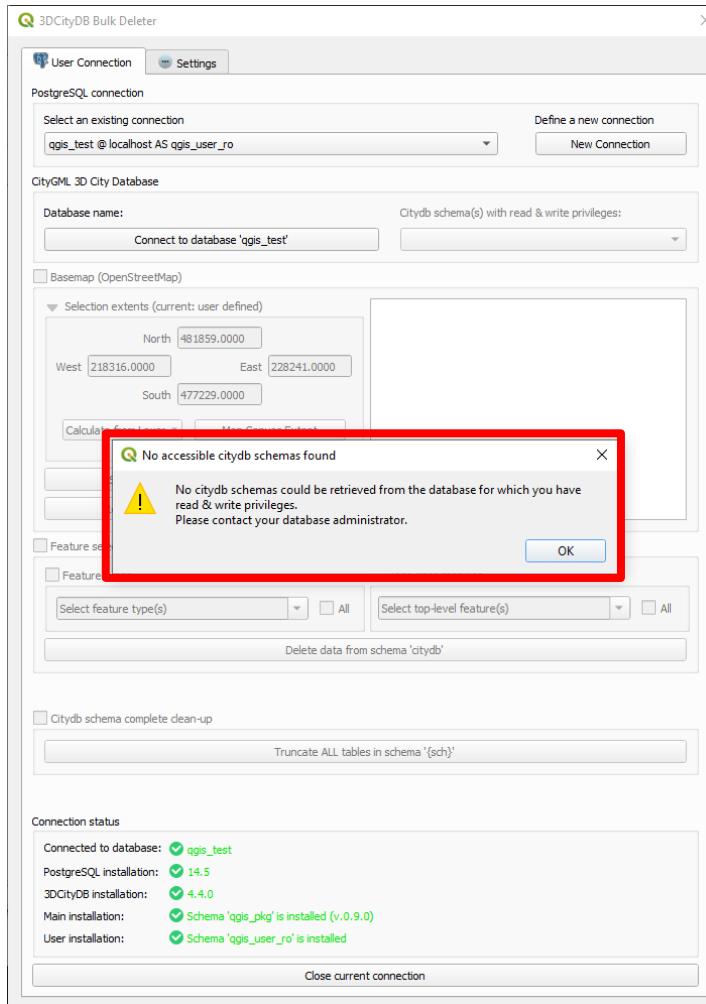


# Bulk Deleter

3) Once connected, choose one of the available citydb schemas

**Nota bene:** Only the citydb schemas for which you have read & write ("rw") privileges are listed

If there are no citydb schemas for which you have "rw" privileges, you will be notified before the connection is closed and the GUI completely disabled.



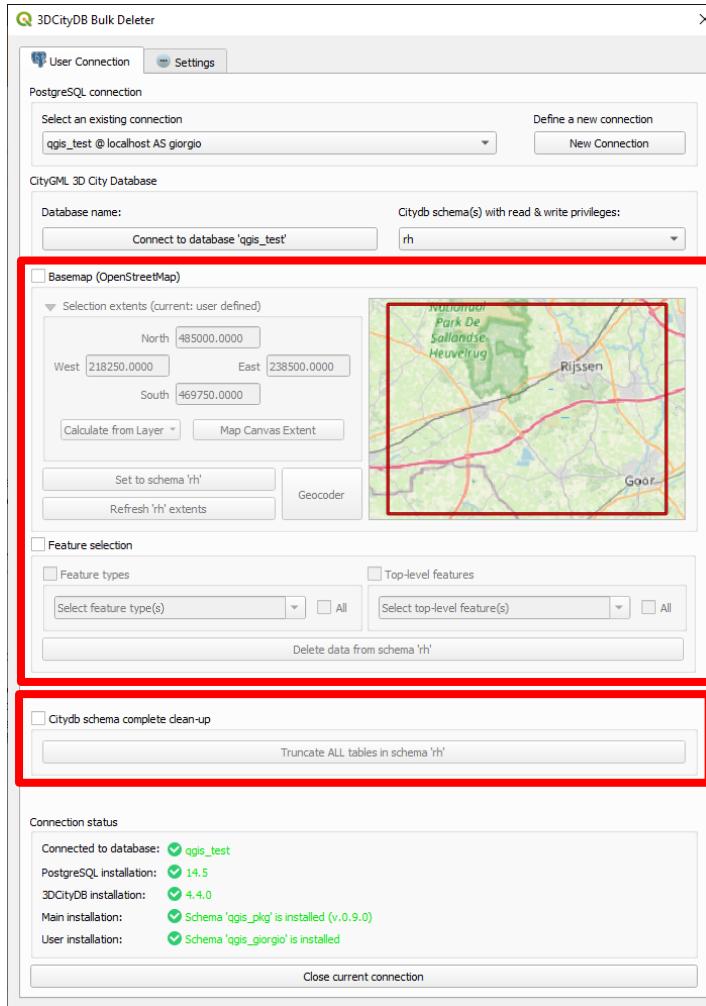
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4) Once you have selected the citydb schema, you can perform 2 types of actions:

- Select specific features to delete (and optionally define a spatial filter, too)
- Clean up the whole schema, i.e. truncate all tables of the selected citydb schema

The GUI will prevent you from choosing both at the same time



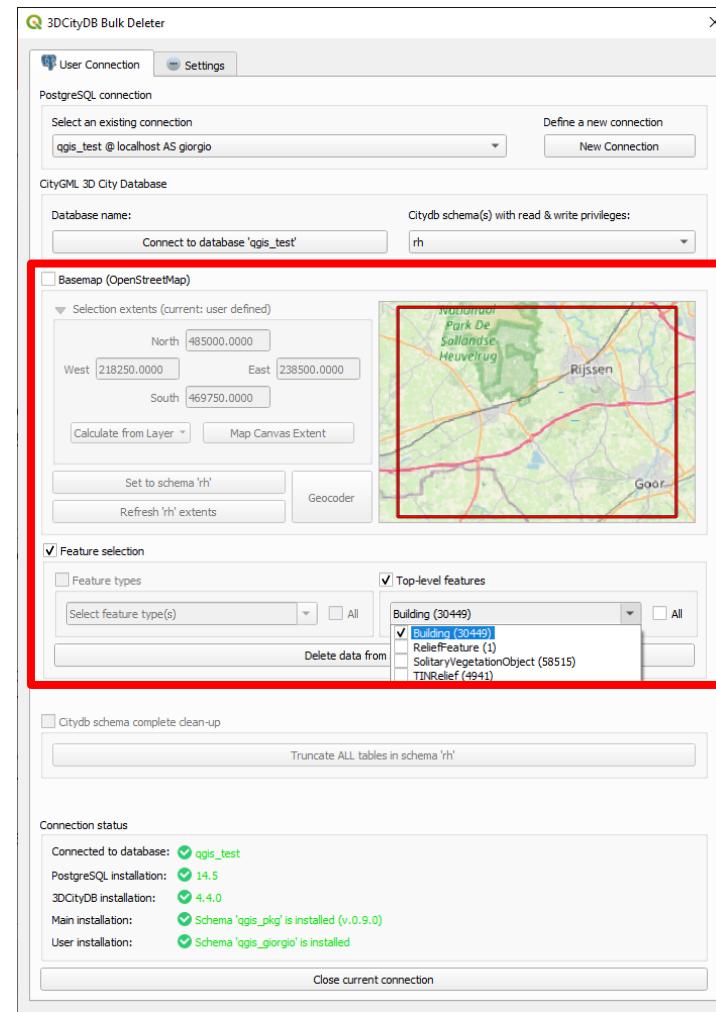
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- 5a) Select the features to delete. Activate the **Feature selection box**. You can now select:
- either CityGML Features types
  - or top-level features

**Remember:** Feature Types correspond to CityGML modules, i.e. they may contain multiple top-level features. For example:

- Feature Type "Vegetation" includes "Solitary Vegetation Object" and "PlantCover" top-level features
- Feature Type "Relief" includes "TINRelief", "BreakLineRelief" and "MassPointRelief" top-level features



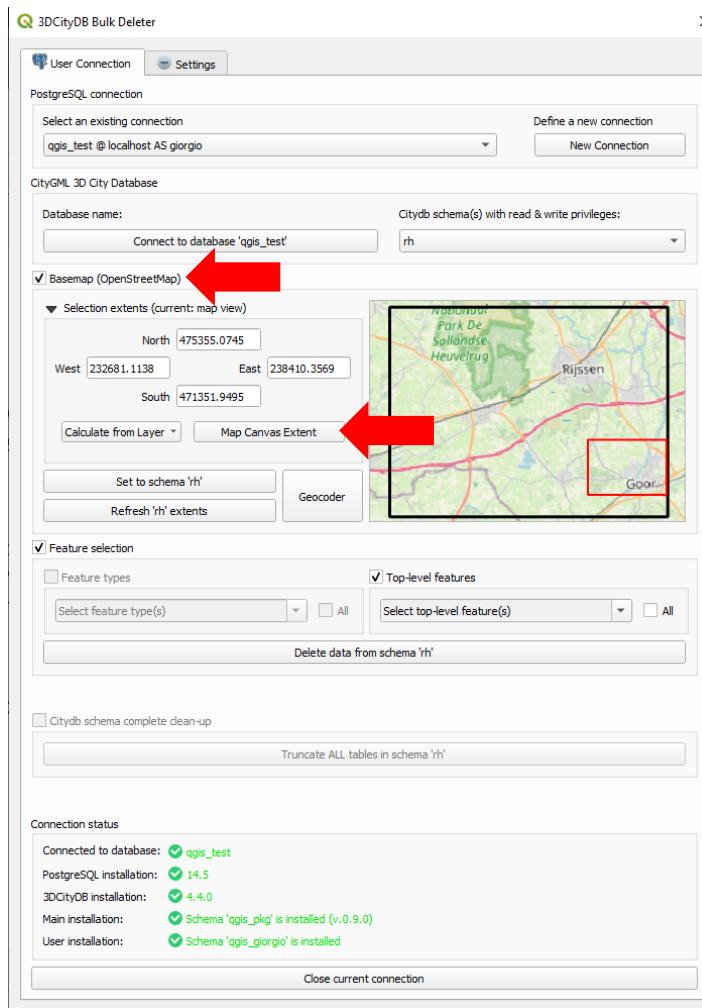
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- 5a) Select the features to delete. Activate the **Feature selection box**. You can now select:
- either CityGML Features types
  - or top-level features
  - and, optionally, define the extents of the area where to delete the selected feature. You must then also activate the **Basemap box** and press the **Map Canvas Extent button**

The delete extents are represented by the **red bounding box**.

**Please note:** The Set to schema {cdb\_schema}, Refresh {cdb\_schema} and GeoCoder buttons follow the same logic as in the Layer Loader



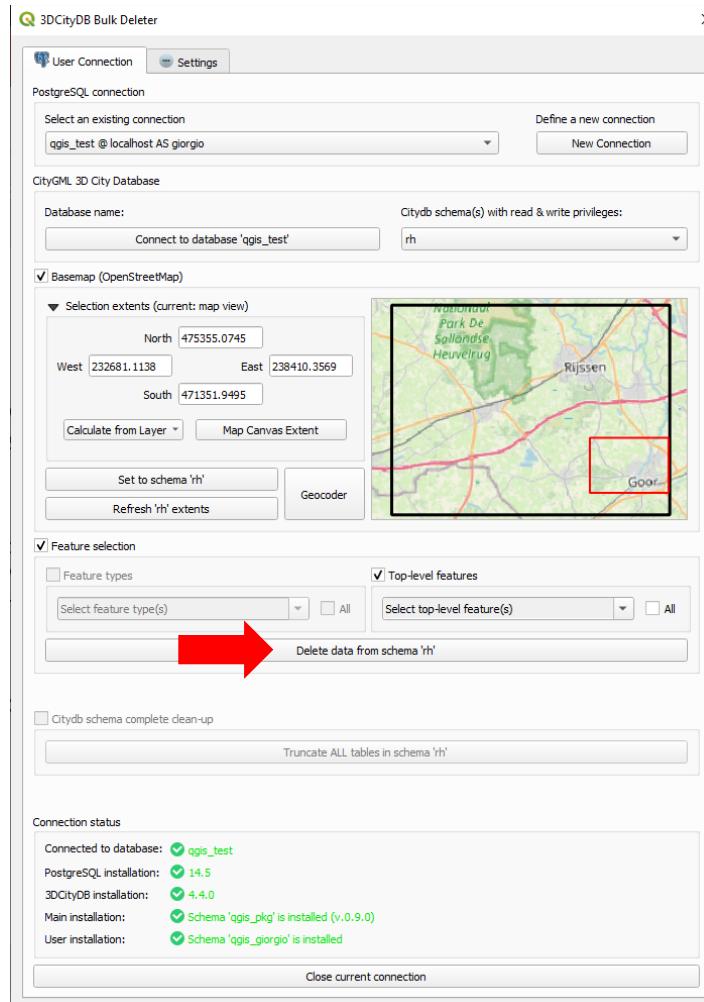
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6a) Press the **Delete data from schema {cdb\_schema}** button

**Beware:** Depending on the quantity of selected features, the operation might take some time.

If you want to completely delete the database, you are recommended to use the other option (see next slides) which is **much faster!**

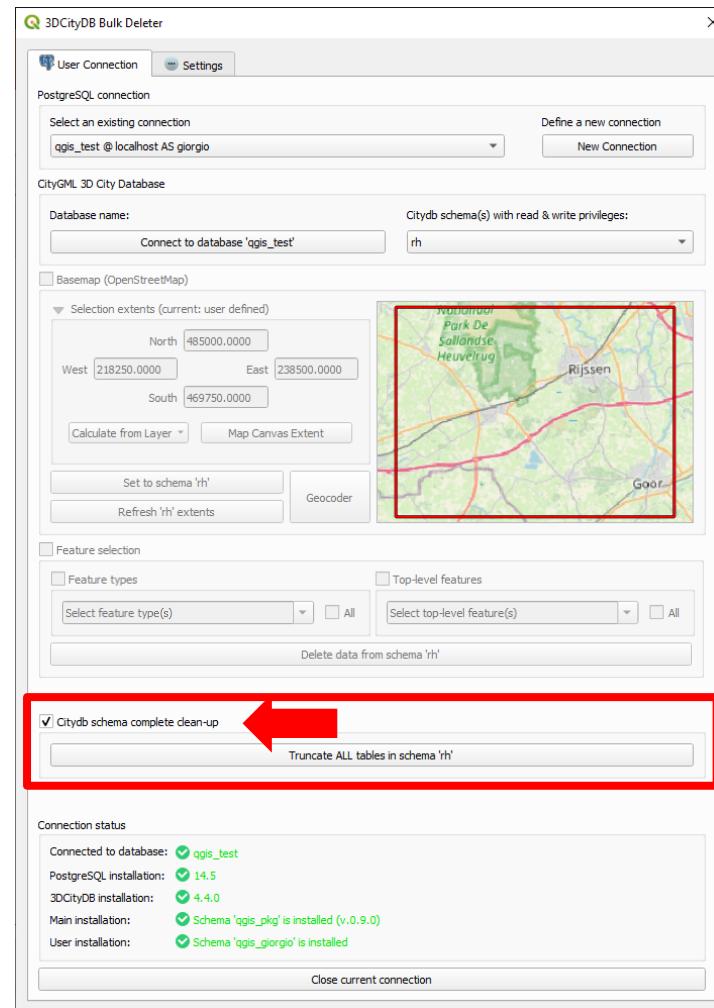


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5b) Enable the **Citydb schema complete clean-up box** and press the **Truncate ALL tables in schema {cdb\_schema}** button.

**Beware:** The selected citydb schema will be completely emptied and reset to its initial state. In addition, all preexisting privileges (also of other users) will be reset to "None"



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# Customised codelists

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

- Codelist values from the non-normative CityGML specifications
- Codelist 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)

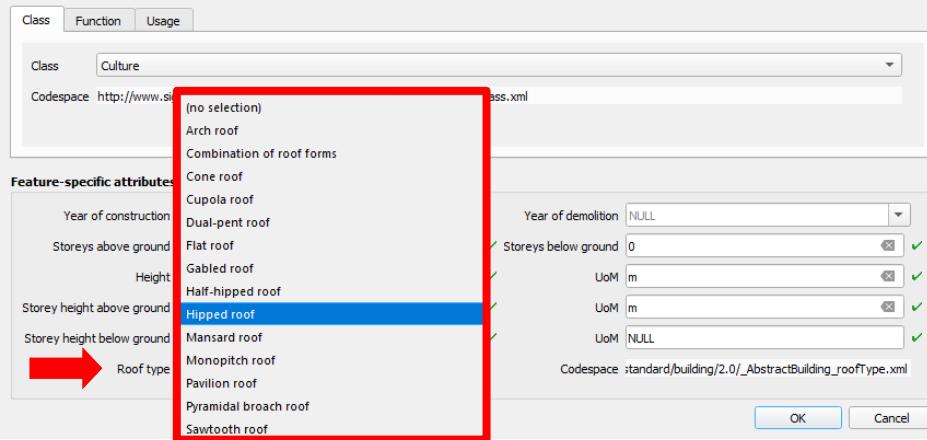
In this way the user does not have to "remember" specific codes when typing, thus reducing the chances of wrong data input

The 3DCityDB-Tools plugin already contains the codelists from the CityGML 2.0 specifications.

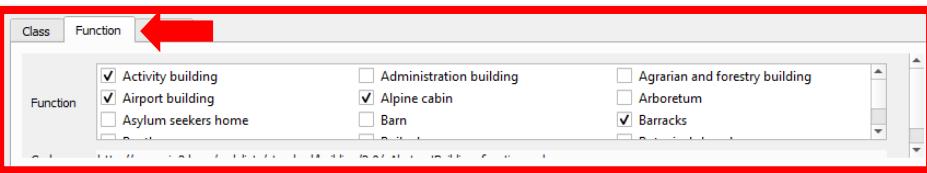
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Property with cardinality [0..1]:  
 drop-down list



Property with cardinality [0..\*]:  
 multiple-selection list



# Customised codelists

Adding customised codelists requires **two steps**:

- 1) Load the actual codelist data** (codelist entries and codelist metadata). Such data must be stored in two predefined tables of the QGIS Package in the 3DCityDB
- 2) Add mapping rules** for automatic setup of the lists in the attribute forms. Such data must be stored in a predefined table of the QGIS Package in the 3DCityDB

Both operations can be carried out either by the database administrator or by the user

1) Administrator:

- The predefined tables are in schema **qgis\_pkg**
- All codelists and rules are made available to each newly created **qgis\_{usr}** schema

2) User:

- The predefined tables are in schema **qgis\_{usr\_name}**
- All codelists and rules are available only to user

# Customised codelists

Adding customised codelists requires **two steps**:

**1) Load the actual codelist data** (codelist entries and codelist metadata). Such data must be stored in two predefined tables of the QGIS Package in the 3DCityDB

- The tables are named **CODELIST** and **CODELIST\_VALUE** in the `qgis_{usr_name}` and **CODELIST\_TEMPLATE** and **CODELIST\_VALUE\_TEMPLATE** in the `qgis_pkg` schema, respectively. Their structure is exactly the same
- The following examples are based on tables CODELIST and CODELIST\_VALUE but the procedure is the same for the \*\_TEMPLATE ones

# Customised codelists

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

Tables (8)
> codelist
> codelist_lookup_config
<b>&gt; codelist_value</b>
> enumeration
> enumeration_value
> extents
> layer_metadata
> settings

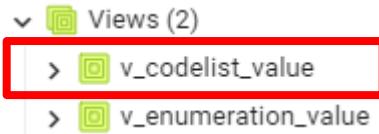
**Table CODELIST (excerpt)**

<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_type.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_type.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

# Customised codelists



In QGIS, all codelists values are retrieved from view **v\_codelist\_value** in the user schema of every user (e.g. "qgis\_giorgio")

**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>

# Customised codelists

To add values to 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

# Customised codelists

Adding customised codelists requires **two steps**:

- 1) Load the actual codelist data (codelist entries and codelist metadata). Such data must be stored in two predefined tables of the QGIS Package in the 3DCityDB
- 2) **Add mapping rules** for automatic setup of the lists in the attribute forms. Such data must be stored in a predefined table of the QGIS Package in the 3DCityDB
  - The table is named **CODELIST\_LOOKUP\_CONFIG** in the `qgis_{usr_name}` and **CODELIST\_LOOKUP\_CONFIG\_TEMPLATE** in the `qgis_pkg` schema, respectively. Their structure is exactly the same
  - The following examples are based on tables **CODELIST\_LOOKUP\_CONFIG** but the procedure is the same for the **\*\_TEMPLATE** one

# Customised codelists

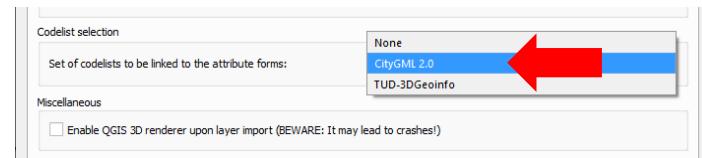
Table **CODELIST\_LOOKUP\_CONFIG** contains fields used to map Codelist values to the corresponding form attributes in QGIS.  
Explanation of the necessary fields is given in the next slide.

- ▼ Tables (8)
  - > codelist
  - > **codelist\_lookup\_config**
  - > codelist\_value
  - > enumeration
  - > enumeration\_value
  - > extents
  - > layer\_metadata
  - > settings

<b>id</b> [PK] integer	<b>name</b> character varying	<b>ade_prefix</b> character var	<b>source_class</b> character varying	<b>source_table</b> character varying	<b>source_column</b> character varying	<b>target_table</b> character varying	<b>key_column</b> character var	<b>value_column</b> character varyir	<b>filter_expression</b> character varying
1	CityGML 2.0	[null]	Bridge	bridge	class	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = '_AbstractBridgeClass'
2	CityGML 2.0	[null]	Bridge	bridge	function	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = '_AbstractBridgeFunctionUsage'
3	CityGML 2.0	[null]	Bridge	bridge	usage	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = '_AbstractBridgeFunctionUsage'
4	CityGML 2.0	[null]	BridgePart	bridge	class	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = '_AbstractBridgeClass'
5	CityGML 2.0	[null]	BridgePart	bridge	function	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = '_AbstractBridgeFunctionUsage'
6	CityGML 2.0	[null]	BridgePart	bridge	usage	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = '_AbstractBridgeFunctionUsage'
7	CityGML 2.0	[null]	Building	building	class	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = '_AbstractBuildingClass'
8	CityGML 2.0	[null]	Building	building	function	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = '_AbstractBuildingFunctionUsage'
9	CityGML 2.0	[null]	Building	building	usage	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = '_AbstractBuildingFunctionUsage'
10	CityGML 2.0	[null]	Building	building	roof_type	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = '_AbstractBuildingRoofType'
11	CityGML 2.0	[null]	BuildingPart	building	class	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = '_AbstractBuildingClass'
12	CityGML 2.0	[null]	BuildingPart	building	function	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = '_AbstractBuildingFunctionUsage'
13	CityGML 2.0	[null]	BuildingPart	building	usage	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = '_AbstractBuildingFunctionUsage'
14	CityGML 2.0	[null]	BuildingPart	building	roof_type	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = '_AbstractBuildingRoofType'
15	CityGML 2.0	[null]	BuildingRoom	room	class	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = 'RoomClass'
16	CityGML 2.0	[null]	BuildingRoom	room	function	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = 'RoomFunctionUsage'
17	CityGML 2.0	[null]	BuildingRoom	room	usage	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = 'RoomFunctionUsage'
18	CityGML 2.0	[null]	BuildingFurnit...	building_furnit...	class	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = 'BuildingFurnitureClass'
19	CityGML 2.0	[null]	BuildingFurnit...	building_furnit...	function	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = 'BuildingFurnitureFunctionUsage'
20	CityGML 2.0	[null]	BuildingFurnit...	building_furnit...	usage	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = 'BuildingFurnitureFunctionUsage'

# Customised codelists

Those in yellow are the fields the must be added by the user. The other ones will be added automatically



**NAME:** The name indicating the set of mapping rules. It must be the same for all rules belonging to the same group. This label will be the selectable one in the QGIS GUI.

**SOURCE\_CLASS:** The CityGML/ADE\* class the CodeList will be associated to (\*ADEs are currently not supported)

**SOURCE\_TABLE:** The corresponding citydb table which contains the column to be associated to a codelist

**SOURCE\_COLUMN:** The column to be associated to a codelist

**ALLOW\_MULTI:** FALSE if the cardinality is 0..1, TRUE if it is 0..\*

**NUM\_COLUMNS:** Number of column presented in the widget and containing look-up values. Default: 1 when ALLOW\_MULTI is FALSE, 3 when ALLOW\_MULTI is TRUE.

**FILTER\_EXPRESSION:** String containing the expression to filter the values of the desired codelist in the GUI form. It refers to the values of the columns DATA\_MODEL and NAME of view V\_CODELIST (see previous slides).

integer	name character varying	ade_prefix character var	source_class character varying	source_table character varying	source_colur character var	target_table character var	key_column character var	value_column character var	filter_expression character varying	num_columns integer	allow_multi boolean	allow_null boolean	order_by_value boolean	use_comp boolean
1	CityGML 2.0	[null]	Bridge	bridge	class	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = '_AbstractBridgeClass'	1	false	true	true	false
2	CityGML 2.0	[null]	Bridge	bridge	function	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = '_AbstractBridgeFunctionUsage'	3	true	true	true	false
3	CityGML 2.0	[null]	Bridge	bridge	usage	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = '_AbstractBridgeFunctionUsage'	3	true	true	true	false
4	CityGML 2.0	[null]	BridgePart	bridge	class	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = '_AbstractBridgeClass'	1	false	true	true	false
5	CityGML 2.0	[null]	BridgePart	bridge	function	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = '_AbstractBridgeFunctionUsage'	3	true	true	true	false
6	CityGML 2.0	[null]	BridgePart	bridge	usage	v_codelist	value	description	data_model = 'CityGML 2.0' AND name = '_AbstractBridgeFunctionUsage'	3	true	true	true	false

# Codelists and look-up tables

To add values to the **CODELIST\_LOOKUP\_CONFIG** table, the user can for example issue a SQL statement such as:

```
-- Optionally, delete previously loaded values belonging to the same codelist group in user schema "qgis_giorgio"  
DELETE FROM qgis_giorgio.codelist_lookup_config WHERE name = 'StarWarsCodelist';  
-- Insert the mapping rules in one single SQL statement  
INSERT INTO qgis_giorgio.codelist_lookup_config  
(name, source_class, source_table, source_column, allow_multi, num_columns, filter_expression)  
VALUES  
('StarWarsCodelist', 'Building' , 'building', 'class' , FALSE, 1, 'data_model = "StarWarsCoruscant" AND name =  
"CoruscantBdgClass"),  
('StarWarsCodelist', 'Building' , 'building', 'function' , TRUE , 3, 'data_model = "StarWarsCoruscant" AND name =  
"CoruscantBdgFunction"),  
('StarWarsCodelist', 'Building' , 'building', 'usage' , TRUE , 3, 'data_model = "StarWarsCoruscant" AND name =  
"CoruscantBdgUsage"),  
('StarWarsCodelist', 'Building' , 'building', 'roof_type' , FALSE, 1, 'data_model = "StarWarsCoruscant" AND name =  
"CoruscantBdgRoofType");
```

This SQL statement can be adapted by changing only the parts in red. For the qgis\_pkg, use table CODELIST\_LOOKUP\_CONFIG\_TEMPLATE instead.

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# 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 choose to drop only the schema of a selected user (e.g. "qgis\_giorgio")
- The administrator can remove all user schemas AND the qgis\_pkg schema

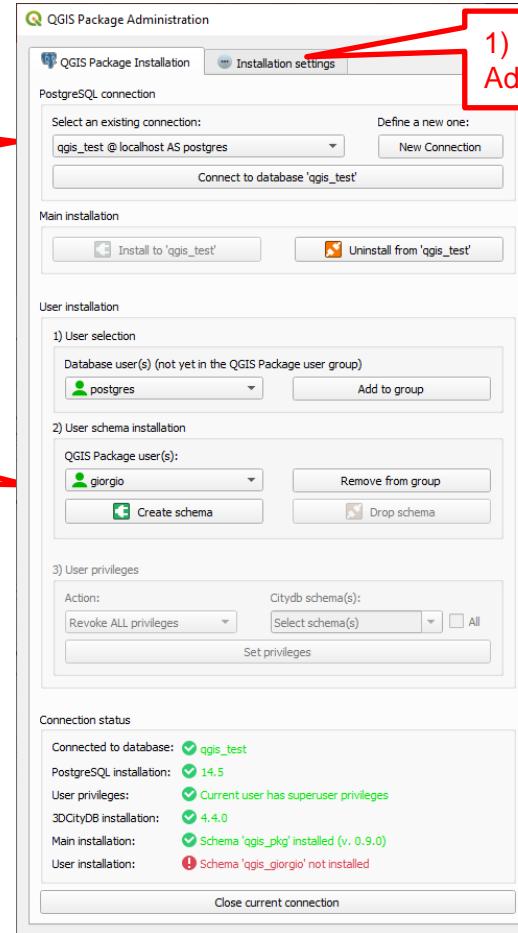
## 2) **Removal of the 3DCityDB-Tools plugin** from QGIS

- 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

# Drop user schema

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2) Connect as administrator



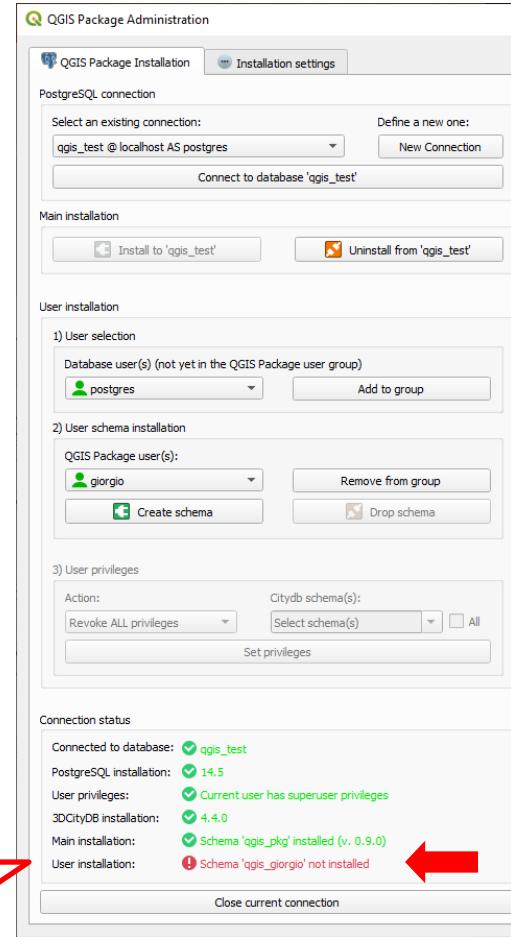
1) Load the "QGIS Package Administration" GUI

3) Select the user

4) Drop the schema of the selected user.  
All privileges will be automatically reset to "None"

# Drop user schema

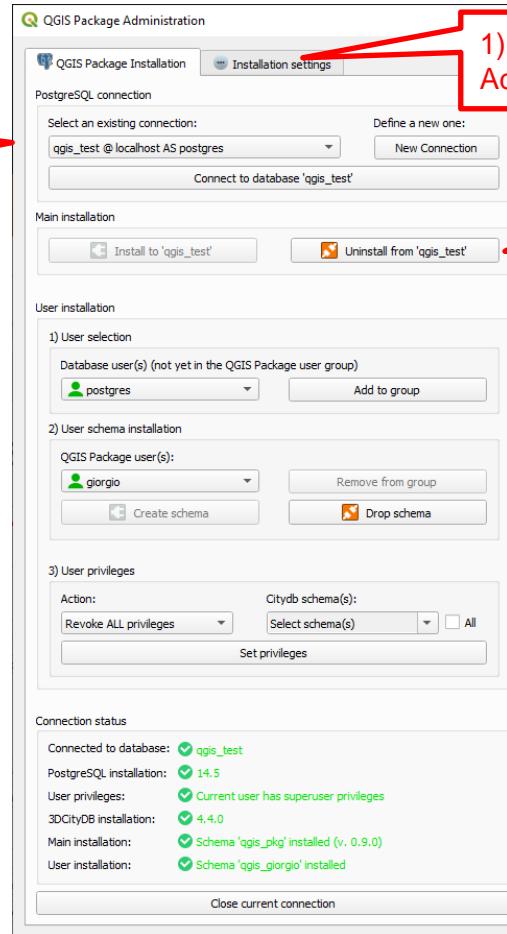
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# Software uninstall: Uninstall QGIS Package

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2) Connect as administrator

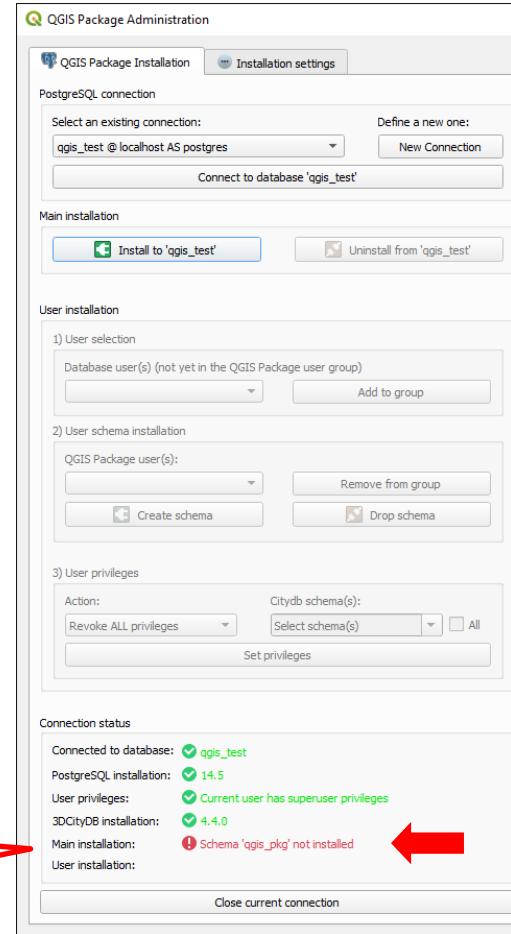


1) Load the "QGIS Package Administration" GUI

3) Uninstall the QGIS Package from the current database

# Uninstall QGIS Package

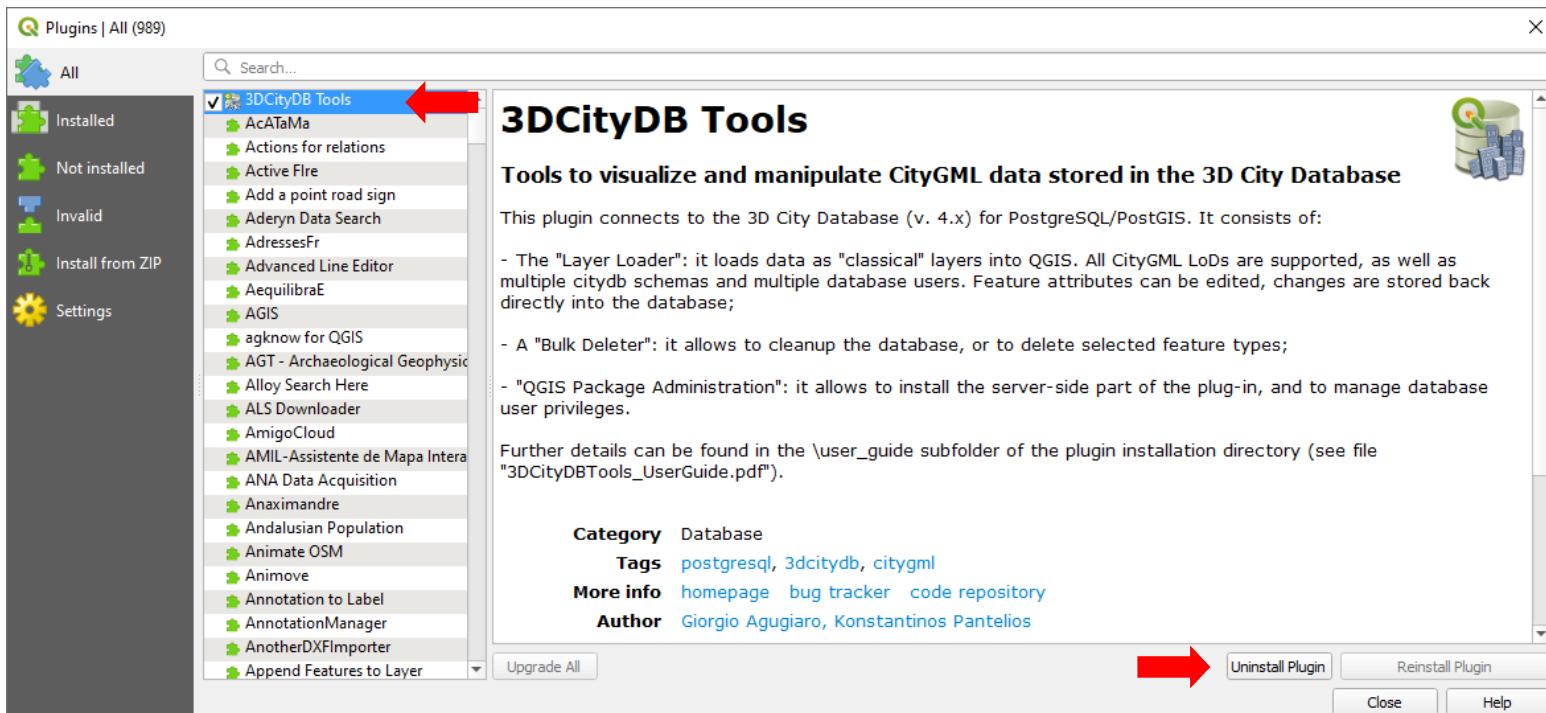
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# Uninstall 3DCityDB-Tools

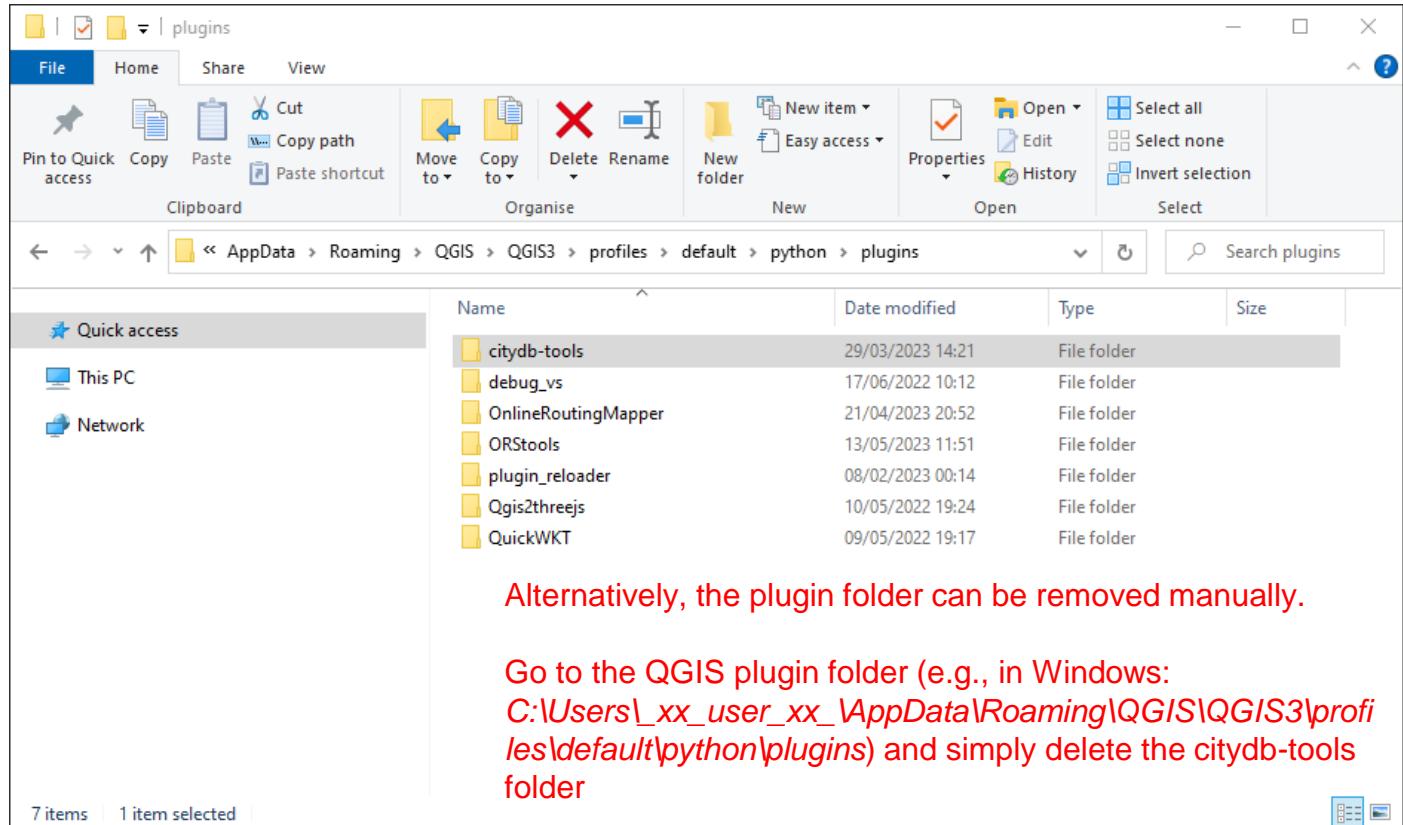
The plugin can be uninstalled from the \Plugins\Manage and Install Plugins... Menu in QGIS

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# Uninstall 3DCityDB-Tools



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# Current limitations

In general:

- CityGML appearances are not supported
- The Layer Loader does not support CityObjectGroups
- CityGML ADEs (Application Domain Extensions) are not supported

The QGIS Package does not support:

- Raster-based Relief features
- Generation of layers for CityObjectGroups

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# QGIS Package in a nutshell

- It represents the **server-side part** of the QGIS plugin
  - Most of the actions carried out from the QGIS GUI can be actually performed also by interacting directly with the database (e.g. using **PgAdmin**)
- It can be installed and used independently from the QGIS client-side part
  - E.g. with FME, or programmatically via Python, SQLAlchemy, etc.
- It requires
  - PostgreSQL **v. 10 or higher**
  - 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 in a nutshell

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The database administrator can:

- Create user schemas
- Grant/revoke privileges per user and per citydb schema
- Create, refresh, drop layers
- Drop user schemas

The required SQL functions are all available in schema **qgis\_pkg**.

# QGIS Package: Create user schemas

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The database administrator can create user schemas for specific database users.

For example:

- User "giorgio" -> schema "qgis\_giorgio"
- User "konstantinos" -> schema "qgis\_konstantinos"
- 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 database superusers)

In a user schema all necessary tables, updatable views, materialized views etc. will be created

## SQL example

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

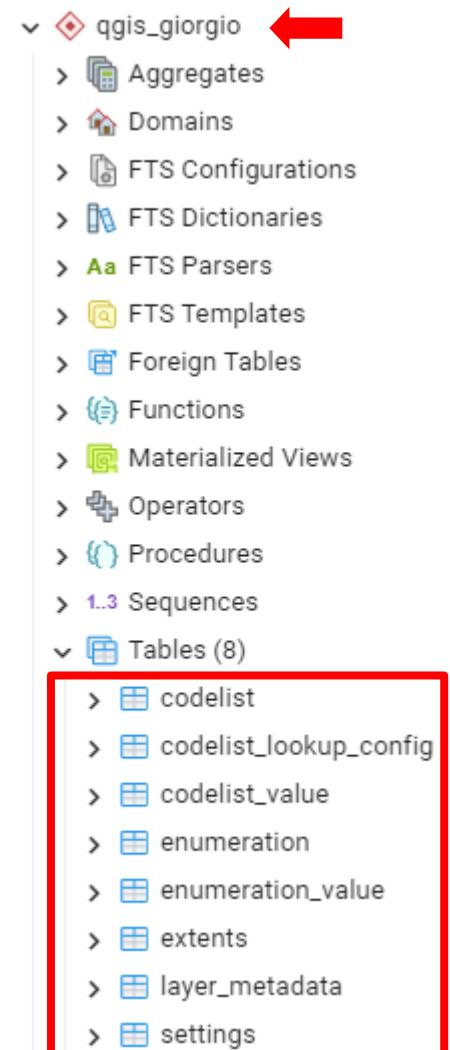
# QGIS Package: Create user schemas

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## User schema overview

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

- Tables **CODELIST**, **CODELIST\_LOOKUP\_CONFIG** and **CODELIST\_VALUE** are used to store codelists and related settings. See slides on **advanced options** for more details
- Tables **ENUMERATION** and **ENUMERATION\_VALUE** are used to store enumerations
- Table **EXTENTS** contains the bounding boxes of the citydb schemas and those of the materialized views
- Table **LAYER\_METADATA** contains information about generated and refreshed layers
- Table **SETTINGS** is used to store the user's settings (from the QGIS GUI)



◊	qgis_giorgio
>	Aggregates
>	Domains
>	FTS Configurations
>	FTS Dictionaries
>	Aa FTS Parsers
>	✉ FTS Templates
>	Foreign Tables
>	Functions
>	Materialized Views
>	Operators
>	Procedures
>	1..3 Sequences
▽	Tables (8)
>	codelist
>	codelist_lookup_config
>	codelist_value
>	enumeration
>	enumeration_value
>	extents
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# QGIS Package: User management

The database administrator can grant read-only (ro) or read-write (rw) privileges to the users.

- Privileges can be granted to a specific citydb schema. Please note the **cdb\_schema** parameter, requiring a single varchar value with the specific schema name

## SQL examples

```
-- Database user "giorgio" is added to group "qgis_pkg_usrgroup_qgis_test", can access data in citydb schema "citydb" of database "qgis_test" with read-only privileges
```

```
SELECT qgis_pkg.grant_qgis_usr_privileges(usr_name := 'giorgio', priv_type := 'ro', cdb_schema := 'citydb');
```

```
-- Database user "konstantinos" is added to group "qgis_pkg_usrgroup_qgis_db", can access data in citydb schema "citydb_2" of database "qgis_db" with read-write privileges
```

```
SELECT qgis_pkg.grant_qgis_usr_privileges(usr_name := 'konstantinos', priv_type := 'rw', cdb_schema := 'citydb_2');
```

# QGIS Package: User management

The database administrator can grant read-only (ro) or read-write (rw) privileges to the users

- Alternatively, privileges can be granted to multiple (or all) citydb schemas at the same time; Please note the **cdb\_schemas** (with s!) parameter, requiring an array of varchar values containing the schema names, or NULL for all schemas

## SQL examples

```
-- Database user "camilo" is added to group "qgis_pkg_usrgroup_starwars", can access data in citydb schemas  
"alderaan" and "hoth" of the current database "starwars" with read-only privileges
```

```
SELECT qgis_pkg.grant_qgis_usr_privileges(usr_name := 'camilo', priv_type := 'ro', cdb_schemas :=  
ARRAY['alderaan', 'hoth']);
```

```
-- Database user "giorgio" is added to group "qgis_pkg_usrgroup_starwars", can access data in ALL citydb schemas of  
the current database "starwars" with read-write privileges
```

```
SELECT qgis_pkg.grant_qgis_usr_privileges(usr_name := 'giorgio', priv_type := 'rw', cdb_schemas := NULL);
```

# QGIS Package: User management

The database administrator can revoke privileges from the users

## 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\_{cdb\_schema}". If required, the administrator must remove them manually (or use the QGIS plug-in GUI).

-- Database user "giorgio" is removed from group "qgis\_pkg\_usrgroup\_starwars" and won't be able to use the QGIS plugin anymore for the database "starwars"

```
REVOKE qgis_pkg_usrgroup_starwars FROM giorgio;
```

# QGIS Package: Layer management

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The database administrator can 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)

# QGIS Package: Layer management

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## Function

**qgis\_pkg.create\_layers(usr\_schema, cdb\_schema [, perform\_snapping] [, digits]  
[, area\_poly\_min] [, bbox\_corners\_array] [, is\_geographic] [, 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>is_geographic</b>	boolean	DEFAULT False. True is the coordinate system of the citydb schema has geographic coordinates, False if it has projected coordinates.
<b>force_layer_creation</b>	boolean	DEFAULT False. Otherwise: force creation of all layers, also the empty ones.

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## 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 "konstantinos", create all waterbody module layers for existing data in citydb schema "alderaan" within a certain bounding box. The bounding box is defined by the lower-left and upper-right coordinates (i.e. x\_min, y\_min, x\_max, y\_max)

```
SELECT qgis_pkg.create_layers_waterbody('konstantinos', 'alderaan', bbox_corners_array := '{10, 20, 110, 220}');
```

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## 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)
```

# QGIS Package: Layer management

After creating the layers, you may (optionally) want to register also their bounding box in the EXTENTS table of the respective qgis\_schema. This will enable the plugin in QGIS to "see" and represent the extents also from the plugin GUI.

## SQL examples

```
-- In user schema "qgis_giorgio", update the extents for the whole dataset in citydb schema "citydb"  
SELECT qgis_pkg.upsert_extents('qgis_giorgio', 'citydb', 'db_schema');
```

```
-- In user schema "qgis_giorgio", update the extents for the user-defined bounding box in citydb schema "citydb"  
SELECT qgis_pkg.upsert_extents(  
    usr_schema := 'qgis_giorgio',  
    cdb_schema := 'citydb',  
    cdb_bbox_type := 'm_view', -- must be one of ('db_schema', 'm_view', 'qgis')  
    cdb_envelope := ST_Envelope('LINESTRING(232038 480366, 232600 480856)::geometry),  
    is_geographic := FALSE);
```

**Please note:** the *cdb\_envelope* parameter requires a PostGIS geometry that is a polygon. As long as this requirement is fulfilled, other PostGIS functions can be used, for example:

- `ST_GeomfromText('POLYGON(...))')`
- `ST_MakePolygon(...)`

The SRID can be omitted as it is automatically set based on the one from the selected citydb schema. The coordinates must be however in the same CRS of the selected citydb!

# QGIS Package: Layer management

The database administrator can refresh the materialized views with function **qgis\_pkg.refresh\_layers(...)**.

- 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\_layers\_bridge(...)**
  - **qgis\_pkg.refresh\_layers\_building(...)**
  - ...
  - **qgis\_pkg.refresh\_layers\_waterbody(...)**
- All functions are in schema qgis\_pkg and have the same signature (see next slide)

# QGIS Package: Layer management

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## Function

**qgis\_pkg.refresh\_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", refresh all materialized views in citydb schema "citydb"

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

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

**SELECT** qgis\_pkg.refresh\_layers\_waterbody('qgis\_konstantinos', 'alderaan');

# QGIS Package: Layer management

The database administrator can 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)

# QGIS Package: Layer management

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## 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\_konstantinos", drop all waterbody module layers related to citydb schema "alderaan"

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

# QGIS Package: Detail views

Detail views are children tables containing additional layer data (e.g. generic attributes, external references, etc.)

Optionally, they can be created programmatically and dropped in a similar way as normal layers. If created, they will be used (also) by the plugin GUI in QGIS to link these views to the attribute forms as nested tables.

## SQL examples

-- For user "giorgio", create the detail views for citydb schema "citydb"

```
SELECT qgis_pkg.create_details_view('giorgio', 'citydb');
```

-- For user "giorgio", create the detail views for citydb schema "citydb" inside the user-defined bounding box

```
SELECT qgis_pkg.create_detail_view(  
    usr_name := 'giorgio',  
    cdb_schema := 'citydb',  
    bbox_corners_array := ARRAY[ 232038, 480366, 232600, 480856],  
    is_geographic := FALSE);
```

-- In user schema "qgis\_giorgio", drop the detail views for citydb schema "citydb"

```
SELECT qgis_pkg.drop_detail_view('qgis_giorgio', 'citydb');
```

# QGIS Package: Drop user schema

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The database administrator can 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 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 layers using the drop_layer_x functios
SELECT qgis_pkg.drop_layers_building('qgis_giorgio');
SELECT qgis_pkg.drop_layers_bridge('qgis_giorgio');

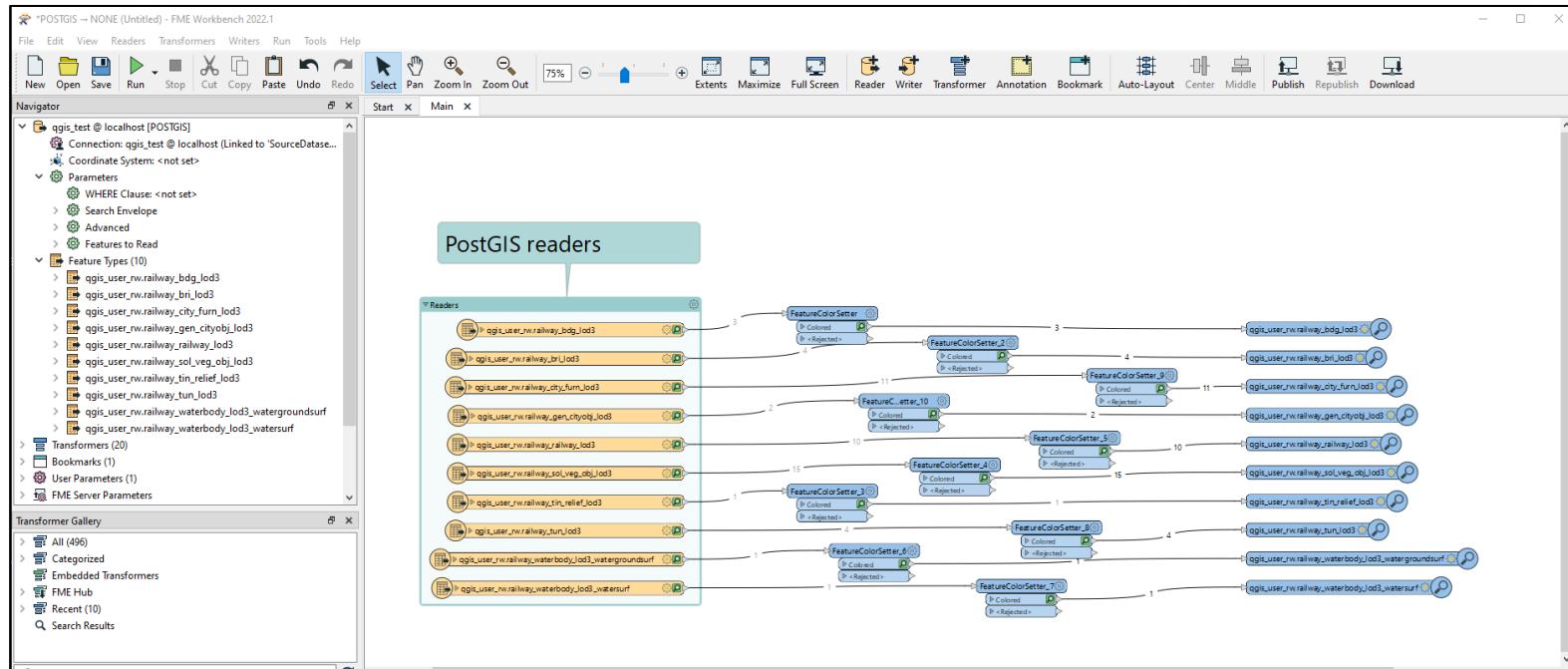
...
-- Then drop the user schema
DROP SCHEMA qgis_giorgio CASCADE;
-- Optionally (if necessary) remove user "giorgio" from the "qgis_pkg_usrgroup_qgis_test" associated to database
-- "qgis_test"
REVOKE qgis_pkg_usrgroup_qgis_test FROM giorgio;
```

# 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 **PostGIS readers**

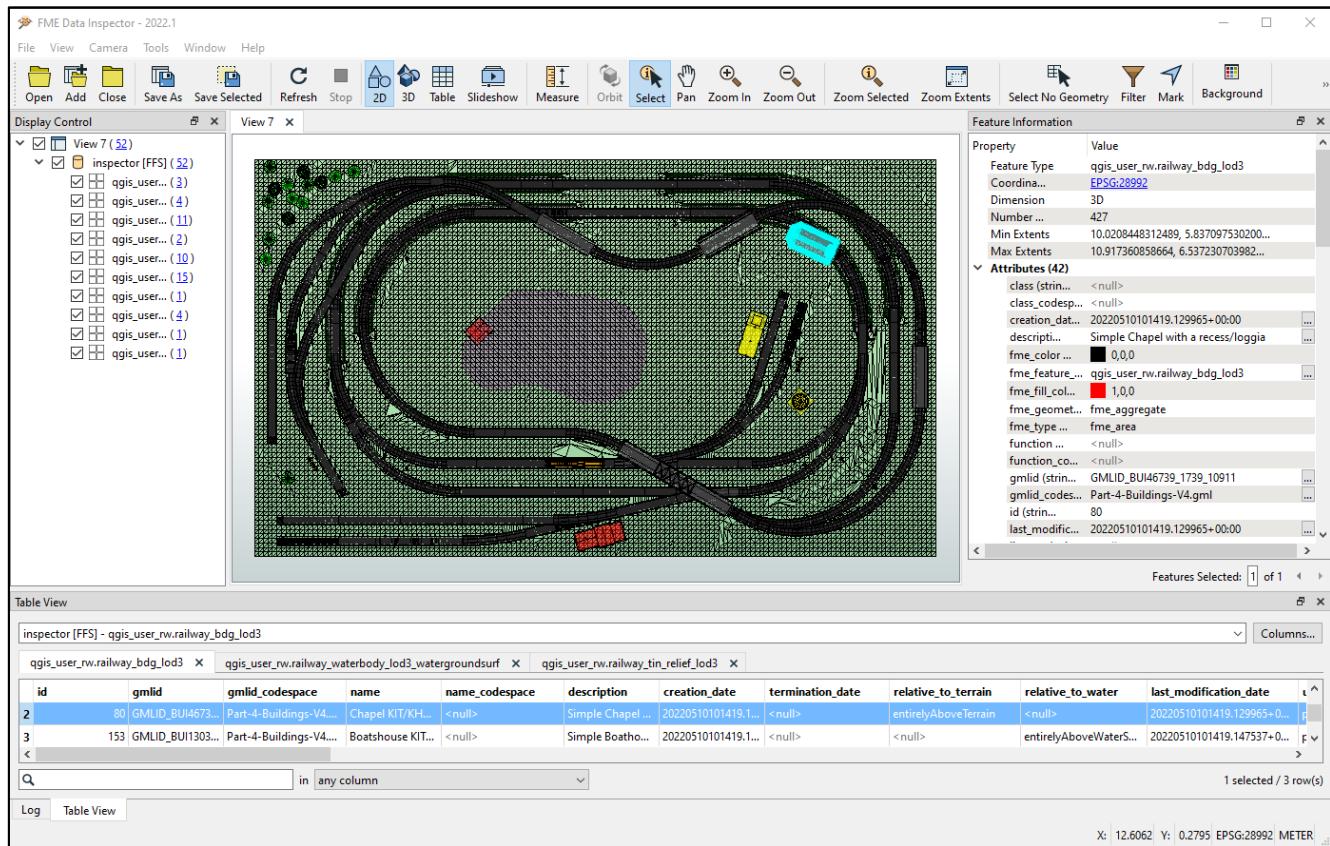
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# QGIS Package via FME

- 2D visualisation via FME Data Inspector

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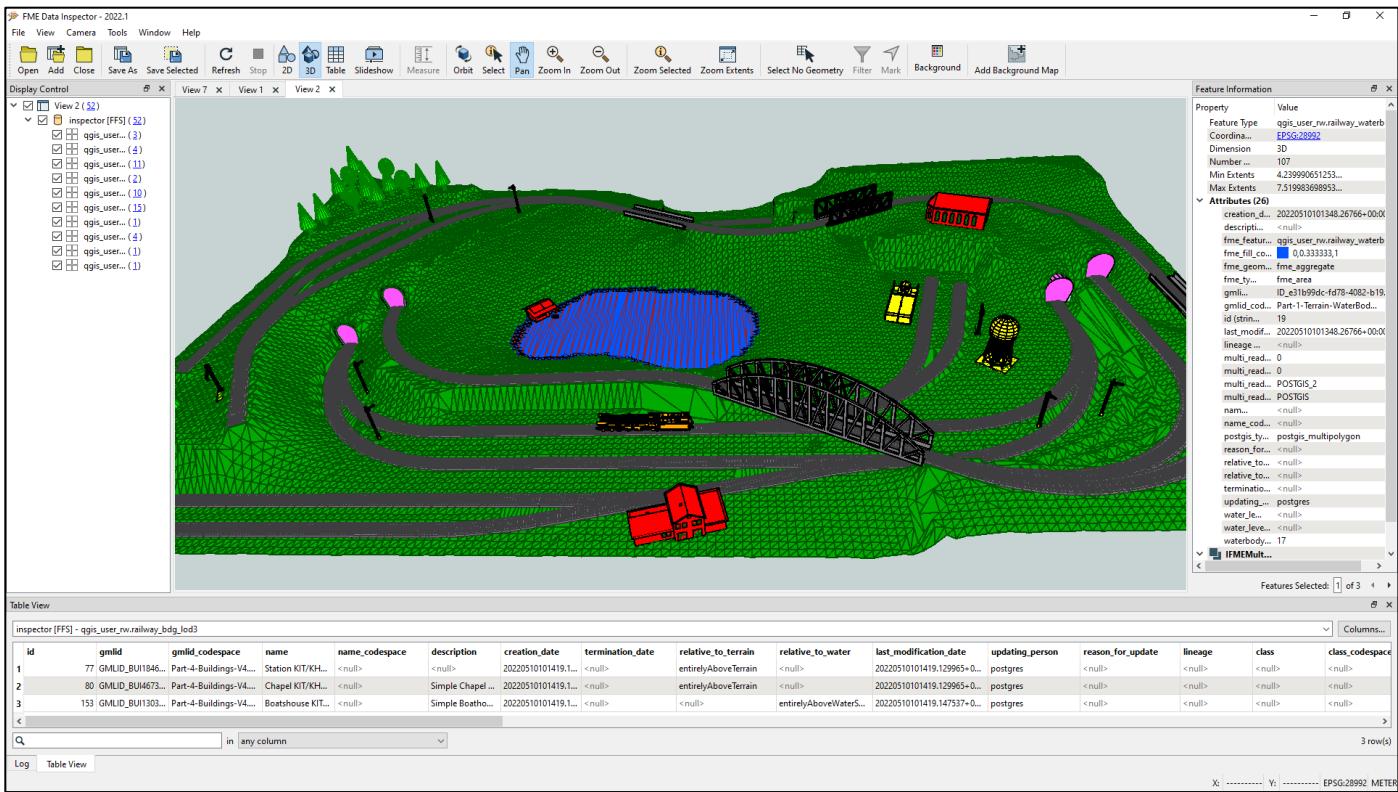
The screenshot shows the FME Data Inspector application window. The main area displays a 2D map of a railway network with various tracks and buildings. The map is overlaid with a grid pattern. On the left, a tree view shows multiple layers under 'View 7 (52)', including 'inspector [FFS]' which contains several sub-layers labeled 'qgis\_user...' followed by numbers from 1 to 15. The top menu bar includes File, View, Camera, Tools, Window, Help, and various toolbar icons for selection, measurement, and navigation. To the right, there are two panes: 'Feature Information' showing properties like Feature Type (qgis\_user\_rw.railway\_bdg\_lod3), Coordinate System (EPSG:28992), Dimension (3D), and Number (427); and 'Attributes (42)' listing columns such as class, class\_codespace, creation\_date, description, fme\_color, fme\_fill\_color, fme\_geometries, fme\_type, function, gmlid, gmlid\_codespace, id, last\_modification\_date, name, name\_codespace, and termination\_date. At the bottom, a 'Table View' pane shows a detailed table for the selected feature, with columns for id, gmlid, gmlid\_codespace, name, name\_codespace, description, creation\_date, termination\_date, relative\_to\_terrain, relative\_to\_water, and last\_modification\_date. The table currently displays two rows of data.

Table View											
inspector [FFS] - qgis_user_rw.railway_bdg_lod3											
qgis_user_rw.railway_bdg_lod3			qgis_user_rw.railway_waterbody_lod3_watergroundsurf			qgis_user_rw.railway_tin_relief_lod3					
id	gmlid	gmlid_codespace	name	name_codespace	description	creation_date	termination_date	relative_to_terrain	relative_to_water	last_modification_date	
2	80	GMLID_BU14673...	Part-4-Buildings-V4...	Chapel KIT/KH...	<null>	Simple Chapel...	20220510101419.1...	<null>	entirelyAboveTerrain	<null>	20220510101419.12995+...
3	153	GMLID_BU1130...	Part-4-Buildings-V4...	Boathouse KIT...	<null>	Simple Boatho...	20220510101419.1...	<null>	entirelyAboveWaterS...	20220510101419.147537+...	

# QGIS Package via FME

- 3D visualisation via FME Data Inspector

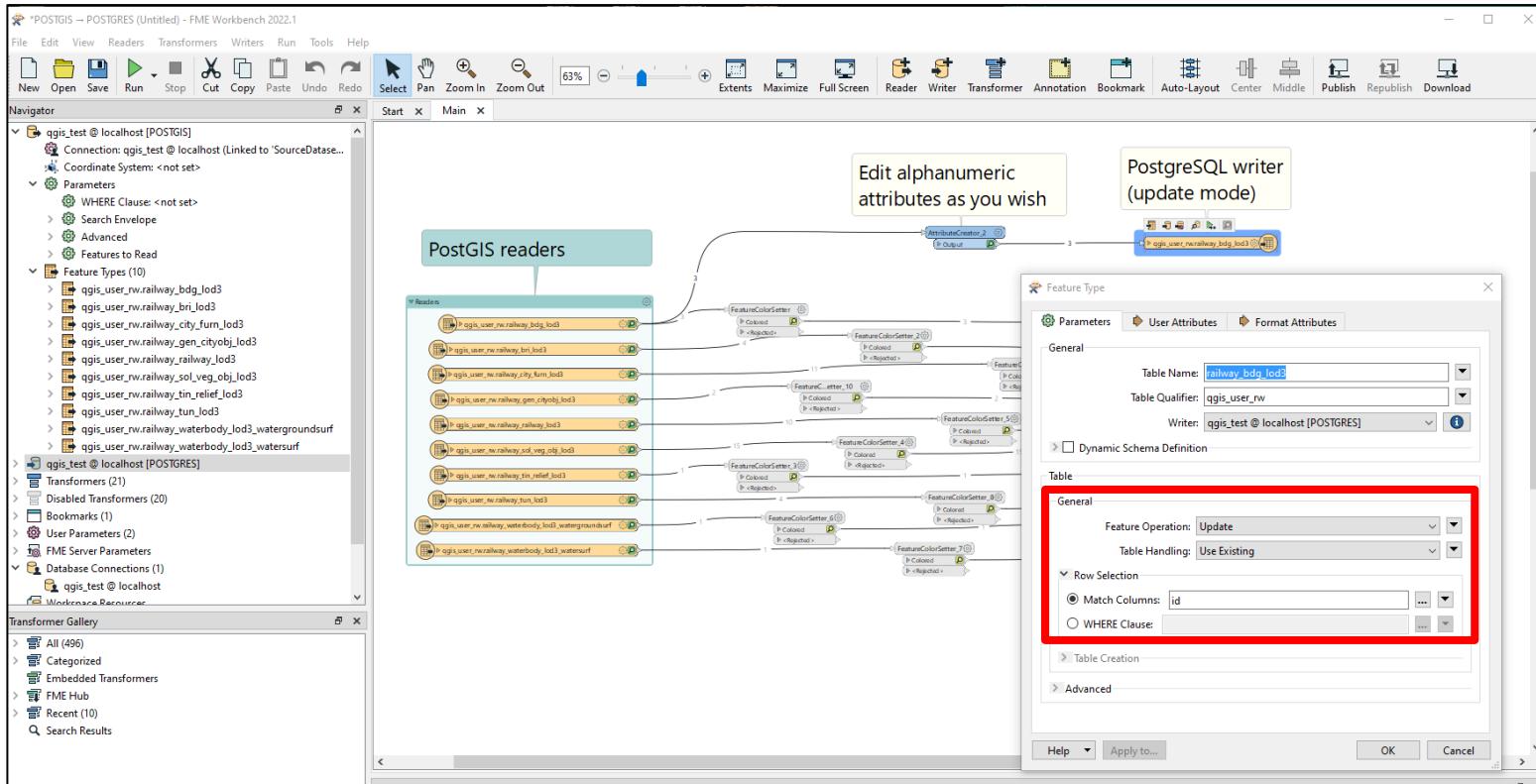
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# QGIS Package via FME

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

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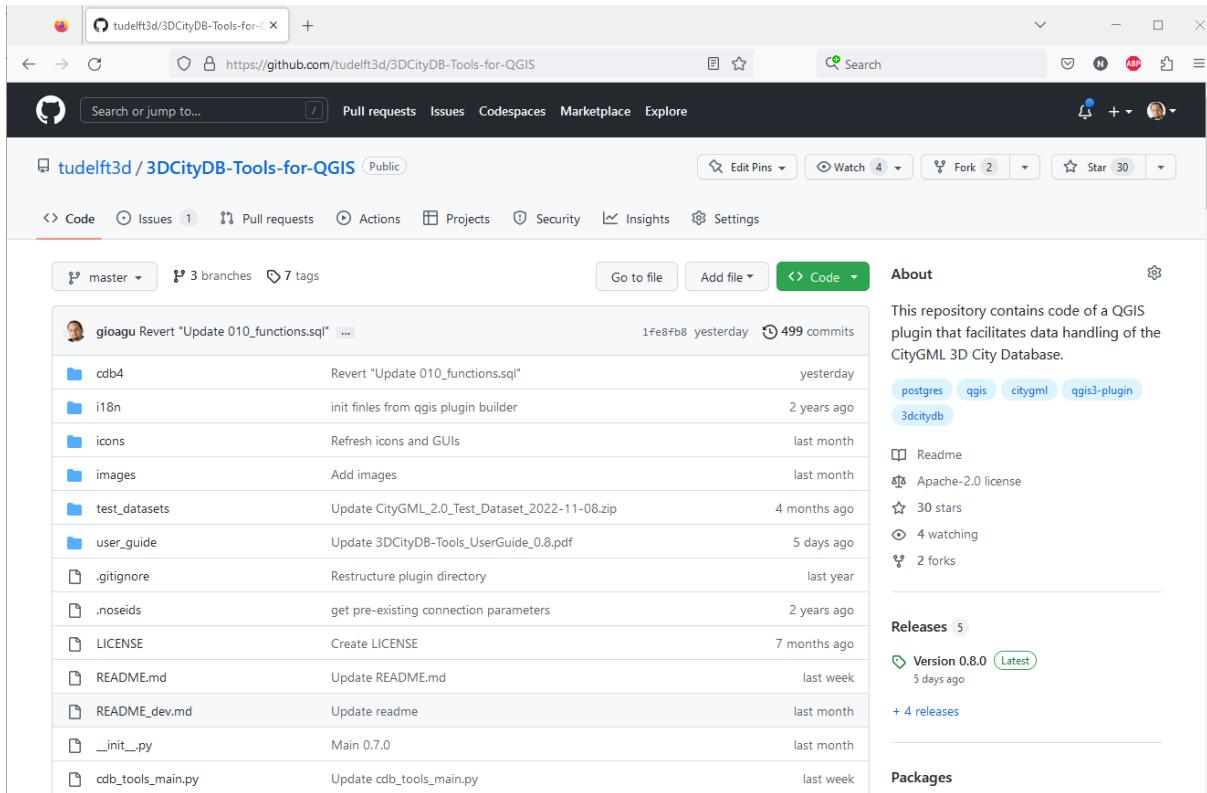
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# Resources

## Source code and GitHub repository

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



The screenshot shows the GitHub repository page for 'tudelft3d / 3DCityDB-Tools-for-QGIS'. The repository is public and has 499 commits. The main page displays a list of recent commits, including updates to functions.sql, i18n files, icons, images, test datasets, user guides, and plugin restructuring. The repository has 30 stars, 4 forks, and 4 releases. It uses PostgreSQL, QGIS, CityGML, and QGIS3-Plugin technologies.

This repository contains code of a QGIS plugin that facilitates data handling of the CityGML 3D City Database.

Tags: postgres, qgis, citygml, qgis3-plugin, 3dcitydb

Readme, Apache-2.0 license, 30 stars, 4 watching, 2 forks

Releases: Version 0.8.0 (Latest), + 4 releases

Packages

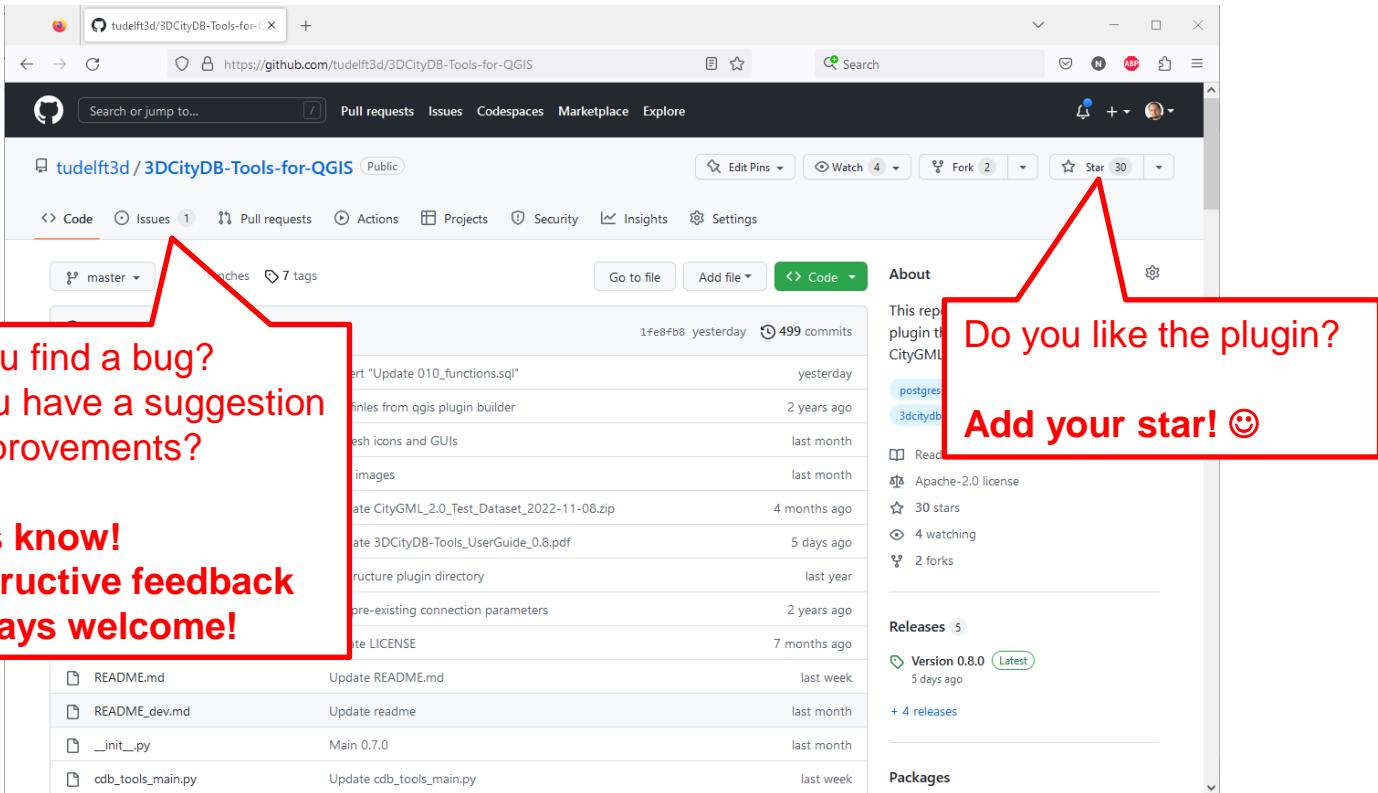
File	Description	Time Ago
gioagu Revert "Update 010_functions.sql"	Revert "Update 010_functions.sql"	yesterday
cdb4	Revert "Update 010_functions.sql"	yesterday
i18n	init finles from qgis plugin builder	2 years ago
icons	Refresh icons and GUIs	last month
images	Add images	last month
test_datasets	Update CityGML_2.0_Test_Dataset_2022-11-08.zip	4 months ago
user_guide	Update 3DCityDB-Tools_UserGuide_0.8.pdf	5 days ago
.gitignore	Restructure plugin directory	last year
.noeseids	get pre-existing connection parameters	2 years ago
LICENSE	Create LICENSE	7 months ago
README.md	Update README.md	last week
README_dev.md	Update readme	last month
__init__.py	Main 0.7.0	last month
cdb_tools_main.py	Update cdb_tools_main.py	last week

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## Source code and GitHub repository

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



Did you find a bug?  
Do you have a suggestion  
for improvements?

Let us know!  
Constructive feedback  
is always welcome!

Do you like the plugin?  
Add your star! ☺

GitHub repository details:

- Repository: tudelft3d / 3DCityDB-Tools-for-QGIS (Public)
- Code: master
- Issues: 1
- Pull requests: 0
- Actions: 0
- Projects: 0
- Security: 0
- Insights: 0
- Settings: 0
- Go to file: 1fe8fb8 yesterday
- Add file: 499 commits
- Code: 1fe8fb8 yesterday
- PostgreSQL: 1fe8fb8 yesterday
- 3dcitydb: 1fe8fb8 yesterday
- Apache-2.0 license: 1fe8fb8 yesterday
- 30 stars: 1fe8fb8 yesterday
- 4 watching: 1fe8fb8 yesterday
- 2 forks: 1fe8fb8 yesterday
- Releases: 5
- Version 0.8.0 (Latest): 5 days ago
- + 4 releases
- Packages: 0

# Resources

## QGIS Plug-in repository

- <https://plugins.qgis.org/plugins/citydb-tools/>



The screenshot shows a web browser displaying the QGIS Python Plugins Repository. The URL in the address bar is <https://plugins.qgis.org/plugins/citydb-tools/>. The page title is "QGIS Python Plugins Repository". On the left, there is a sidebar with a "Upload a plugin" button and a "Plugins" section containing links for "Featured", "All", "Stable", "New Plugins", "Updated Plugins", "Experimental", "Popular", "Most voted", "Top downloads", "Most rated", and "QGIS Server plugins". Below this is a "Plugin Tags" section. The main content area features a large "3DCityDB Tools" plugin card. The card includes a "Download latest" button, a 5-star rating with "(52) votes", and a brief description: "Tools to visualize and manipulate CityGML data stored in the 3D City Database". It also has tabs for "About", "Details", and "Versions". Below the card, there is a list of features: "The 'Layer Loader': it loads data as 'classical' layers into QGIS. All CityGML LoDs are supported, as well as multiple citydb schemas and multiple database users. Feature attributes can be edited, changes are stored back directly into the database;". Another feature is listed: "A 'Bulk Deleter': it allows to cleanup the database, or to delete selected feature types;". A third feature is listed: "'QGIS Package Administrator': it allows to install the server-side part of the plug-in, and to manage database user privileges.". At the bottom, a note states: "Further details can be found in the PDF files contained in the \user\_guide subfolder of the plugin installation directory. On the GitHub repository, some test datasets can be downloaded."

# Resources

## Test datasets

- In the GitHub repository, you will find test datasets that you can import into the 3DCityDB (using the Importer/Exporter) to test the 3DCityDB-Tools 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.zip
  - You can find links to many additional free and open CityGML/CityJSON datasets at:
    - Awesome CityGML: <https://github.com/OloOcki/awesome-citygml>
    - 3D Geoinformation group @ TU Delft: <https://3d.bk.tudelft.nl/opendata/opencities/>

# Changelog

## ChangeLog for version 0.8.4

### Main changes

- Minor bug fixes
- Layer Loader
  - Corrected new connections not being updated in Layer Loader dialog
- QGIS Package (version 0.10.2)
  - WaterBody module: Added support for MultiCurve LoD0-1 layers
  - Transportation and Vegetation modules: Corrected minor bugs
  - Added CityGML 2.0 Codelists for WaterBody module
  - Some code refactoring
- Test datasets
  - Updated Railway dataset to contain WaterBody LoD1 MultiCurve
- Installation and user guide (this document)
  - QGIS Package: Corrected/enhanced examples with functions to set user's privileges

# Changelog

## ChangeLog for version 0.8.3

### Main changes

- The plugin is not anymore "experimental"; thus, it can be installed by anybody from QGIS
- Minor edits to the Layer Loader dialog GUI
  - Moved Codelist selection combo box from Settings tab to Layers tab
- Updated this document
  - Added installation from QGIS Plugins repository
  - Updated figures with new Layer Loader dialog GUI
  - QGIS Package: Corrected SQL examples to refresh views
  - QGIS Package: Added SQL examples for detail views
  - QGIS Package: Added SQL examples to upsert the user-defined bounding box extents
  - Corrected some typos and other minor errors

# Changelog

## ChangeLog for version 0.8.2

### Main changes

- Minor internal changes to comply with the QGIS Plugin online repository

## ChangeLog for version 0.8.1

### Main changes

- Layer loader: Detail View layers are now ro/rw depending on user privileges
- QGIS Package: Version 0.10.1

### Bug fixes

- QGIS Package: Fixed bug to set user privileges

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## ChangeLog for version 0.8.0

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### **Client-side: Layer Loader**

- Added support for Address features as layers
- Added support for LoD-independent layers (i.e., "LoDx")
- Redesigned and extended attribute forms to support:
  - External References (per type)
  - Generic Attributes (per type)
  - Addresses
  - All subforms allow insert, update and delete operations
- Added support for CodeLists selection via GUI
- Improved support of datasets with geographic coordinates (bbox)

### **Client side: Bulk Deleter**

- Improved support of datasets with geographic coordinates (bbox)
- Renamed root-class to top-level features

### **Client-side: QGIS Package Administration**

- Minor bug fixes and code clean-up

# Changelog

## Changelog for version 0.8.0 (ctd)

### Server-side (QGIS Package):

- New version 0.10
- Updates to layer\_metadata table
- Updates to layer creation functions
- Added support for (updatable) Detail Views
- Added support for look-up tables metadata
- Improved support to datasets with geographic coordinates (bbox precision)
- Improved speed to compute the bbox and list cdb\_schemas
- Minor code clean-up and bug fixes

# Changelog

## Changelog for version 0.7.1

### Main changes

- Code restructuring to allow for better modularization of current (and future) modules
- Allow for concurrent dialogs, but added logic to:
  - Prevent having user dialogs (and connections) open when using the "QGIS Package Administration"
  - Prevent having user dialogs connected to the same database *and* citydb schema at the same time
- Ships with QGIS Package v. 0.9.1

### Bug fixes

- When cleaning up the database, sequences are now correctly restarted

# Changelog

## Changelog for version 0.7.0

The 3DCityDB-Loader is growing and gets therefore a new name: **3DCityDB-Tools**

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### Server-side (QGIS Package):

- Version 0.9.0
- Each 3DCityDB instance gets not its own database group
- Added support for new client-side functionalities:
  - Refactored layer\_metadata table
  - Added functions to manage groups
  - Added functions to check Feature Types availability
- Minor code clean-up and bug fixes

### Client-side: Admin GUI

- QGIS Package Installation tab: Major rework, added user management
- Installation settings tab (NEW)
- Minor GUI improvements to the New connection dialog
- QGIS Package uninstall procedure is now much faster
- User schema uninstall procedure is now much faster
- Rewritten all SQL queries to follow psycopg2 syntax
- Minor code refactoring and clean-up

# Changelog

## Changelog for version 0.7.0 (ctd)

Motivation  
Plugin overview  
Software installation  
Software use  
Advanced options  
Software uninstall  
Current limitations  
QGIS Package  
Resources  
**Changelog**

### Client-side: Loader GUI

- Connection tab
  - Added Feature Type selection in layer generation
  - Added Geocoding function (based on Nominatim API)
  - Creating and dropping layers is now faster
  - Minor redesign of the GUI
- Settings tab (NEW)
- Editing of layers from read-only citydb schemas is now blocked in QGIS
- QML files are split and loaded separately for forms, 2D styles and (optionally) 3D styles, respectively
- Rewritten all SQL queries to follow psycopg2 syntax
- Major code refactoring and clean-up

### Client side: Bulk Deleter GUI (NEW)

- A user with rw privileges can delete features selecting them:
  - via a spatial filter
  - and/or via a Feature Type/Root-class feature filters
- A user with rw privileges can delete ALL DATA from the selected citydb schema (i.e., truncate all tables)
- Geocoding function (based on Nominatim API)

# Changelog

## Changelog for **version 0.6.0**

### Server-side (QGIS Package)

- Version 0.8.0
- Fixed bug in delete trigger functions to extract the name of the cdb\_schema
- Rewritten functions to compute and upsert the extents
- Added layer support for (#8):
  - Terrain Intersection Curve geometries (bridge, building, tunnel, generics, city\_furniture)
  - MultiCurve geometries (bridge, building, tunnel)
  - MasspointRelief, BreaklinesRelief Features
- Minor code clean-up and bug fixes

### Client-side (Admin):

- Reworked the series of checks carried out upon connection
  - Added check and warning if PostgreSQL < 10.0
  - Added check and warning if QGIS Package < 0.8.0
- Changes to the GUI dialog
  - Reshaped connection buttons
  - Minor other visual improvements (labels, tooltips, etc.)
- Minor code refactoring and clean-up

# Changelog

## Changelog for version 0.6.0 (ctd)

### Client-side (User):

- Added compatibility for QGIS v. 3.28 LTR
- Reworked the series of checks carried out upon connection
  - Added check and warning for outdated QGIS Package versions
  - Added check and warning in case there are no accessible citydb schemas
  - Added check and warning in case there are only empty citydb schemas
- Added functionality to update the cdb\_extents in case data are added/removed to/from the citydb schemas
- Solved bug of bboxes being wrongly resized (enlarged) after canvases are set/changed
- Improved function to import layers
  - Drop QGIS spatial filter if QGIS bbox = Layers bbox
  - Added check to avoid loading multiple times the same layer
- Changes to the GUI dialog, forms, etc.
  - Reshaped connection buttons
  - Added button "Refresh {sch} extents"
  - In the "Layer" tab, the Feature types in the combo box are now ordered alphabetically
  - Minor other visual improvements (labels, tooltips, etc.)
  - Added forms for new Relief Features, etc.
- Further major code refactoring and clean-up

# Changelog

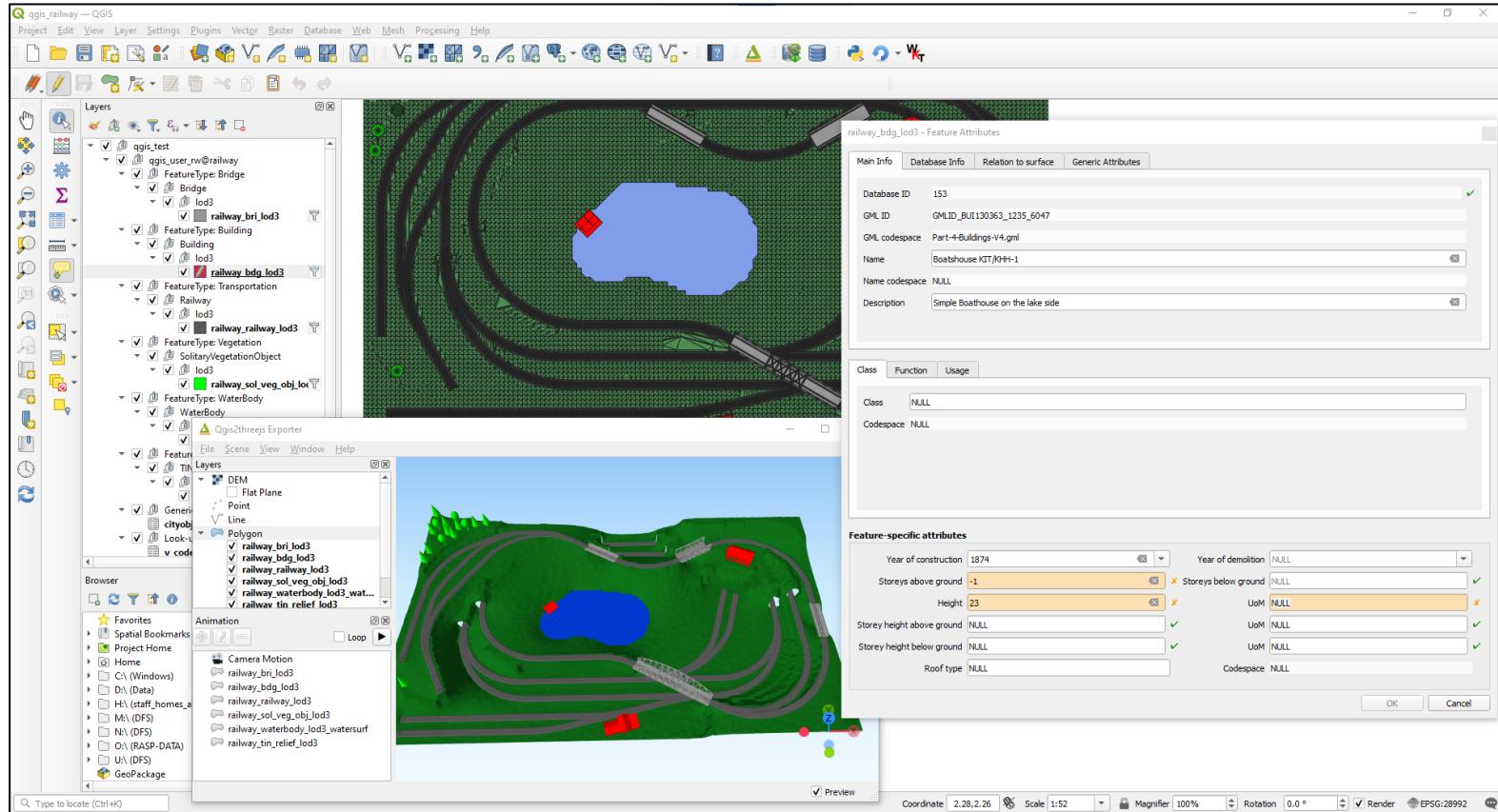
## Changelog for **version 0.5.0**

First public release of the 3DCityDB-Loader plugin for QGIS

### Main changes

- Major code refactoring and cleaning up
- Minor bug fixes
- User guide documentation updated and extended with FME examples
- Switched to TUD GitHub repository

# Enjoy! ☺



# Main developers



**Dr. Giorgio Agugiaro**  
[g.agugiaro@tudelft.nl](mailto:g.agugiaro@tudelft.nl)

3D Geoinformation Group  
TU Delft  
The Netherlands  
<https://3d.bk.tudelft.nl/gagugiaro>



**Konstantinos Pantelios**  
[konstantinospantelios@yahoo.com](mailto:konstantinospantelios@yahoo.com)

MSc Geomatics graduate  
TU Delft  
The Netherlands

## Acknowledgements / suggestions and contributions by:

Tendai Mbwanda, Camilo León-Sánchez (TU Delft), Claus Nagel and Zhihang Yao (Virtual City Systems GmbH)



# 3DCityDB Tools

for



QGIS