



3DCityDB Tools

for

QGIS

Installation and user guide

Version 0.8.6

Last update: 12 October 2023

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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!)

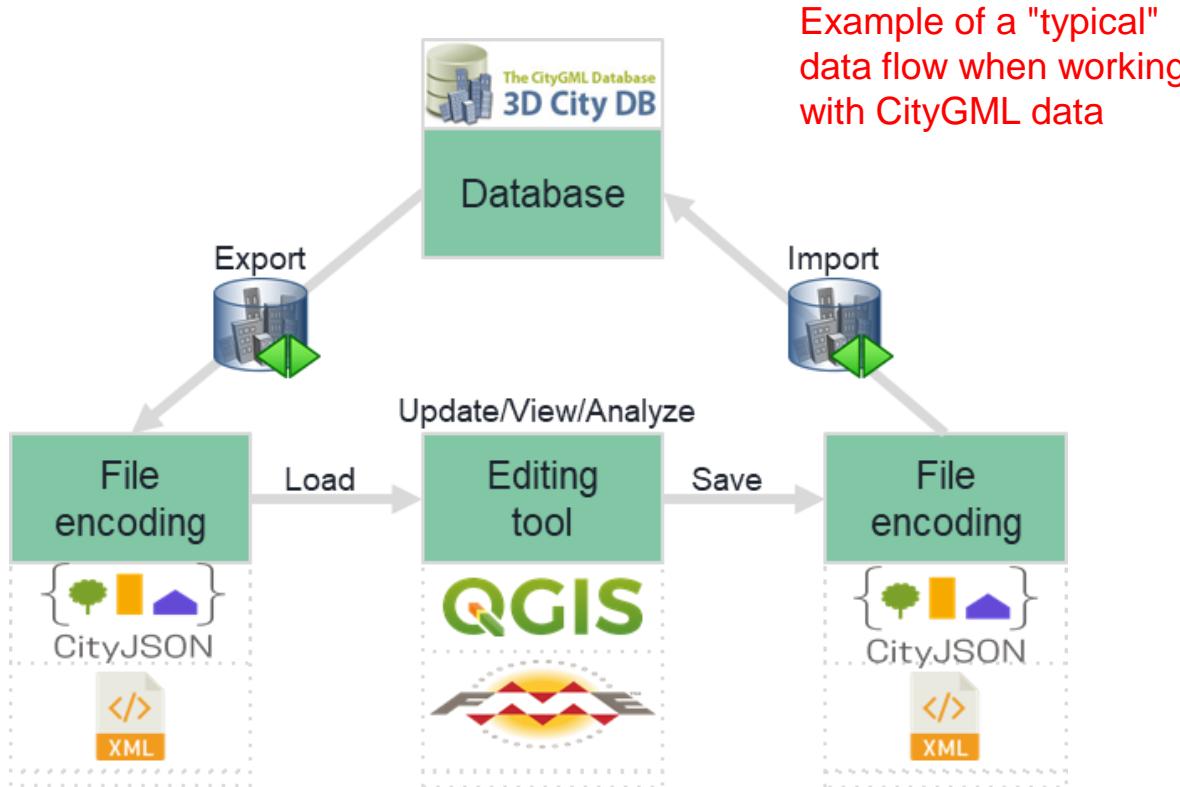
Motivation

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

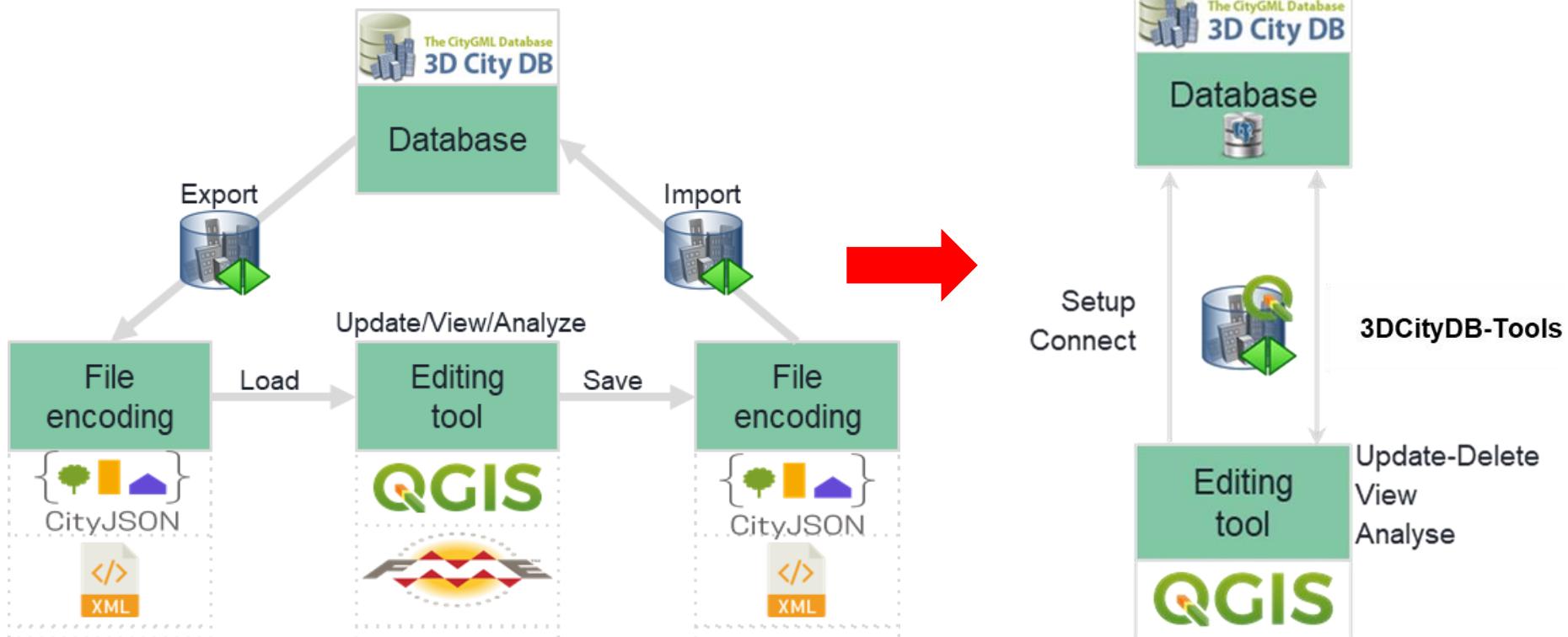


Motivation



Motivation

Vision / goal of the plugin



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Main functionalities

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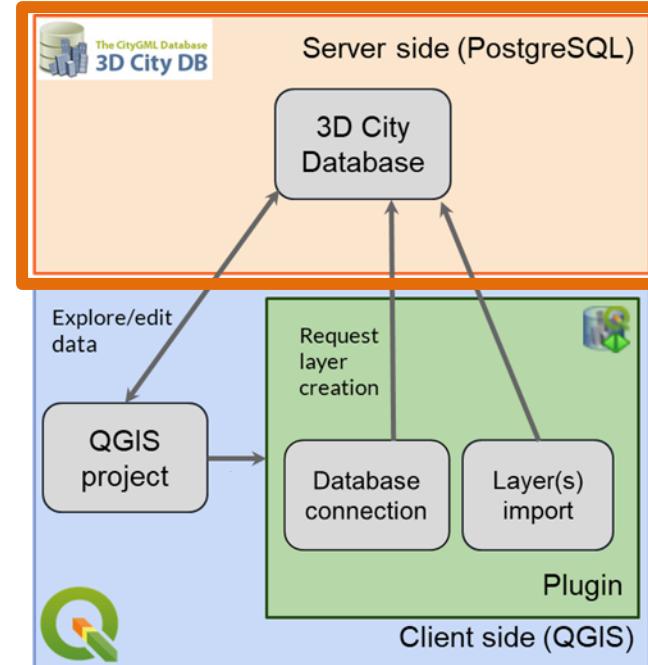
- Create "**SFS-like layers**" to hide 3DCityDB complexity when interacting with data
 - Deal efficiently with multi-LoD / different geometries / implicit representations
 - Up to ≈600 possible combinations in CityGML!
 - Merge all standard attributes of a CityObject into a single "table"
- **Deal with 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



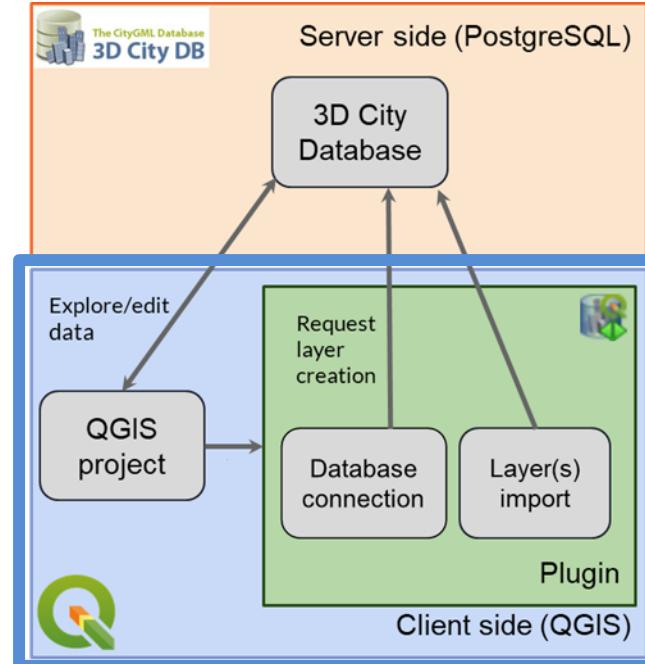
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Client-side

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
QGIS 3.28 LTR	✓	Works
QGIS 3.26, 3.24	✓	Should work, but not supported
QGIS 3.22 LTR	✓	Works. Reference version used for development
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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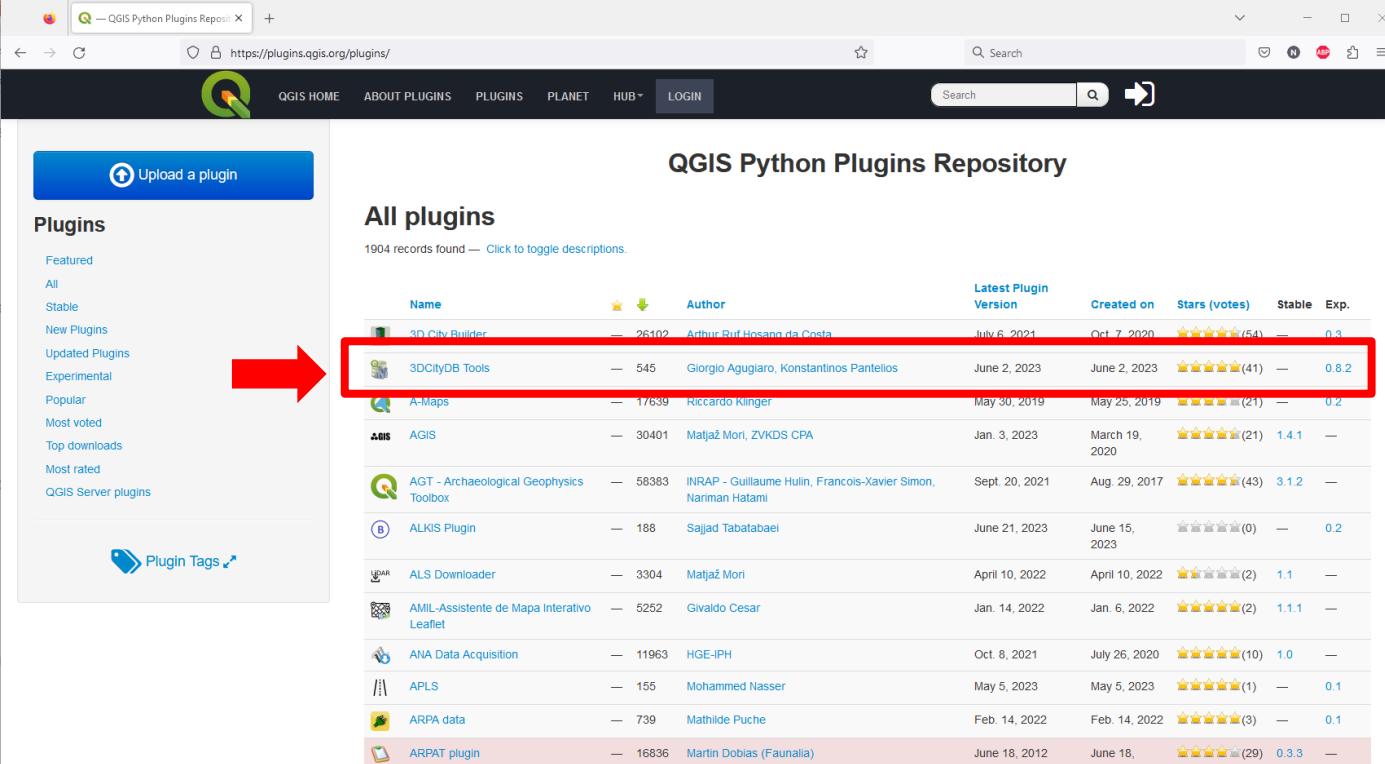
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Installation via QGIS Plugins repository

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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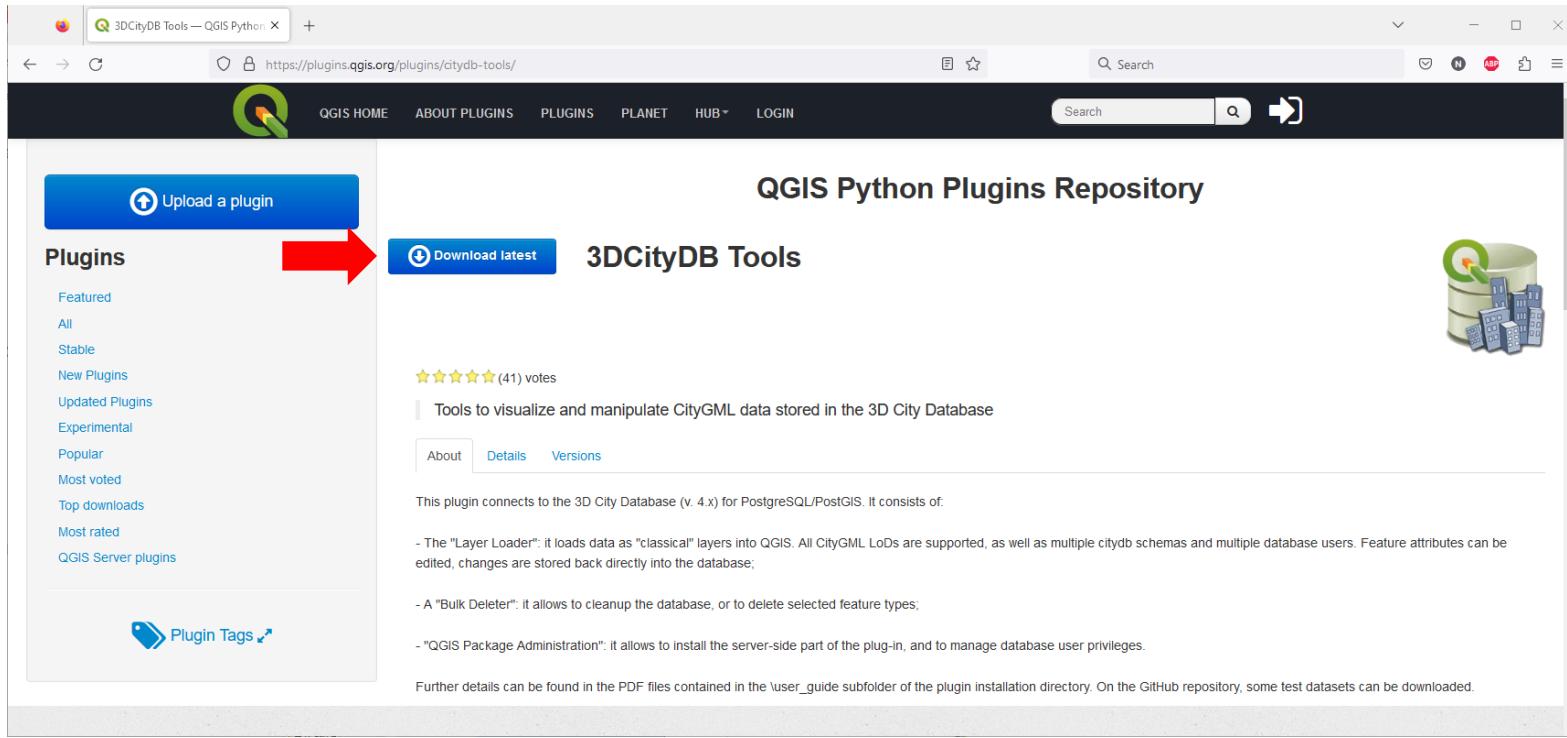
The screenshot shows a web browser displaying the QGIS Python Plugins Repository at <https://plugins.qgis.org/plugins/>. The page title is "QGIS Python Plugins Repository". On the left, there's a sidebar with a "Upload a plugin" button and a "Plugins" section containing filters for "Featured", "All", "Stable", "New Plugins", "Updated Plugins", "Experimental", "Popular", "Most voted", "Top downloads", "Most rated", and "QGIS Server plugins". Below this is a "Plugin Tags" section. A large red arrow points from the sidebar towards the main content area. The main content area is titled "All plugins" and shows a list of 1904 records. The first item in the list, "3DCityDB Tools", is highlighted with a red border. The table columns include Name, Author, Latest Plugin Version, Created on, Stars (votes), Stable, and Exp. The "3DCityDB Tools" entry has a download count of 545, was created on June 2, 2023, and has a rating of 4.8 stars from 41 votes.

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 Puché	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! ☺

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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 links like 'Featured', 'All', 'Stable', etc., and a 'Plugin Tags' section. A red arrow points from the 'Plugins' sidebar to the 'Download latest' button for the '3DCityDB Tools' plugin. The main content area is titled 'QGIS Python Plugins Repository' and shows the '3DCityDB Tools' plugin details. It includes a star rating of 4.1 from 41 votes, a brief description ('Tools to visualize and manipulate CityGML data stored in the 3D City Database'), and sections for 'About', 'Details', and 'Versions'. Below the plugin details, there is a list of features and a note about PDF files and GitHub datasets.

3DCityDB Tools — QGIS Python

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

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Plugins

Featured All Stable New Plugins Updated Plugins Experimental Popular Most voted Top downloads Most rated QGIS Server plugins

Download latest

3DCityDB Tools

4.1 (41) votes

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

About Details Versions

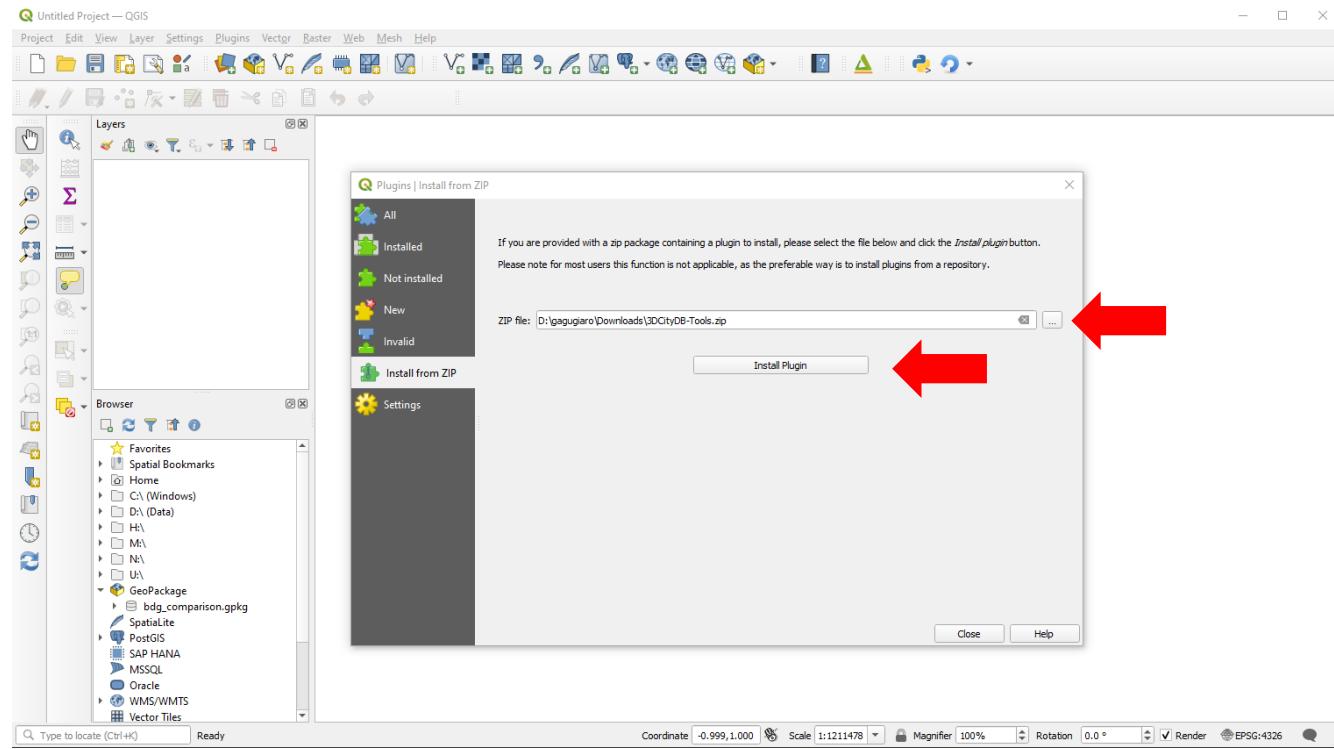
This plugin connects to the 3D City Database (v. 4.x) for PostgreSQL/PostGIS. It consists of:

- 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

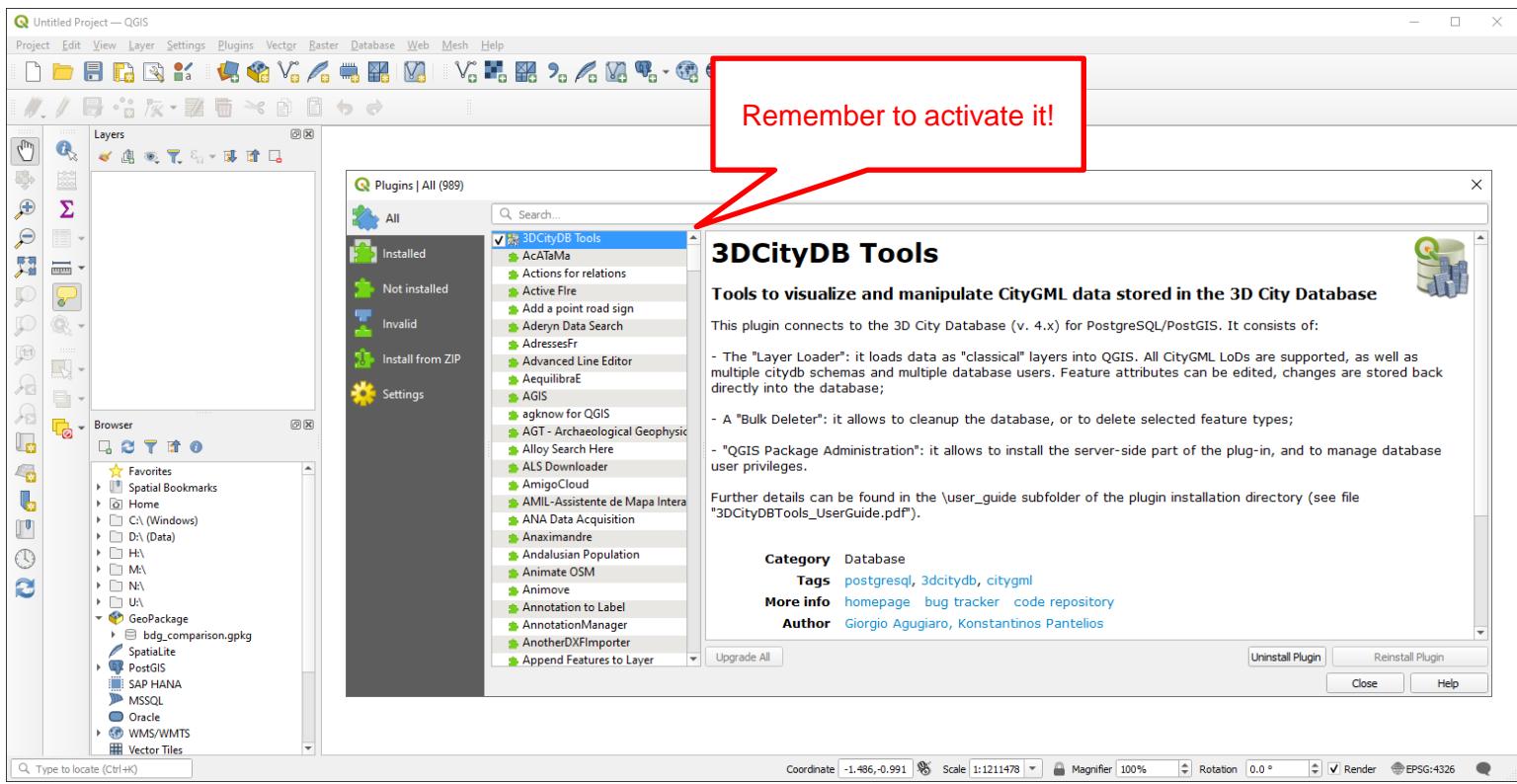
- The plugin is available also as **zip file** from the **GitHub repository**
- In QGIS, open the Plugins\Manage and install plugins window, and choose "Install from ZIP". Select the zip file and click the "Install Plugin" button



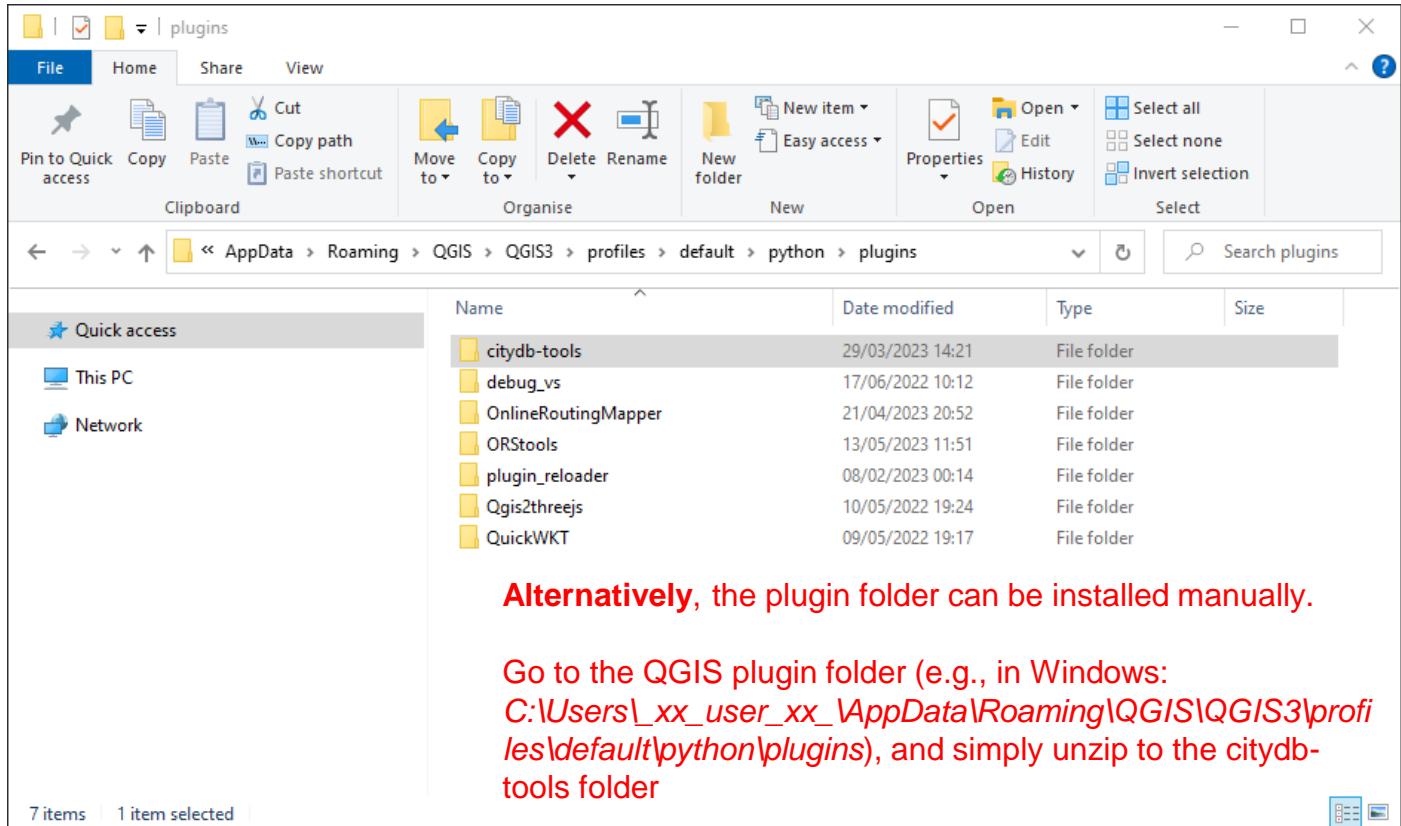
Manual installation

- Upon installation, you must activate the plugin

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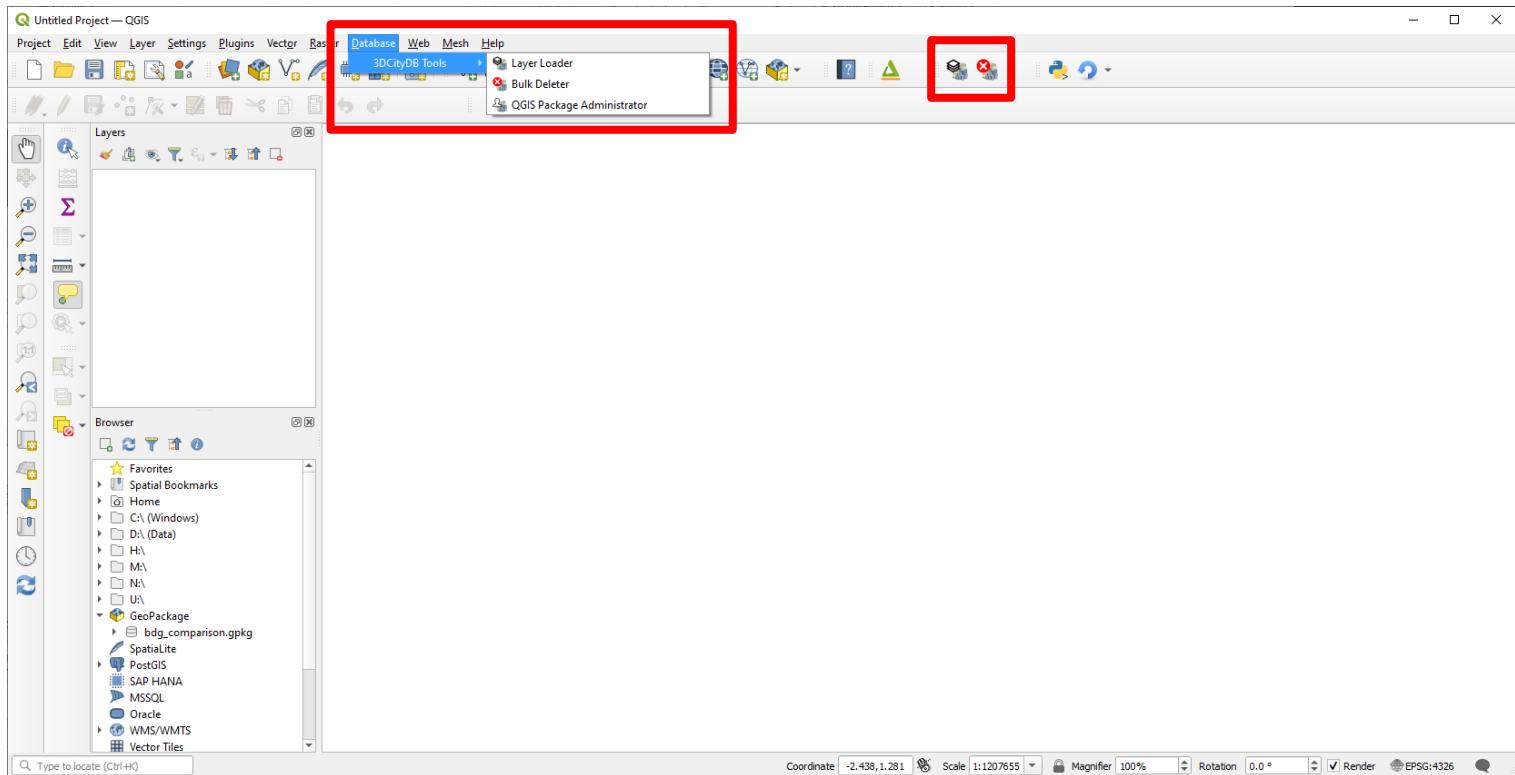


Manual installation



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:

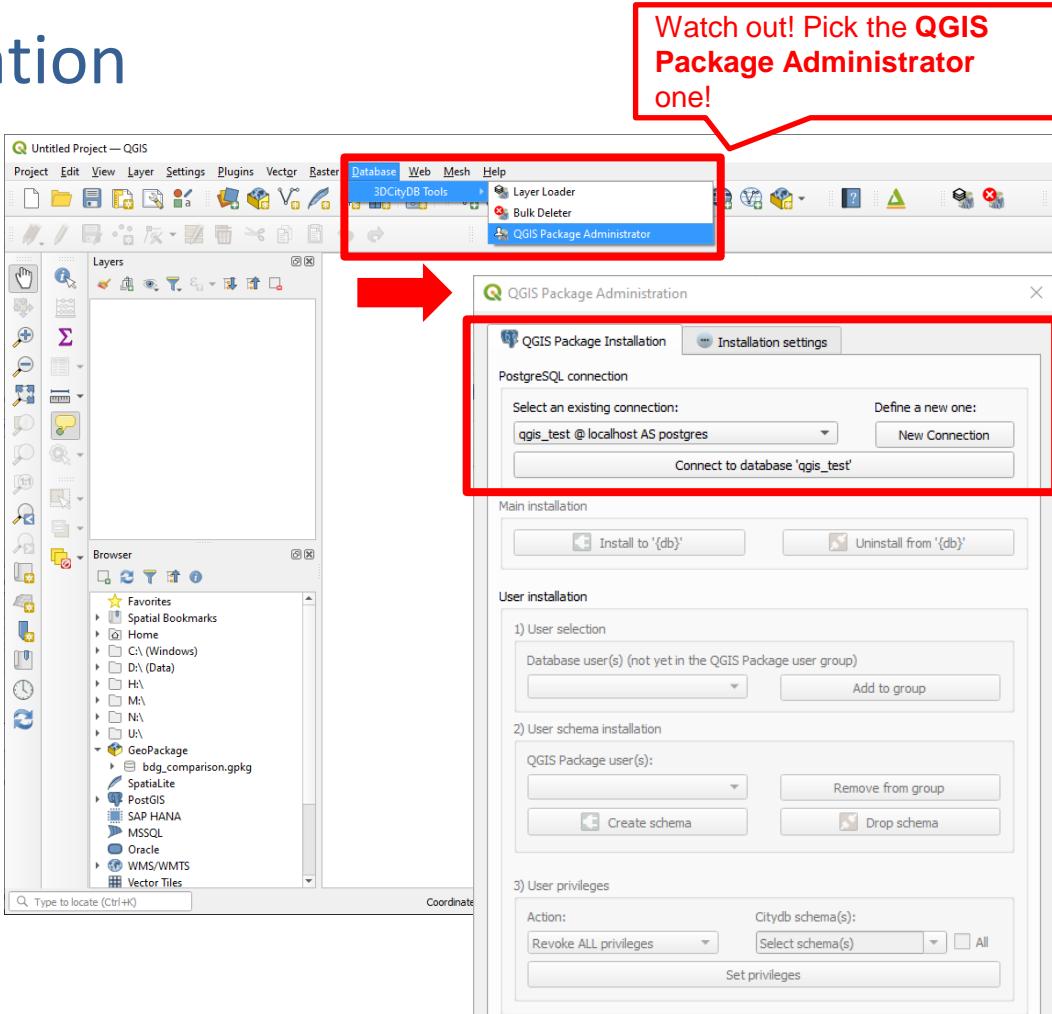
- A "**simplified installation**", which carries out all 4 operation at once and automatically installs 2 default users
- A "**normal installation**", where the administrator has complete control over each step

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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")



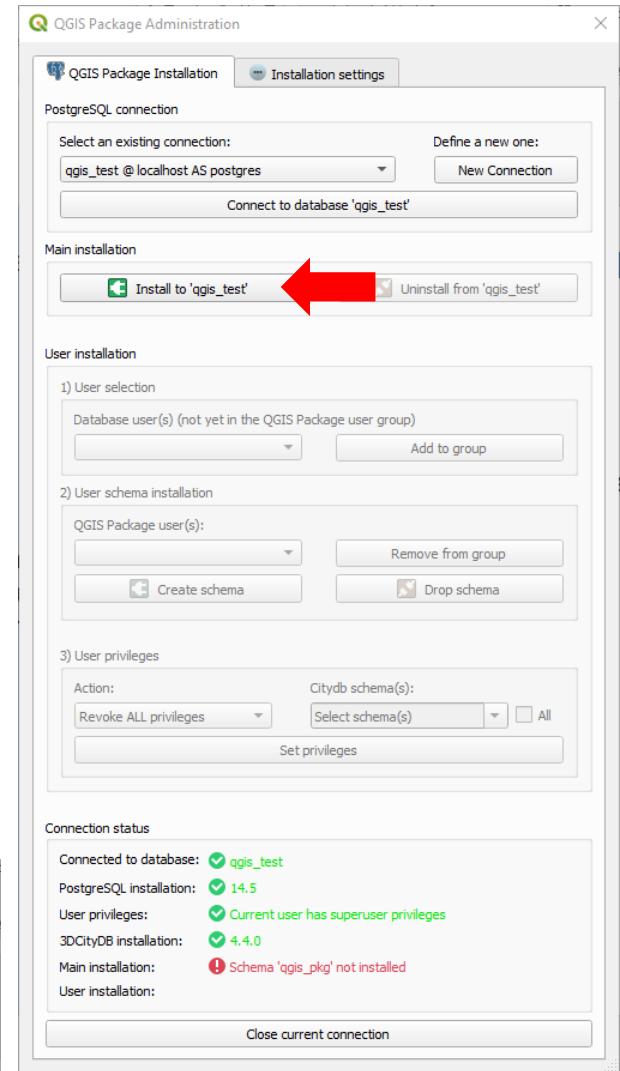
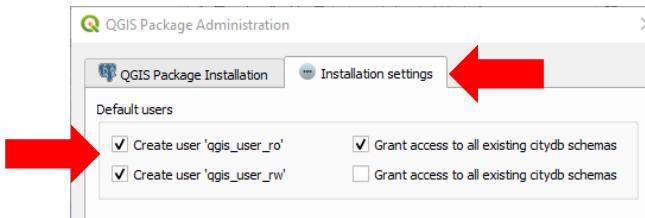
Back-end installation

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 'Main installation' section contains two buttons: 'Install to 'qgis_test'' (with a green arrow icon) and 'Uninstall from 'qgis_test''. A red arrow points from the left towards the 'Install to 'qgis_test'' button. The 'User installation' and 'Connection status' sections are also visible below.

Back-end installation

2.1) "Simplified" installation

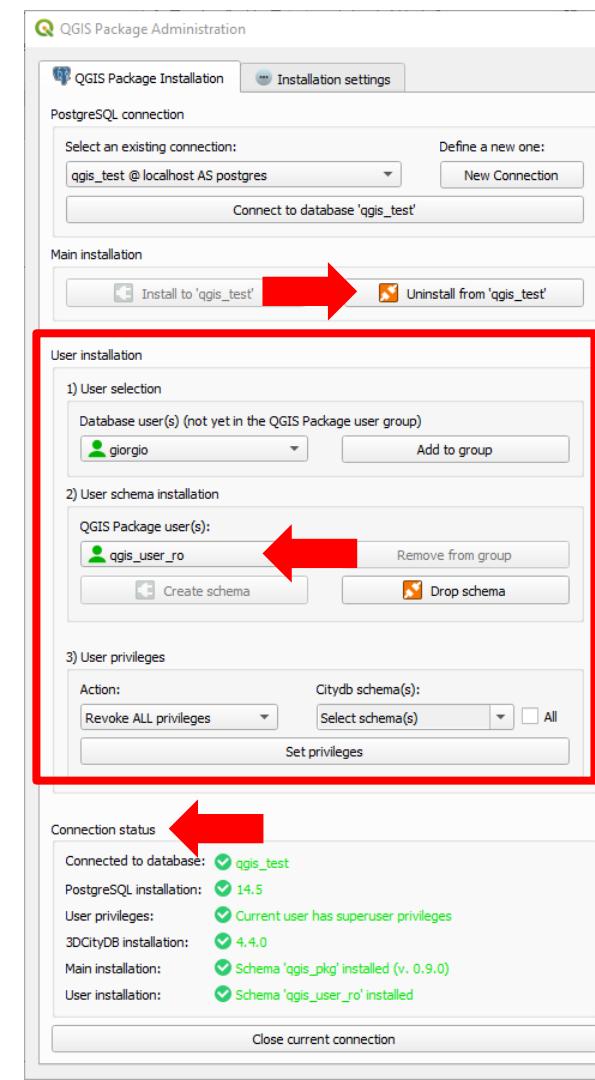
Upon successful installation:

- 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

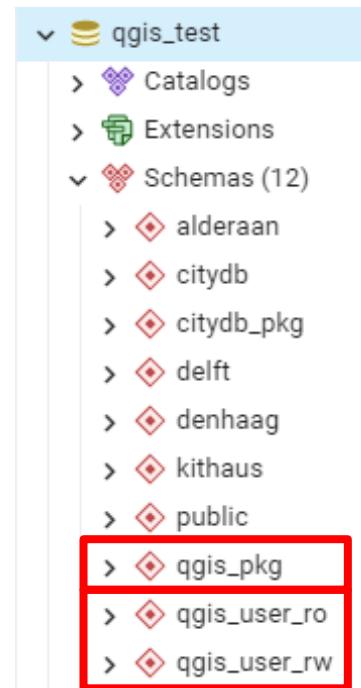
The credentials for the default users are:

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**



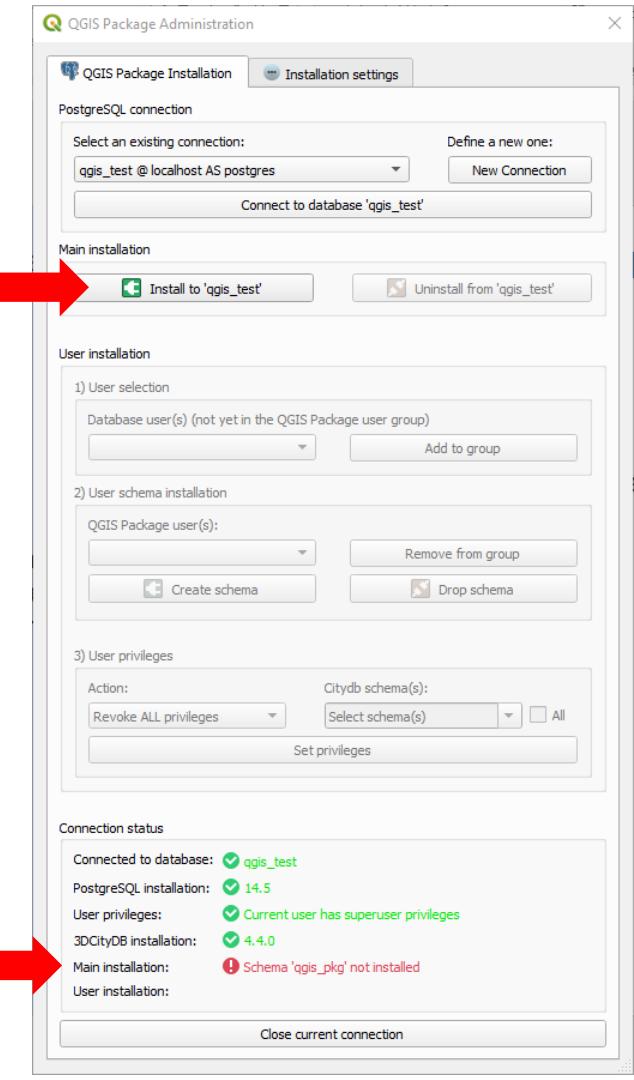
Back-end installation

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.



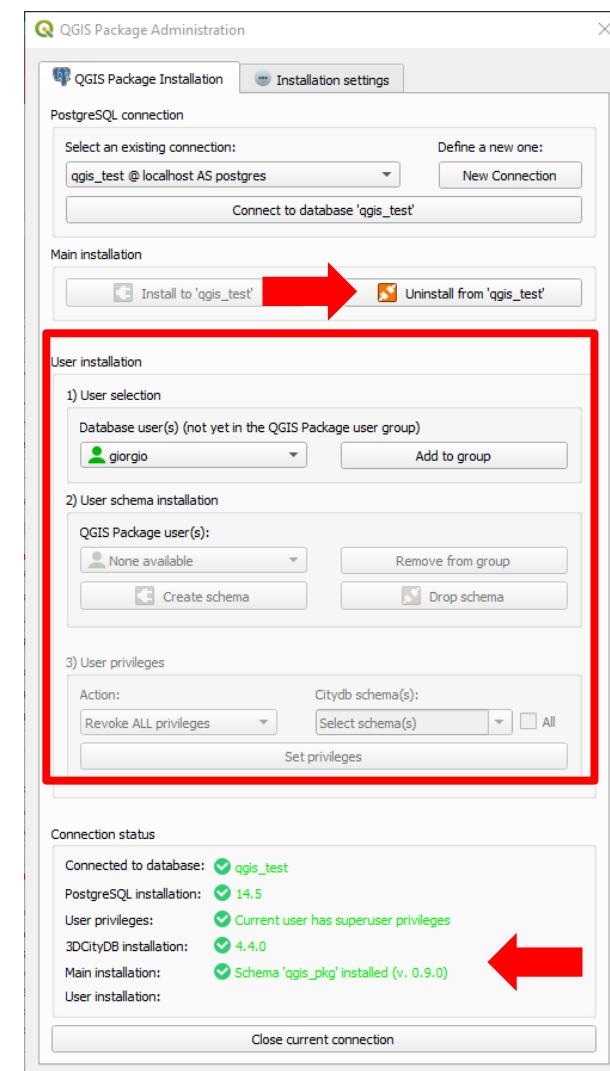
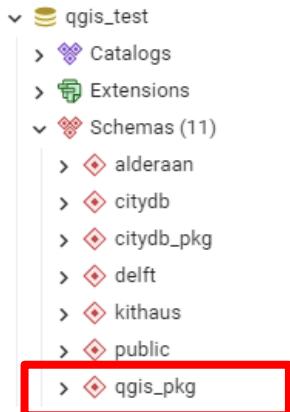
Back-end installation

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**

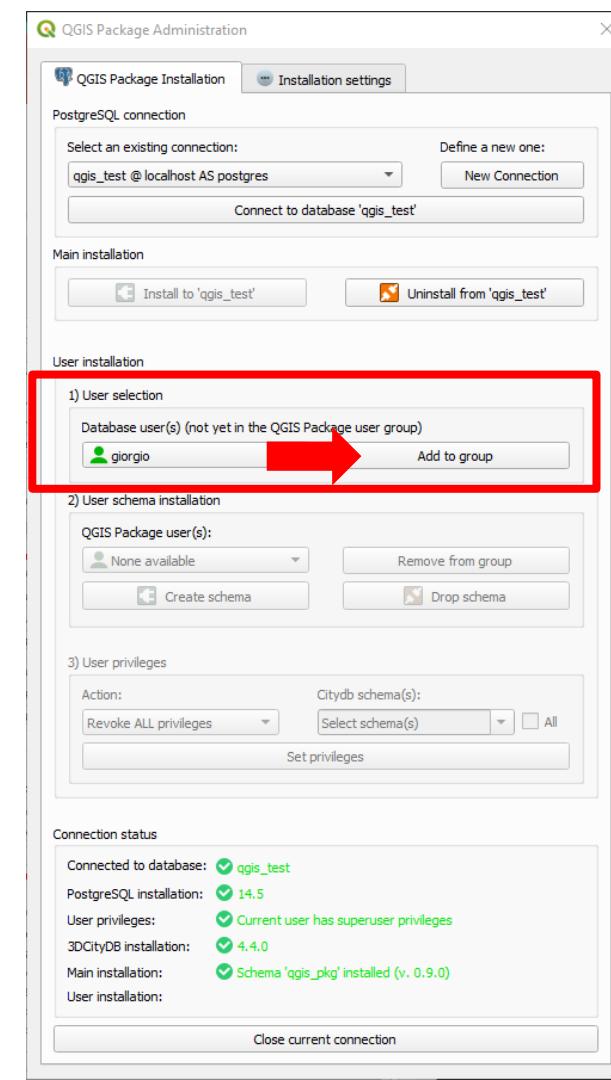
The "**qgis_pkg**" schema is created in the the selected current database



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

A screenshot of the QGIS Package Administration window. In the 'User selection' section, a user named 'giorgio' is listed in a dropdown menu. A red arrow points to the 'Add to group' button next to the dropdown. The window also includes sections for 'User schema installation' and 'User privileges', and a 'Connection status' summary at the bottom.

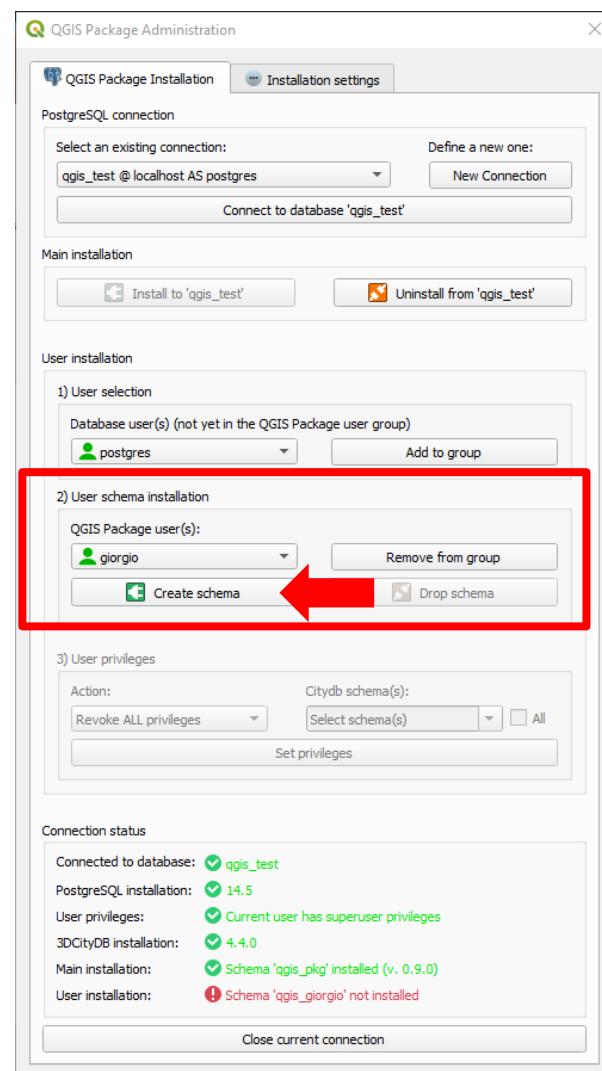
For each 3DCityDB there group named "**qgis_pkg_usrgroup_**" + **database name** is created. It contains those users that will be allowed to interact with the database from the front-end.
Example: for database "qgis_test" there is a group called "qgis_pkg_usrgroup_qgis_test".

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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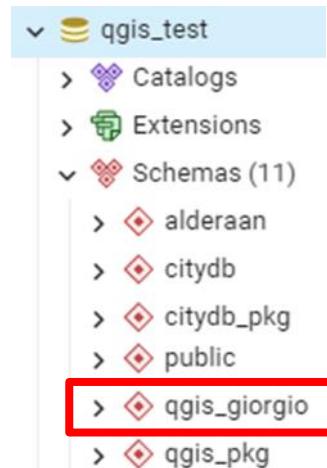


Back-end installation

2.2) "Normal" installation

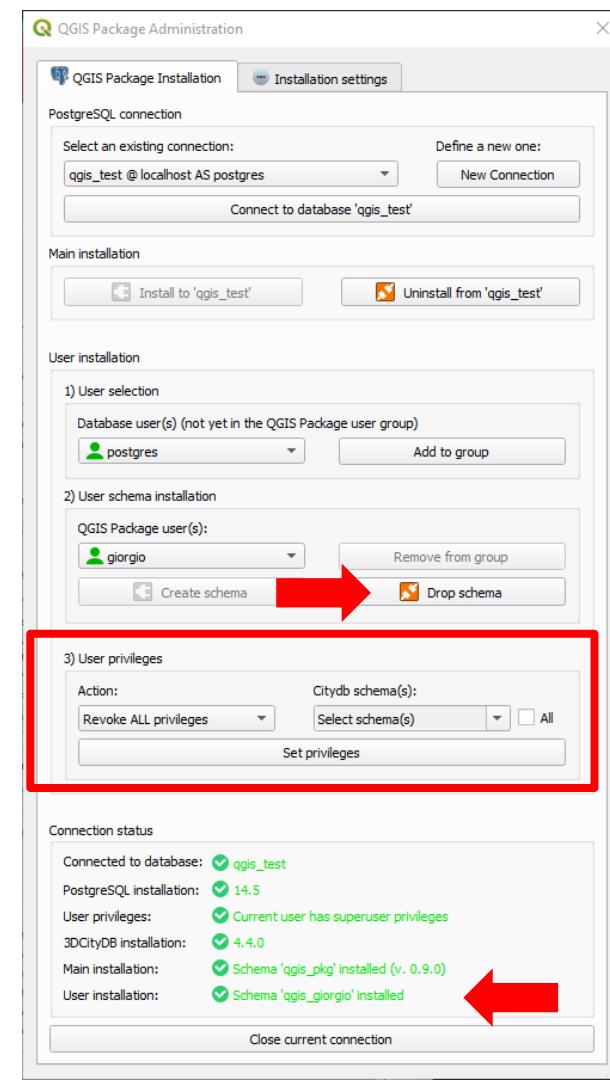
Upon successful creation of the user schema:

- 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): postgres 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

Close current connection

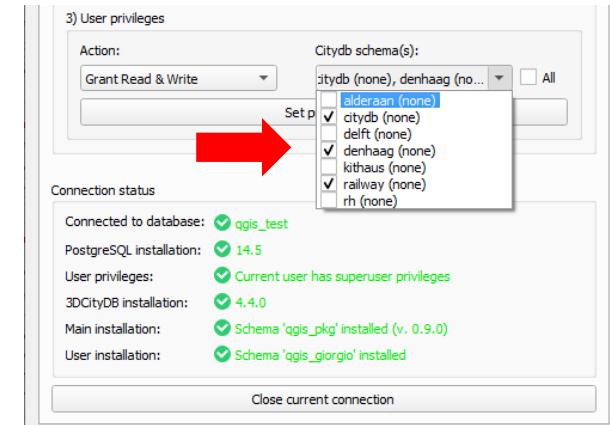
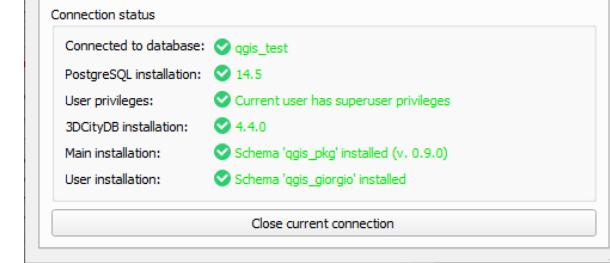
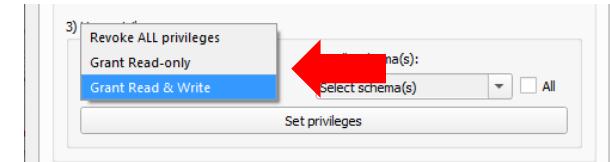
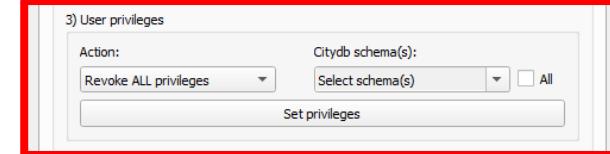
Back-end installation

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

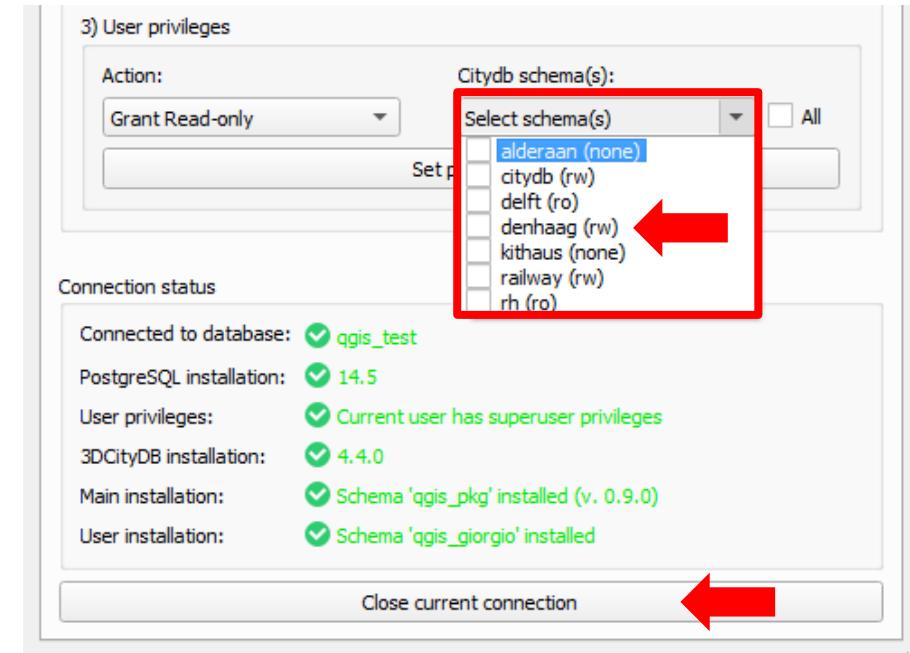
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Every time new privileges are set, the status in the drop down menu is updated with "ro" (read-only), "rw" (read & write) or "none".

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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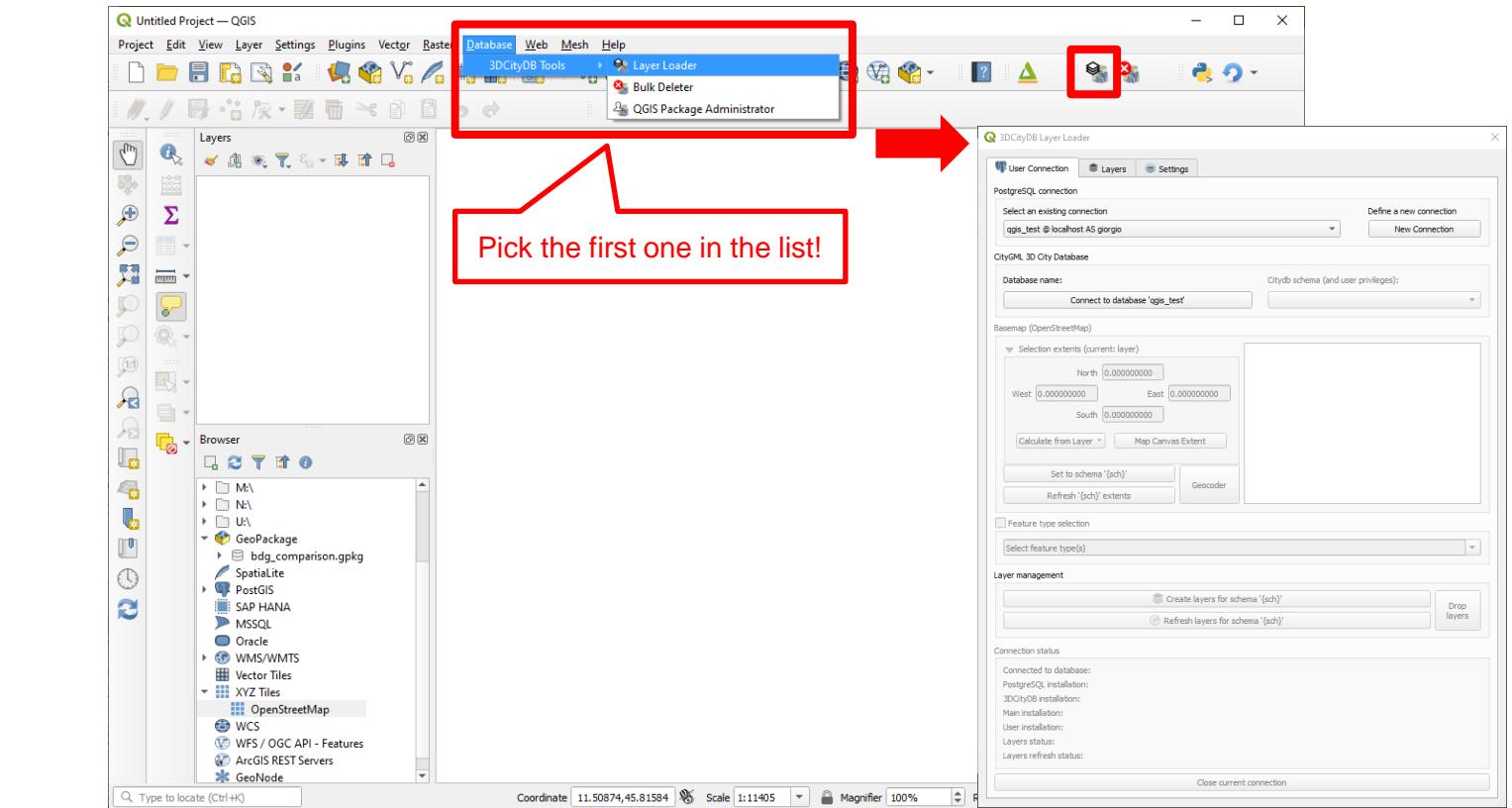
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Layer Loader



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

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Pick the first one in the list!

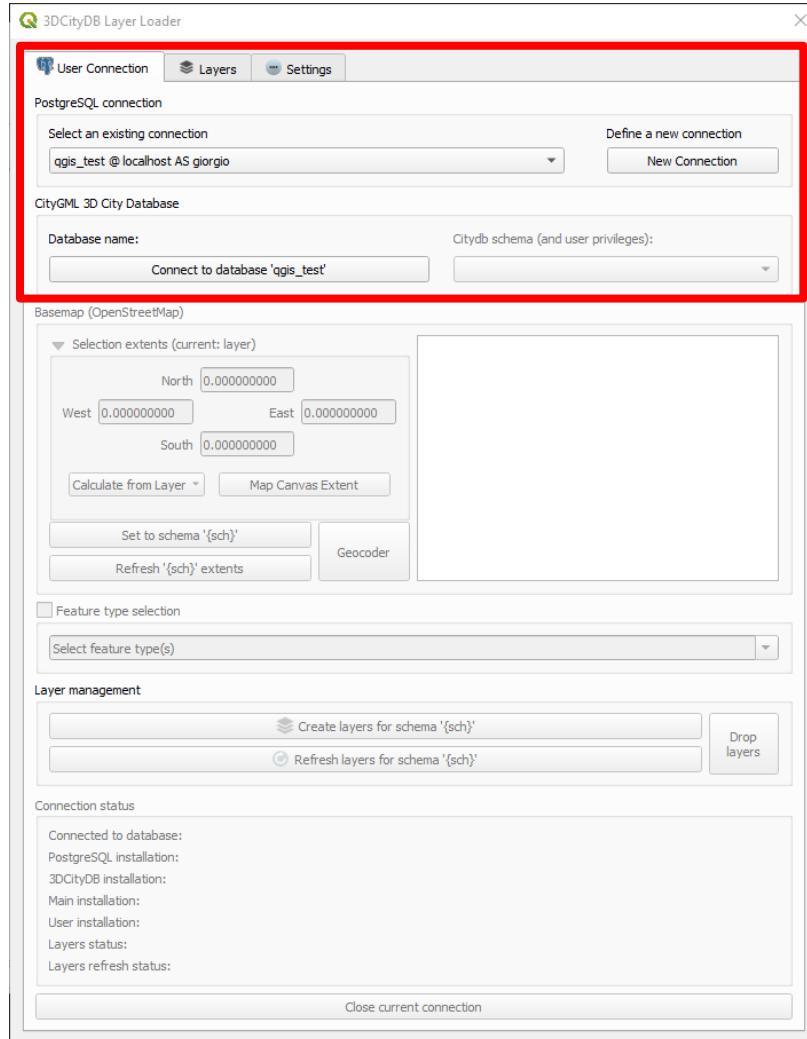
The screenshot shows the QGIS application window. The 'Database' menu is open, revealing the '3DCityDB Tools' submenu which contains 'Layer Loader'. The 'Layer Loader' option is highlighted with a red box. To the right of the menu bar, the QGIS toolbar has an icon for '3DCityDB Layer Loader' (a stack of three buildings) which is also highlighted with a red box. A large red arrow points from the 'Layer Loader' menu item towards the '3DCityDB Layer Loader' dialog window. The dialog window itself is titled '3DCityDB Layer Loader' and contains various configuration options for connecting to a PostgreSQL database and managing layers.

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)



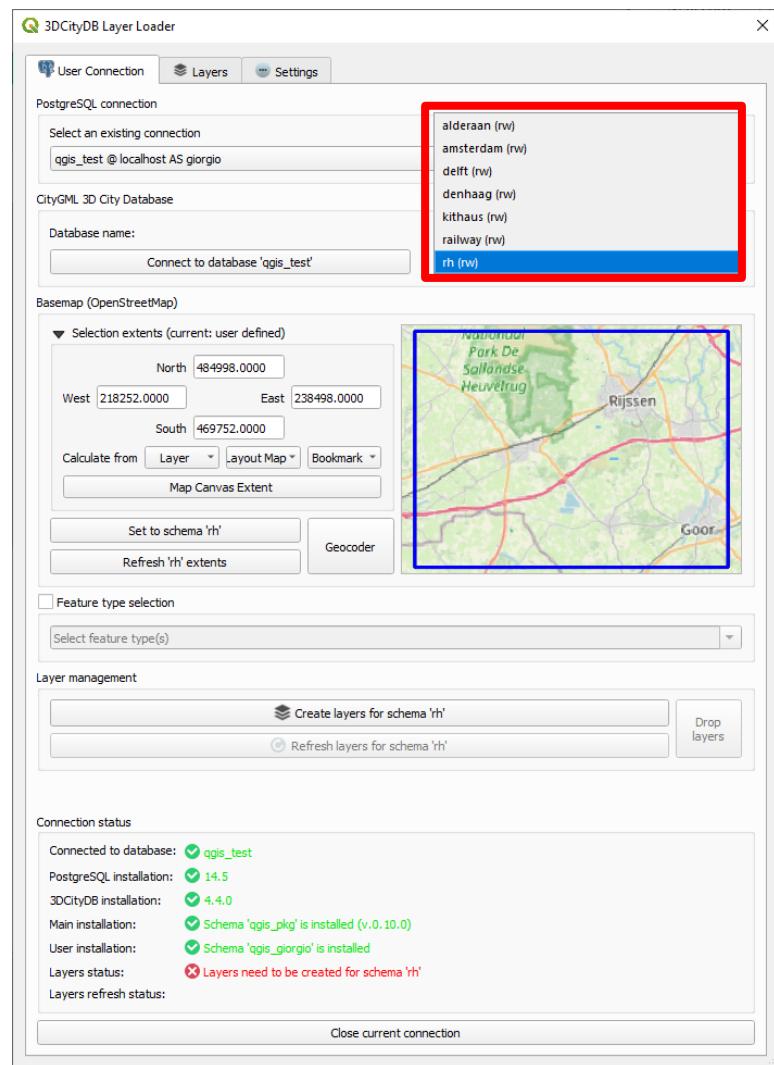
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3) Once connected, choose one of the existing citydb schemas. If they contain CityGML data, they will be listed.
 You will also see your privileges for that citydb schema ("ro" or "rw").

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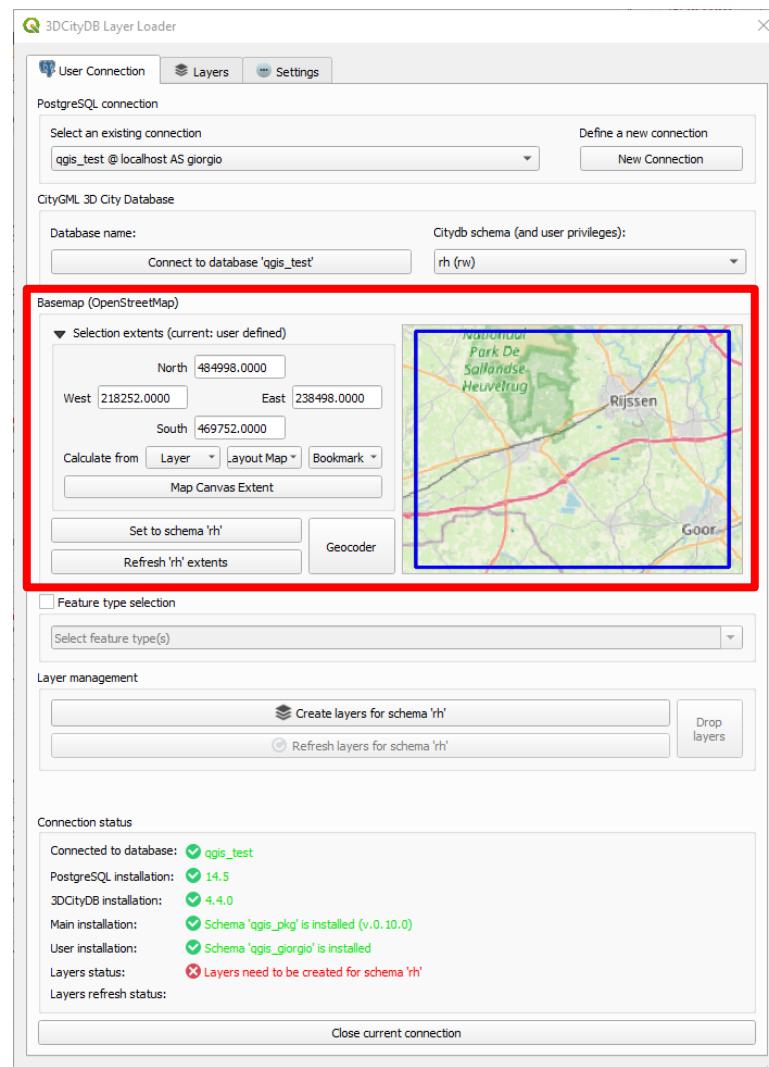
- Layer Loader
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4a) Upon selection of the citydb schema, you will see the extents of the dataset. They correspond to the extents of all currently loaded data in the selected citydb schema (here, for example, schema "rh")

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.

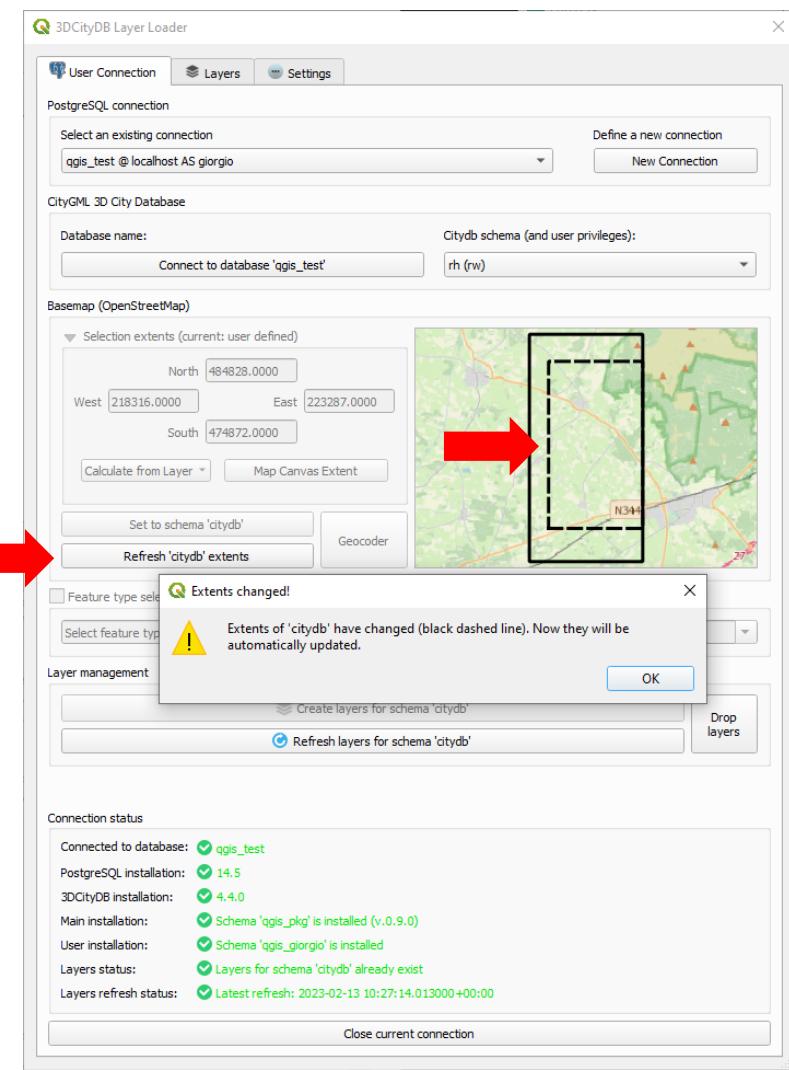


Layer Loader

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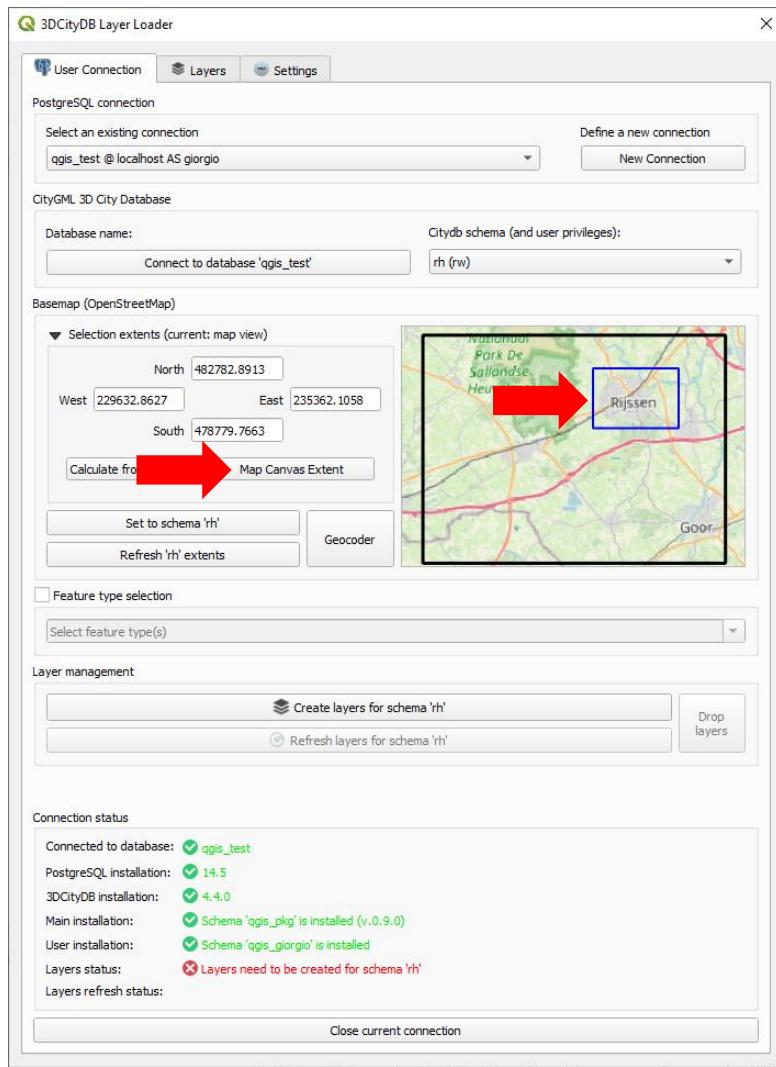
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5) Depending on your needs, you can set the spatial extents of the study area for which the layers will be created

- 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)!



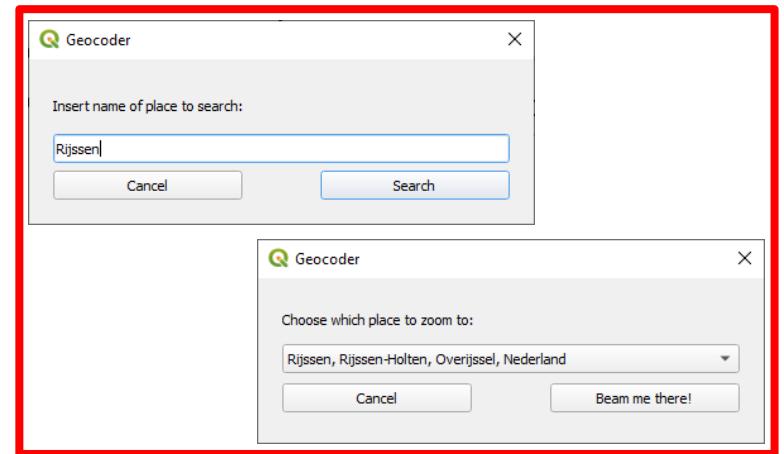
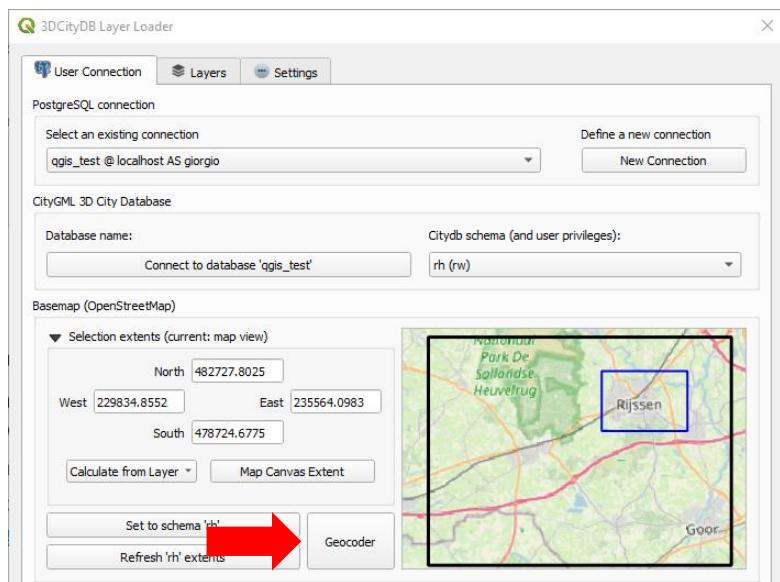
Layer Loader

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**.



Layer Loader

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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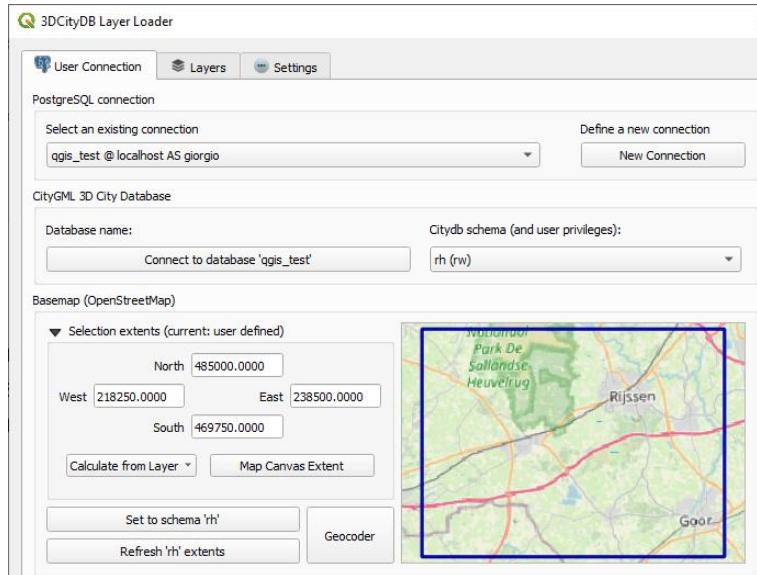
Advanced options

Software uninstall

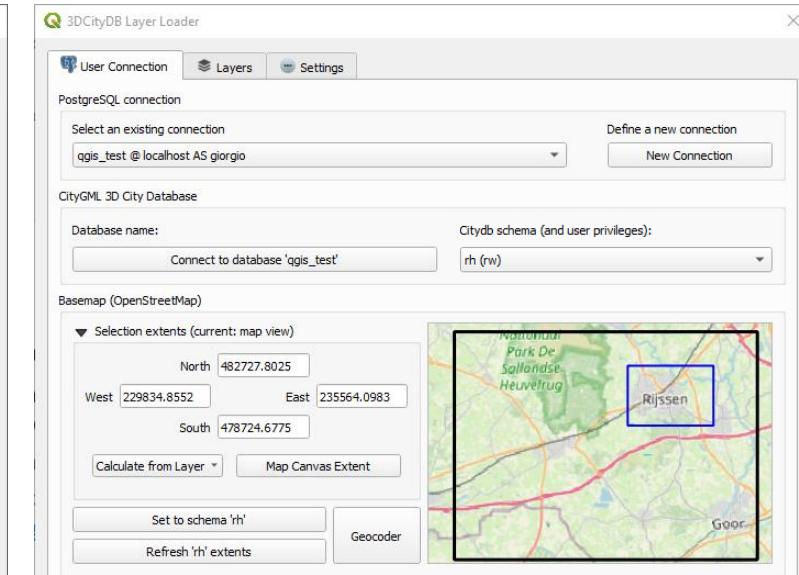
Current limitations

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Both areas coincide (default)



User-selected layers extents

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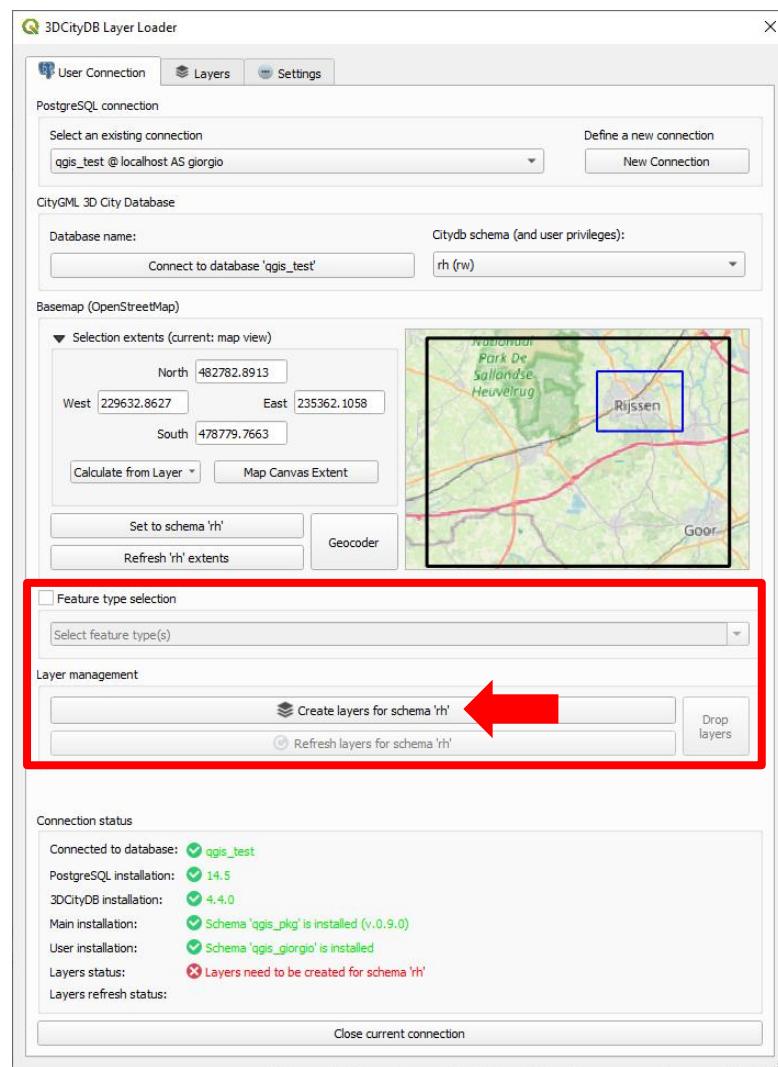
Layer Loader

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.



Layer Loader

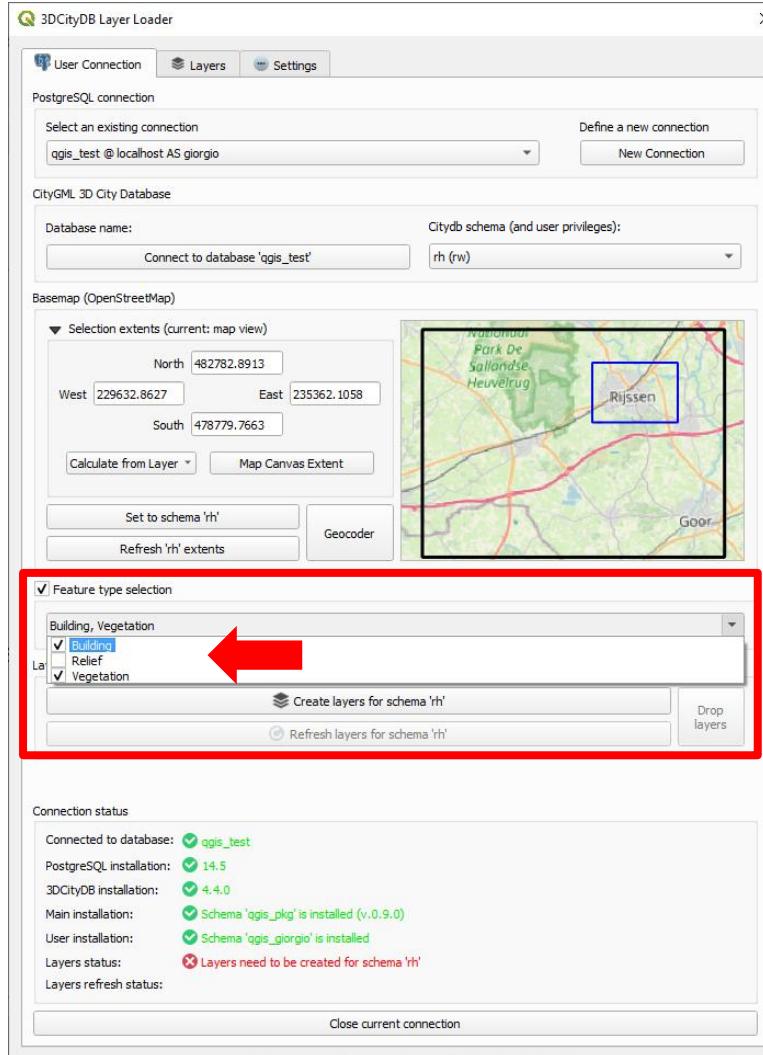
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6a) Create the layers

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.)

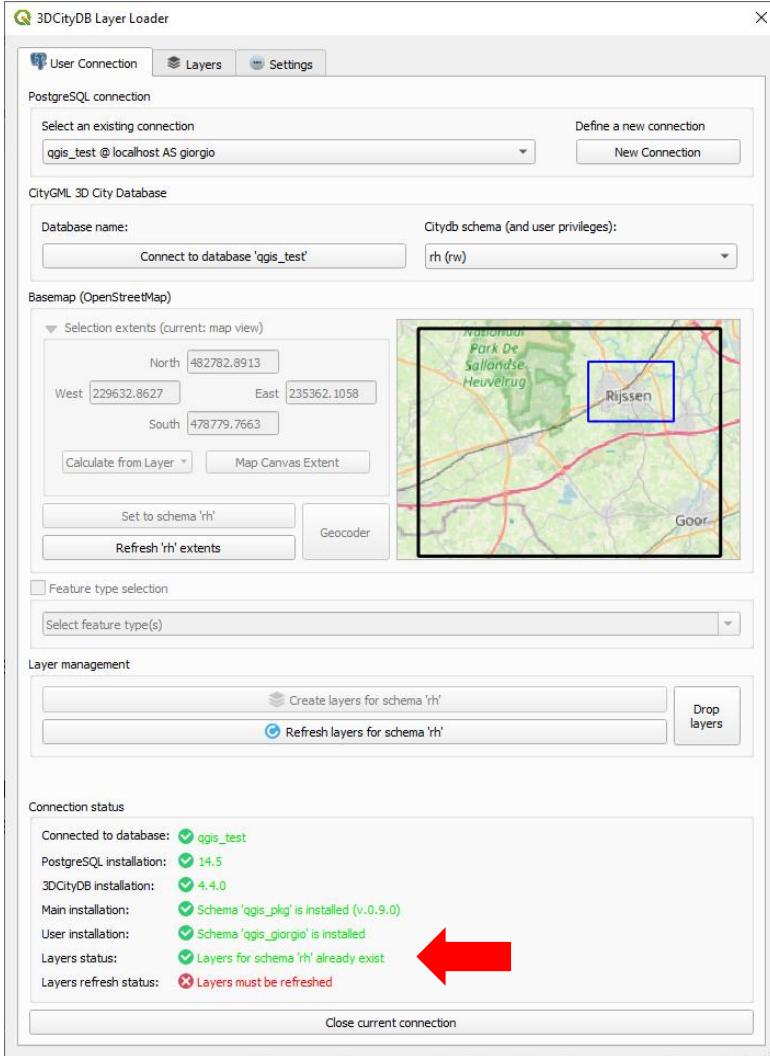


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6b) Create the layers

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



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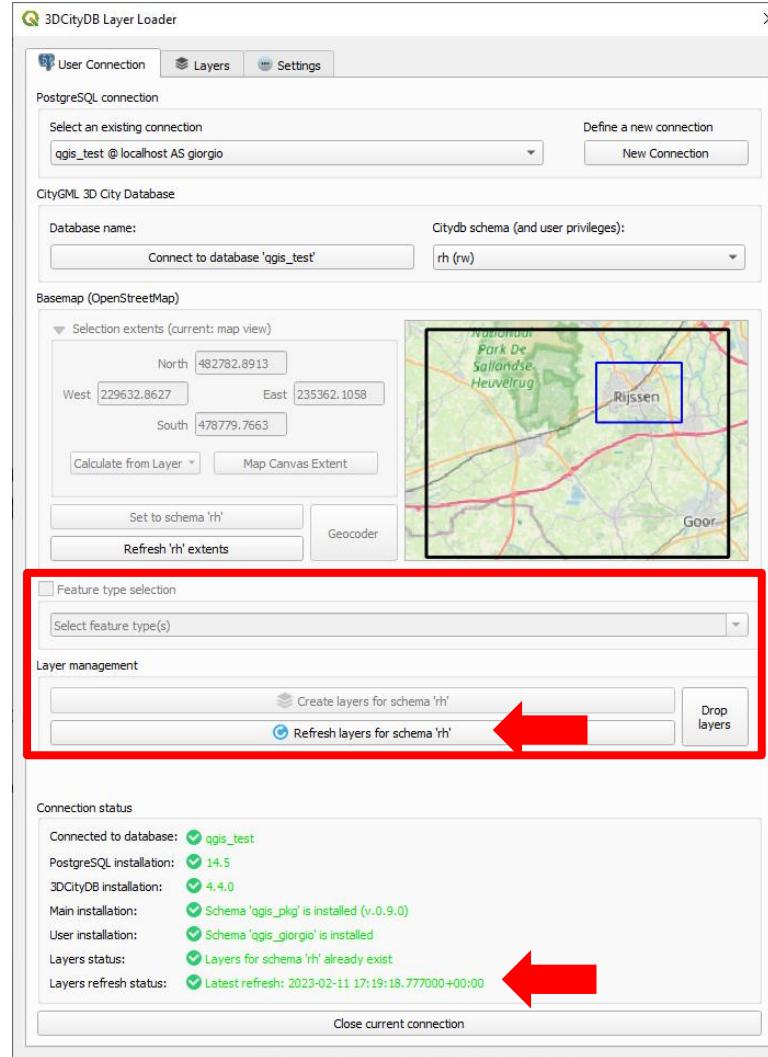
7) Populate/refresh the layers

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:

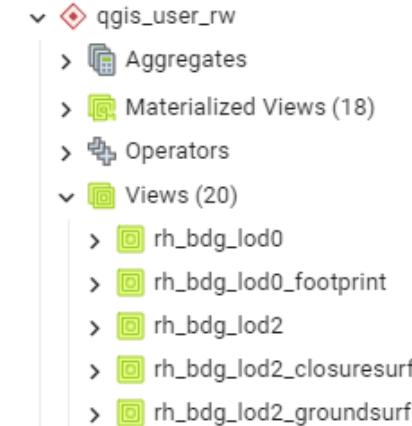
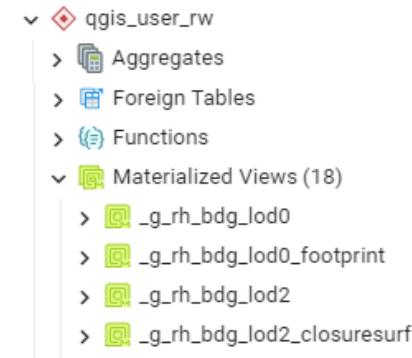
In the database user schema, both materialised views (containing the feature geometries) and the layers (as updatable views, containing the feature attributes linked to the corresponding geometries in the materialised views) can be accessed.

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)

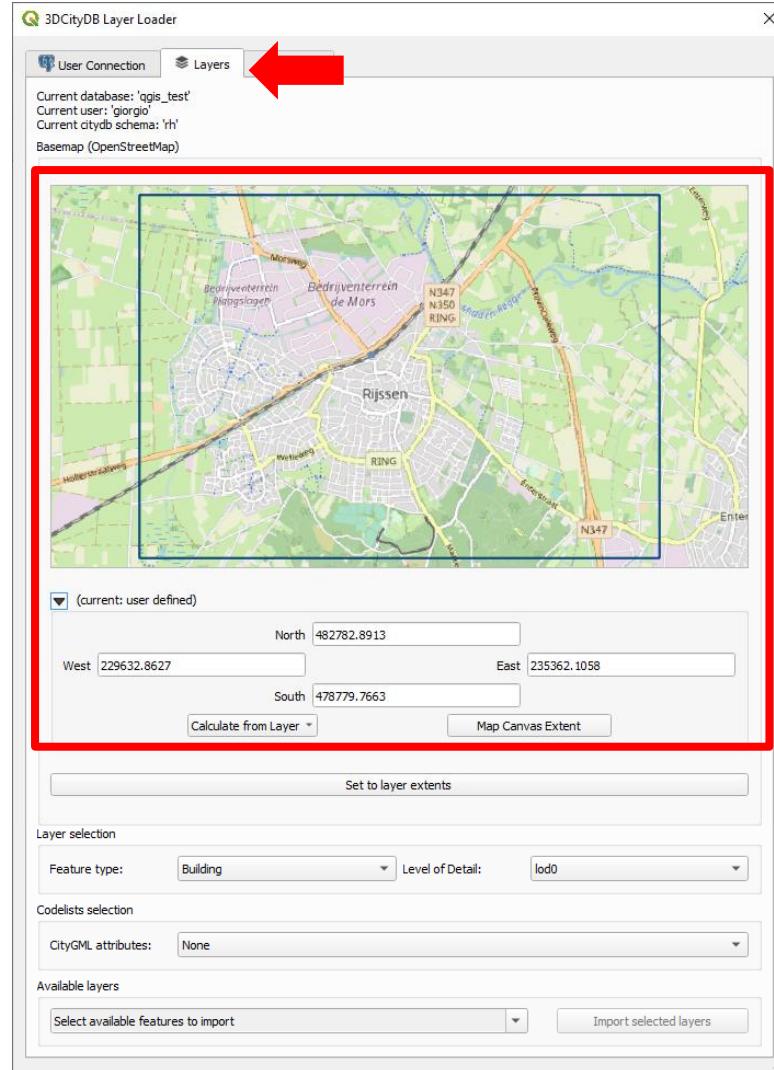


Layer Loader

In the "Layers" tab

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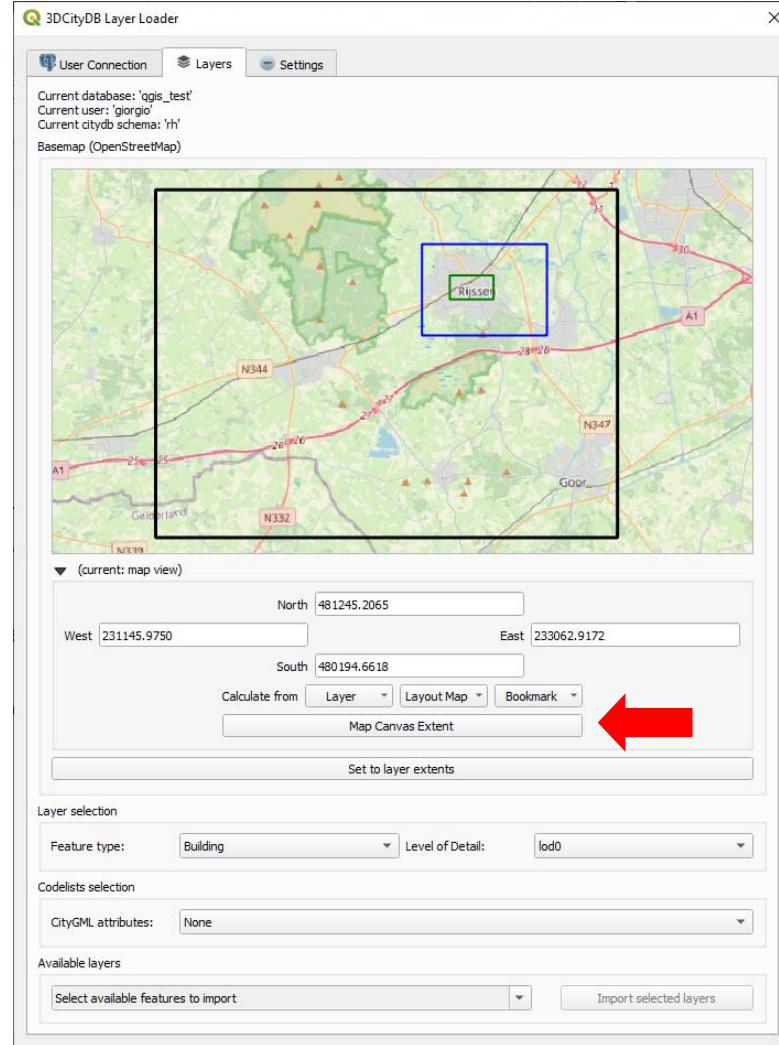
8) You are now directly zoomed to the layers extents (**blue bounding box**)



Layer Loader

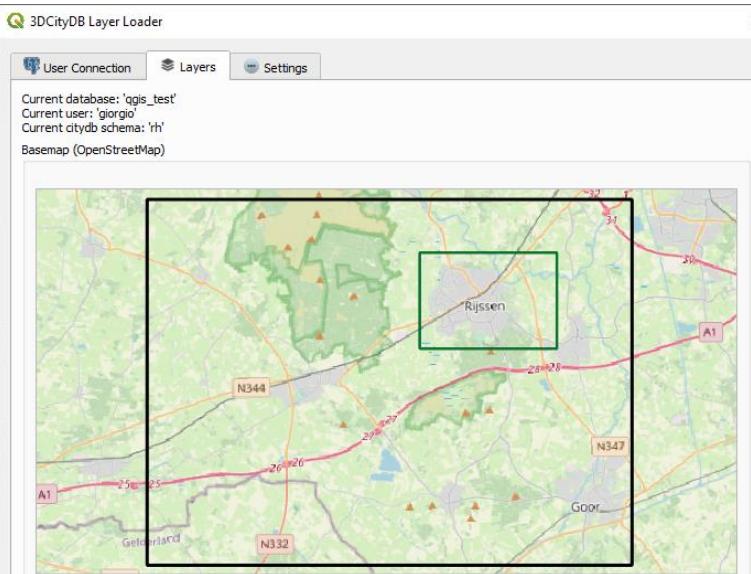
9) Depending on your needs, you can further reduce the extents of the layers to be loaded into QGIS by pressing the **Map Canvas Extent button**. The new extents are represented by the **green bounding box**.

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

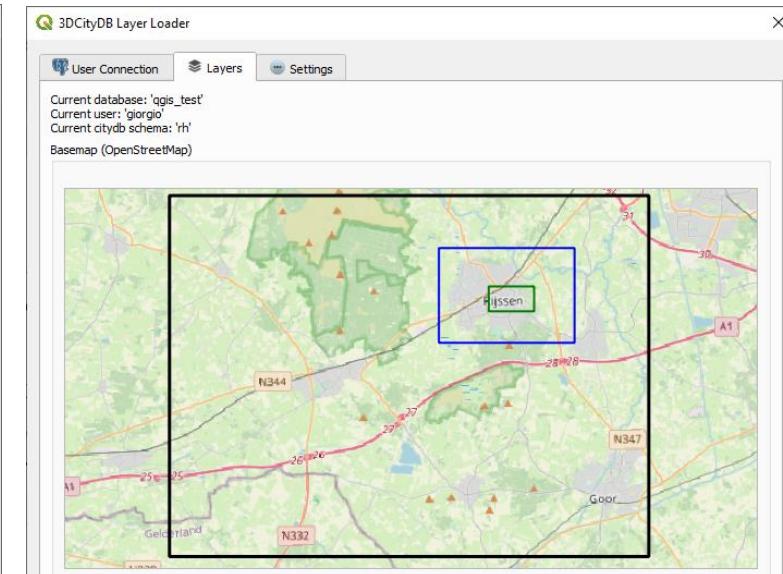


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Database- and QGIS-side extents coincide (default)



User-selected QGIS-layers extents

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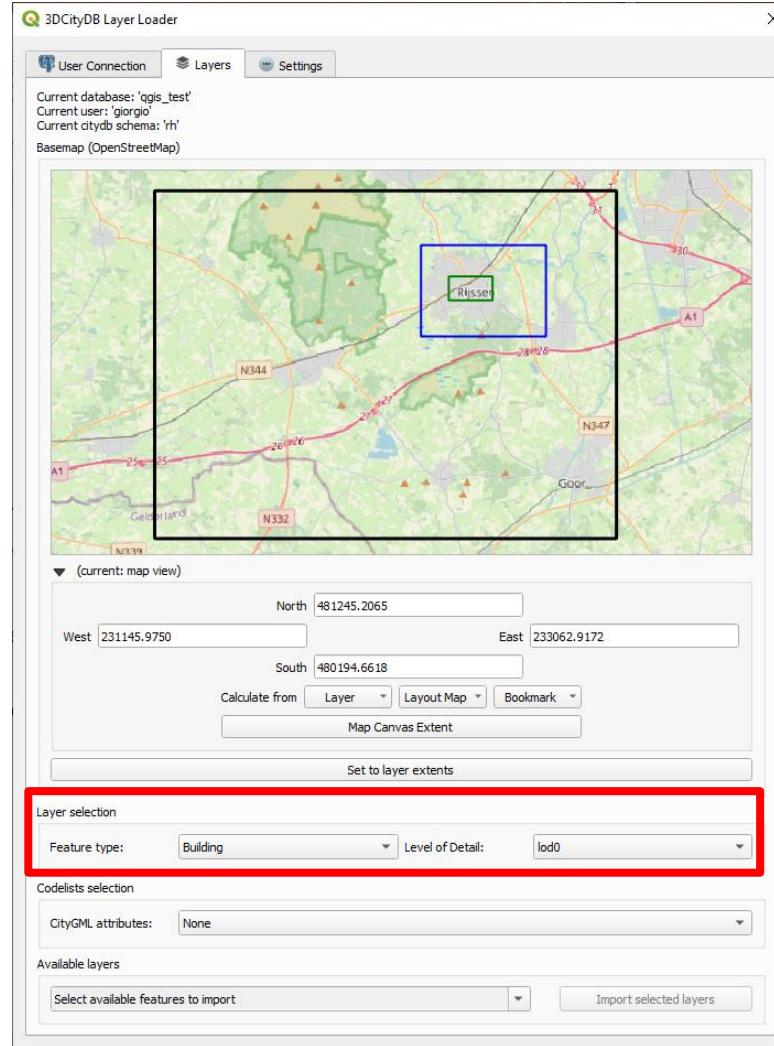
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Layer Loader

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**).



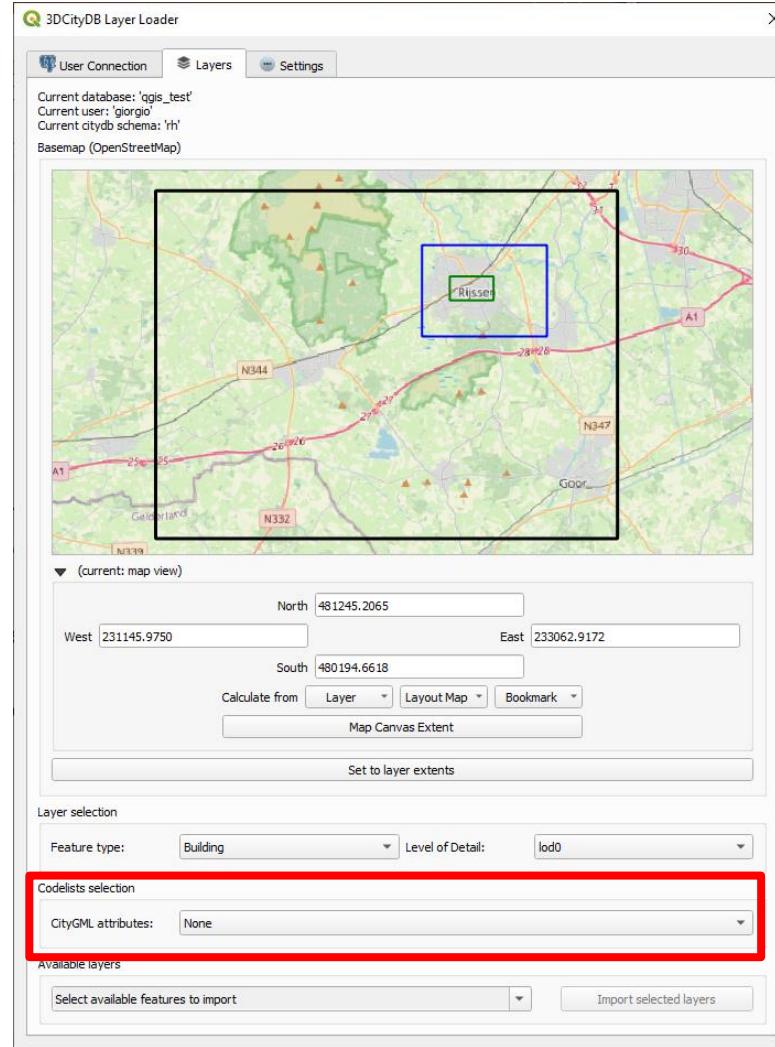
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11) The **Codelist selection** allows to optionally load codelists and set up the attribute forms accordingly (see next slides about "Use in QGIS" for more details)



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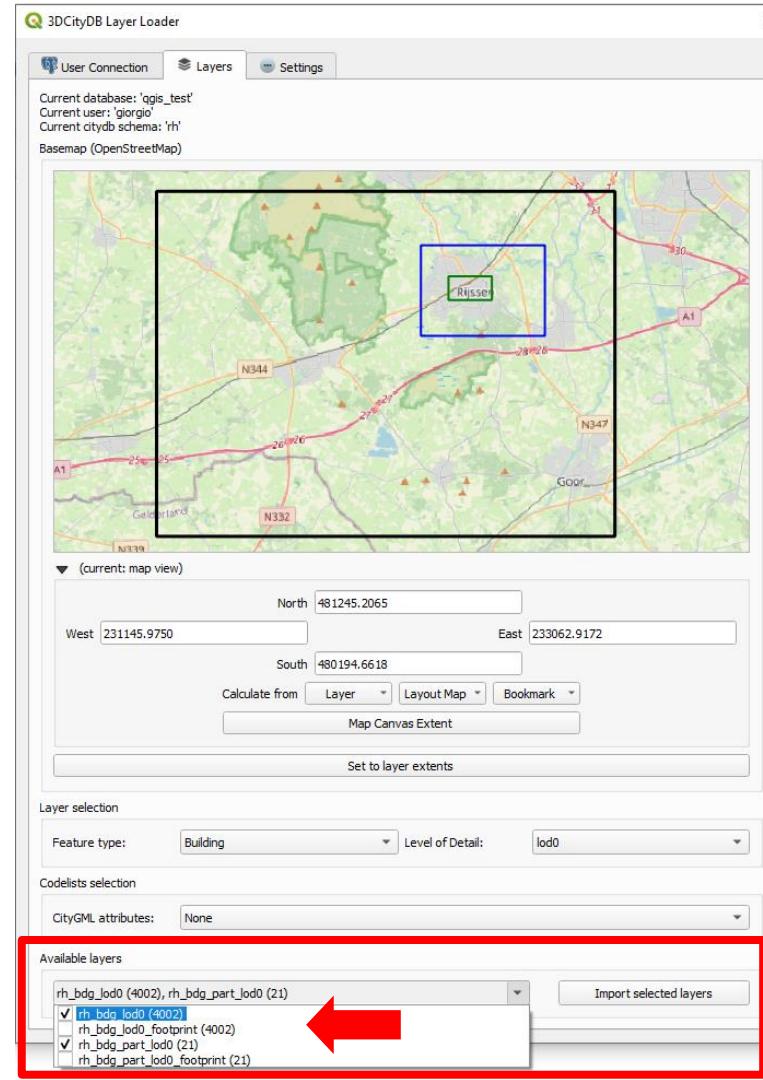
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12) Select the layer(s) to import into QGIS

- 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**).



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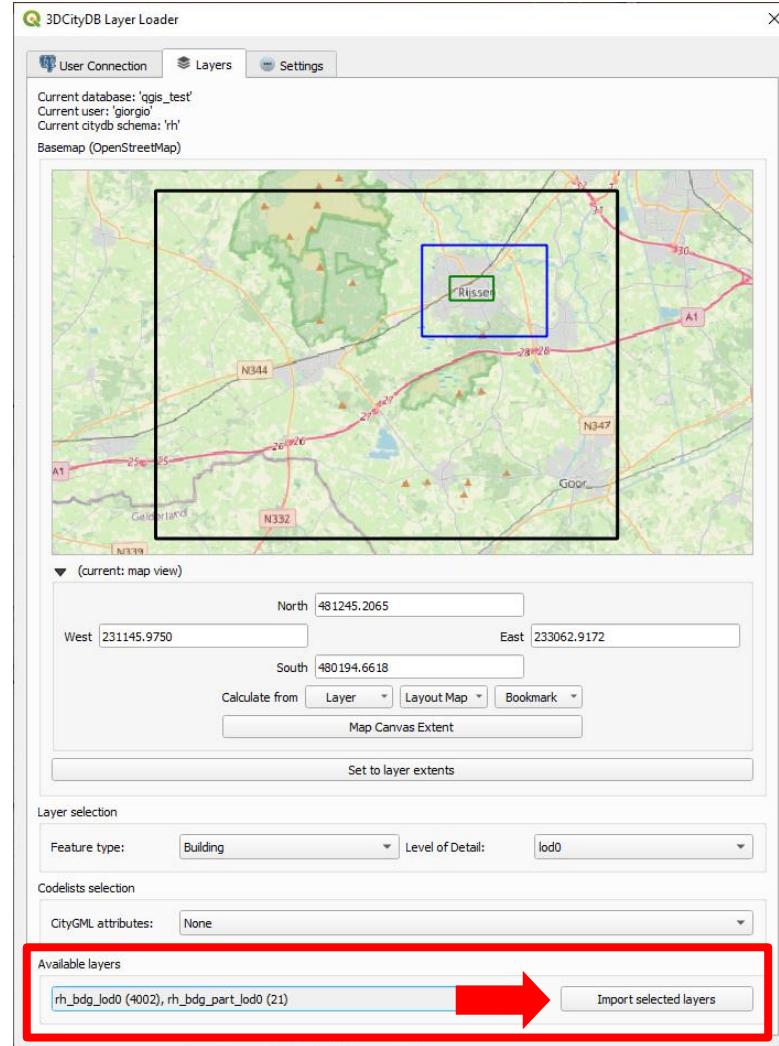
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13) Import the selected layers to QGIS by clicking on the **Import selected layers** button

- 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)

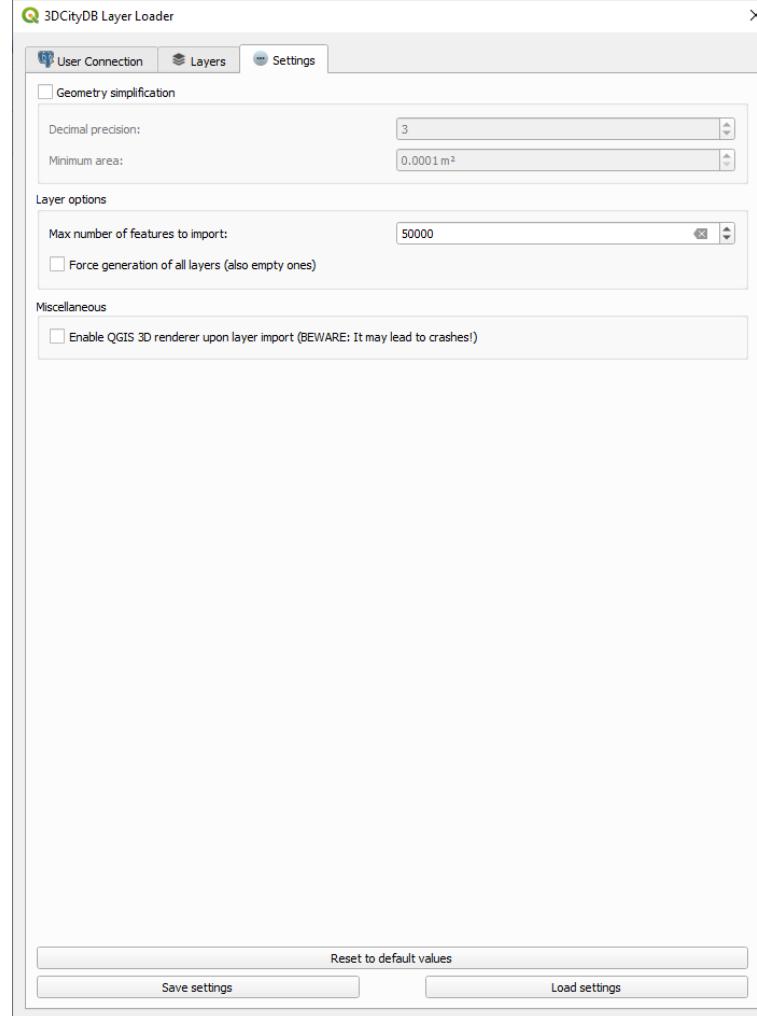
Nota bene: Layers that have already been loaded can be selected, but won't be loaded again



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.



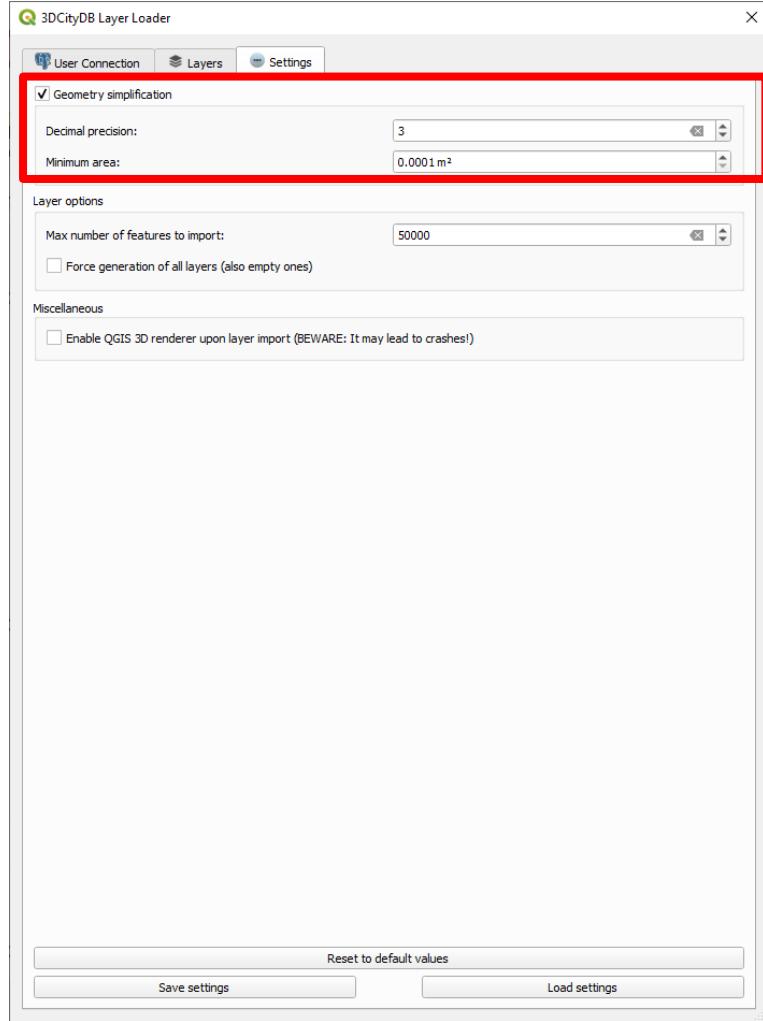
Geometry simplification

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:

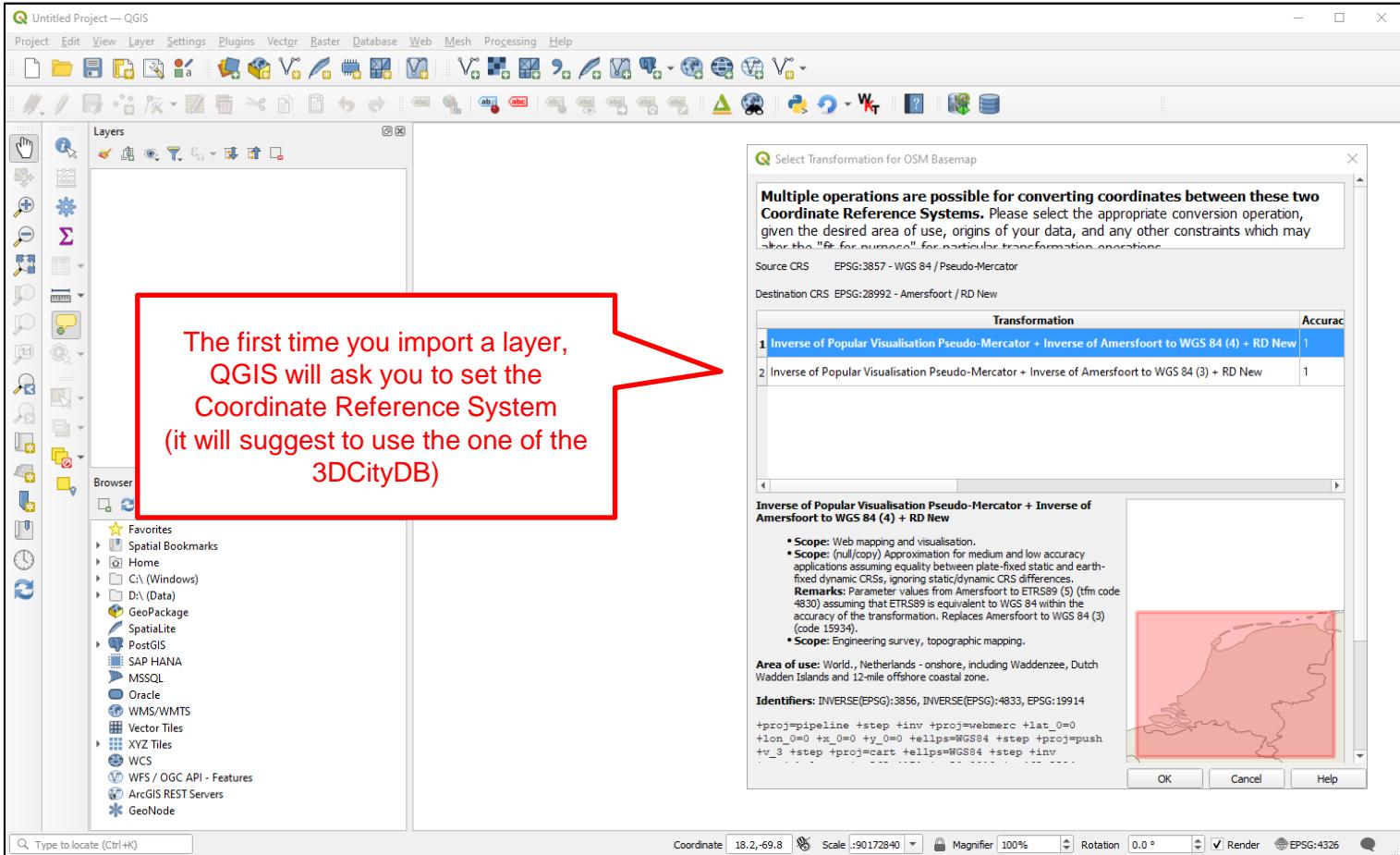
- can significantly increase the time needed to refresh the layers
- does NOT change the original data in the database!



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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)



Source CRS: EPSG:3857 - WGS 84 / Pseudo-Mercator

Destination CRS: EPSG:28992 - Amersfoort / RD New

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

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

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

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

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

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

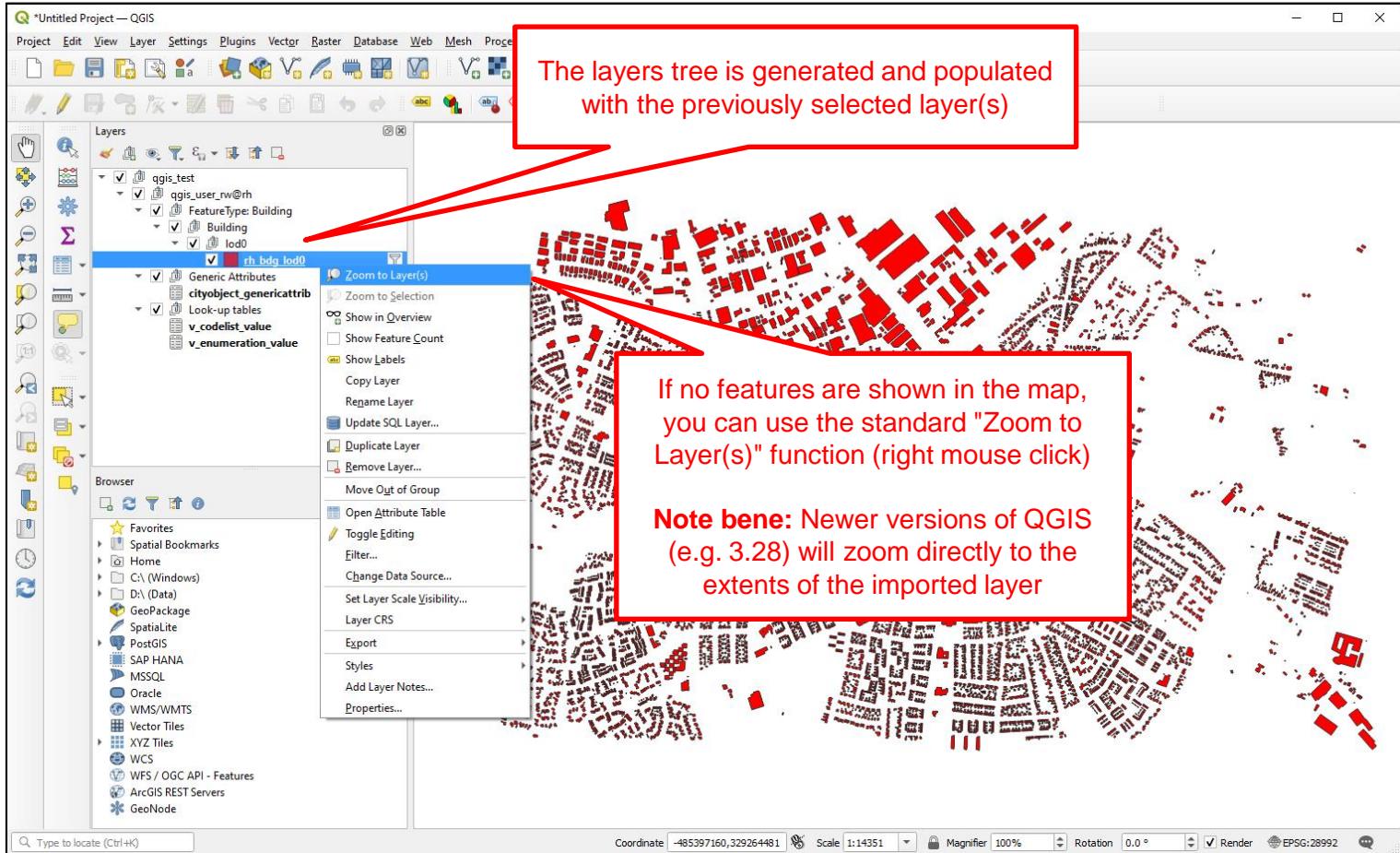
OK Cancel Help

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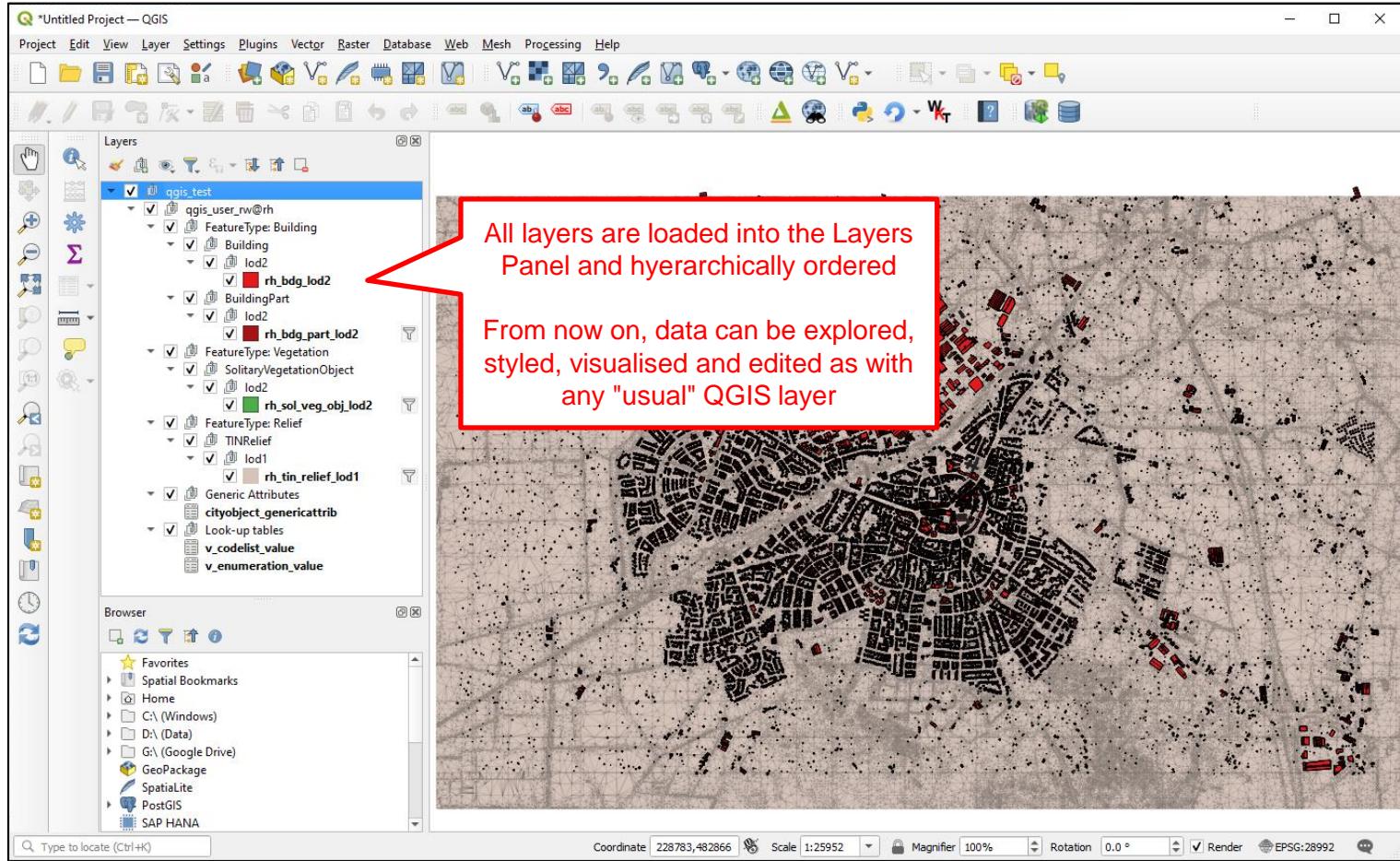
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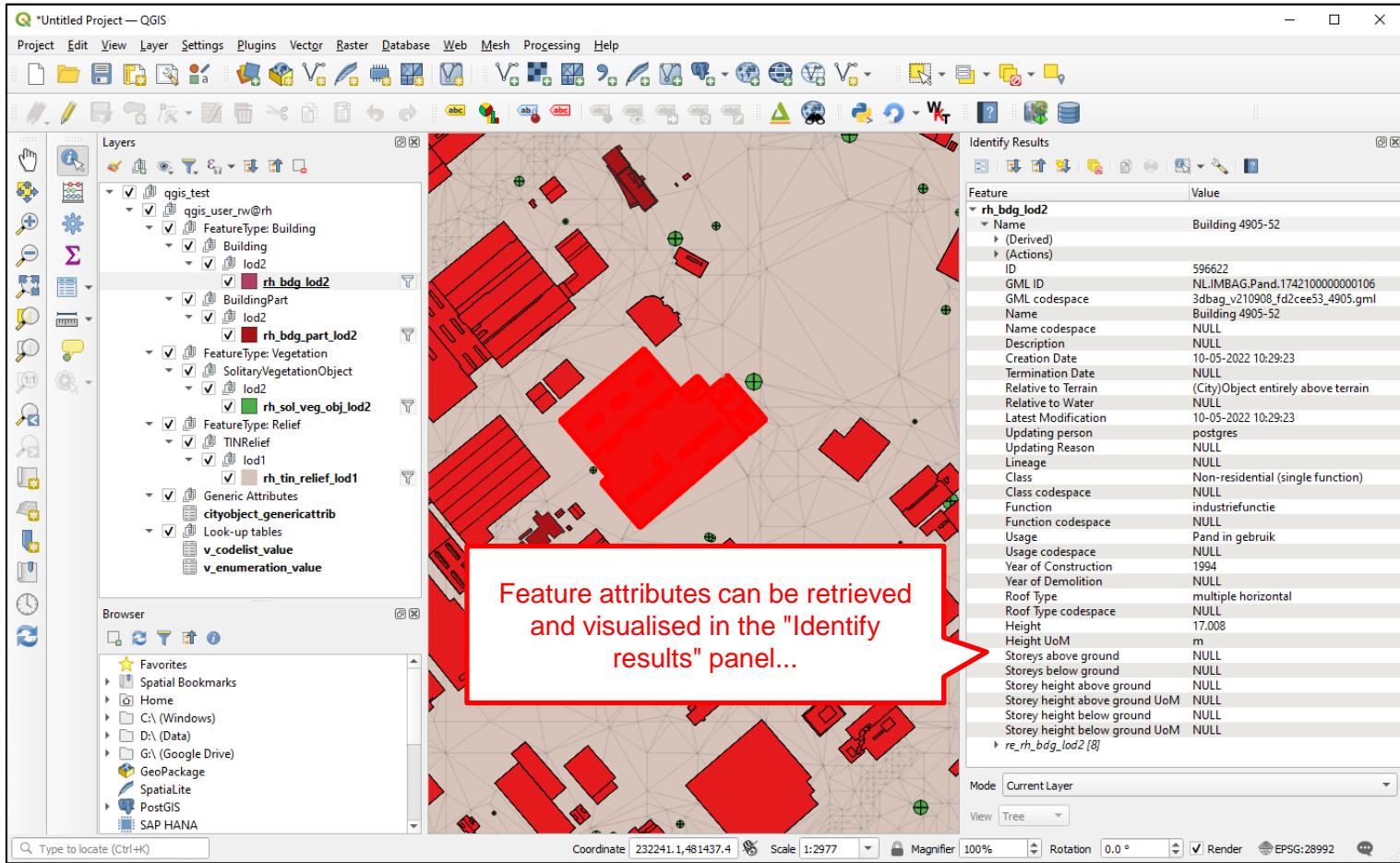
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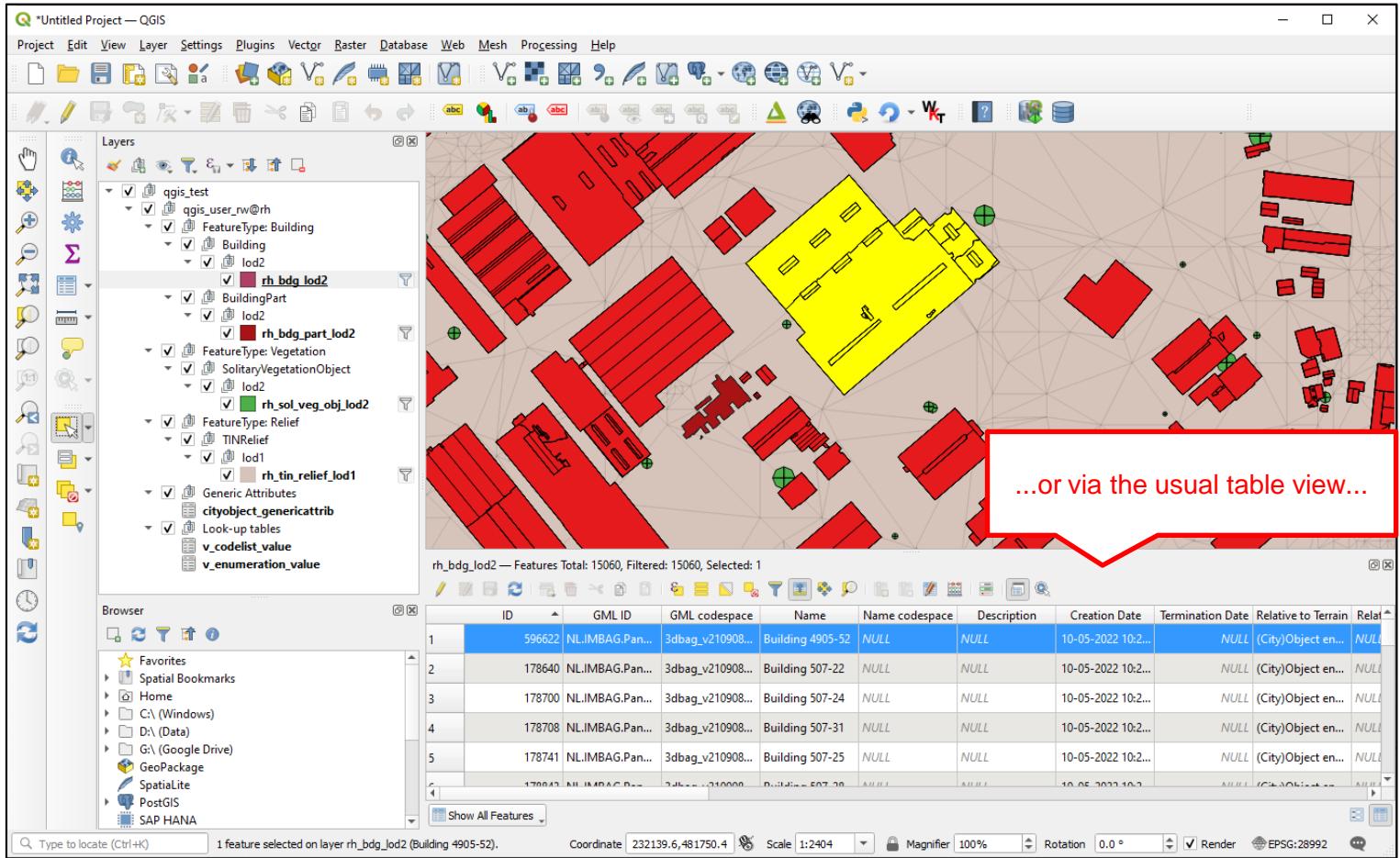
The screenshot shows the QGIS interface with a project titled "Untitled Project — QGIS". The left sidebar contains the "Layers" panel, which lists several layers including "qgis_test", "qgis_user_nv@rh", "Building", "Vegetation", "Relief", and "Generic Attributes". The "Identify Results" panel on the right displays the attributes for a selected feature, specifically a building. A red callout box highlights the text: "Feature attributes can be retrieved and visualised in the \"Identify results\" panel...".

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
View: Tree
Coordinate: 232241.1, 481473.4
Scale: 1:2977
Magnifier
100%
Rotation: 0.0°
Render
EPSG:28992

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The screenshot shows the QGIS interface with a map view and a table view.

Map View: The map displays several building footprints colored red and yellow, overlaid on a grey relief background. A red callout box highlights a specific building feature in the bottom right corner of the map area.

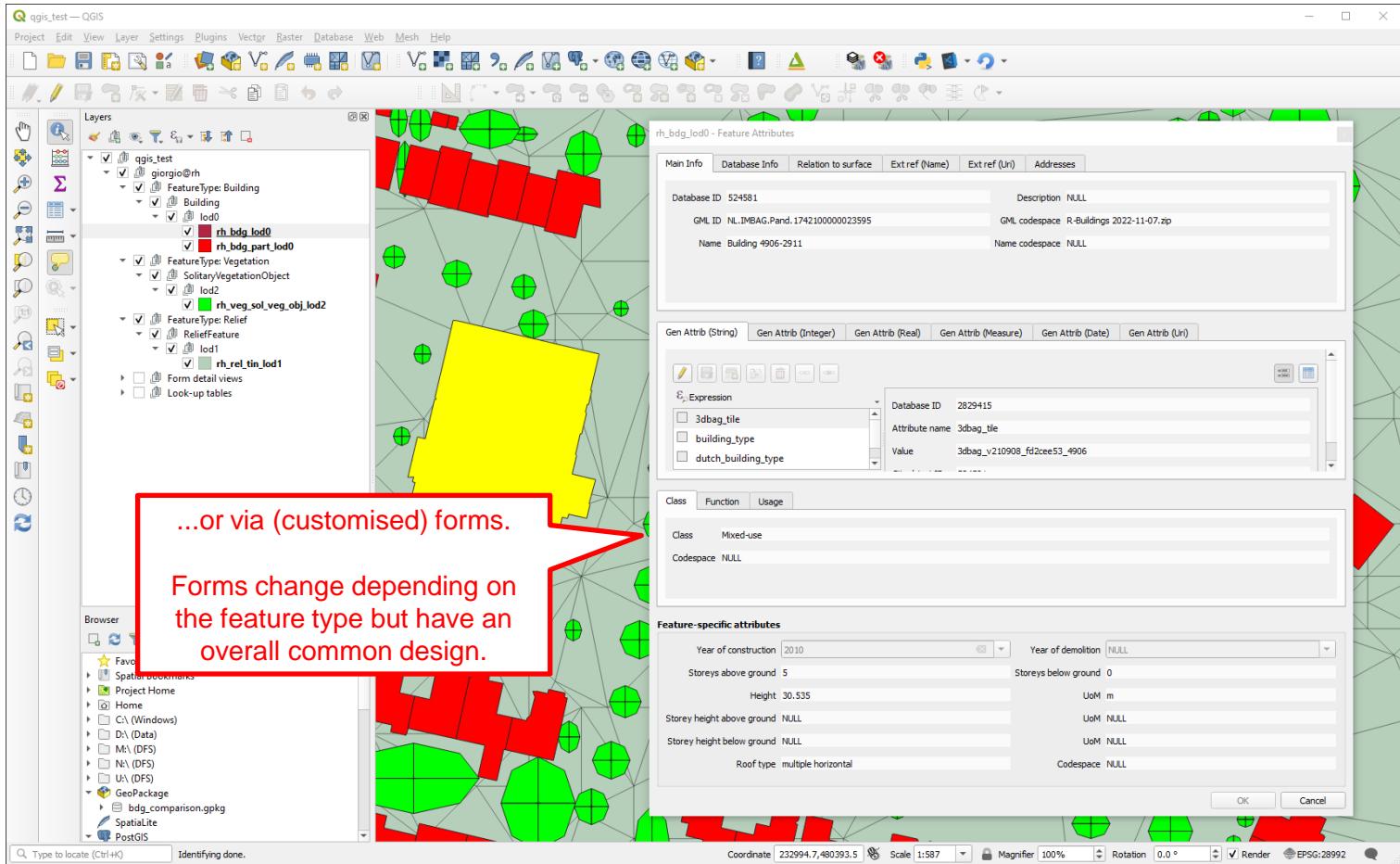
Table View: Below the map, a table titled "rh_bdg_lod2" shows the following data:

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

A red callout box also highlights the table view, indicating that attributes can be viewed via the usual table view.

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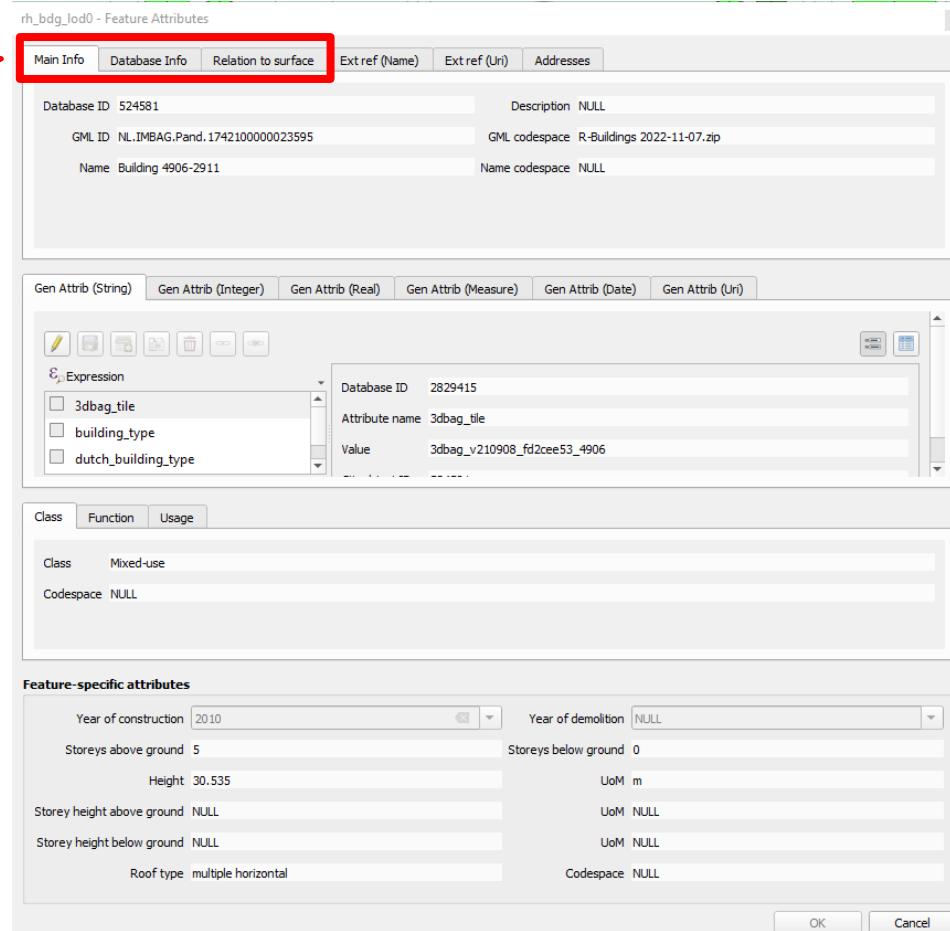
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Attributes are grouped into tabs.



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, displaying basic information like Database ID (524581), GML ID (NL.IMGAG.Pand.1742100000023595), Description (NULL), and Name (Building 4906-2911). Below this, the "Gen Attrib (String)" tab is active, showing an expression builder with three items: "3dbag_tile", "building_type", and "dutch_building_type". The "Value" column for "3dbag_tile" is set to "3dbag_v210908_fd2cee53_4906". The "Function" tab shows the class as "Mixed-use" and the codespace as NULL. The "Feature-specific attributes" section at the bottom contains fields for Year of construction (2010), Year of demolition (NULL), Storeys above ground (5), Height (30.535), Storey height above ground (NULL), Storey height below ground (NULL), Roof type (multiple horizontal), and Codespace (NULL).

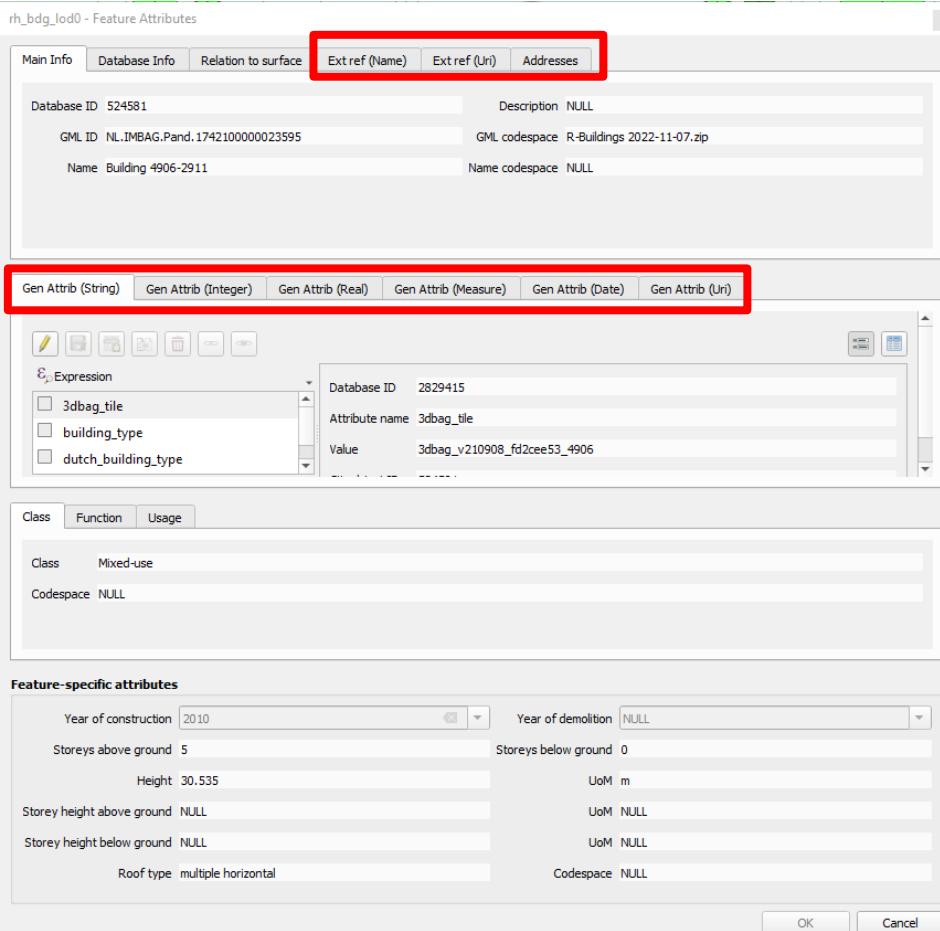
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Use in QGIS: Attributes

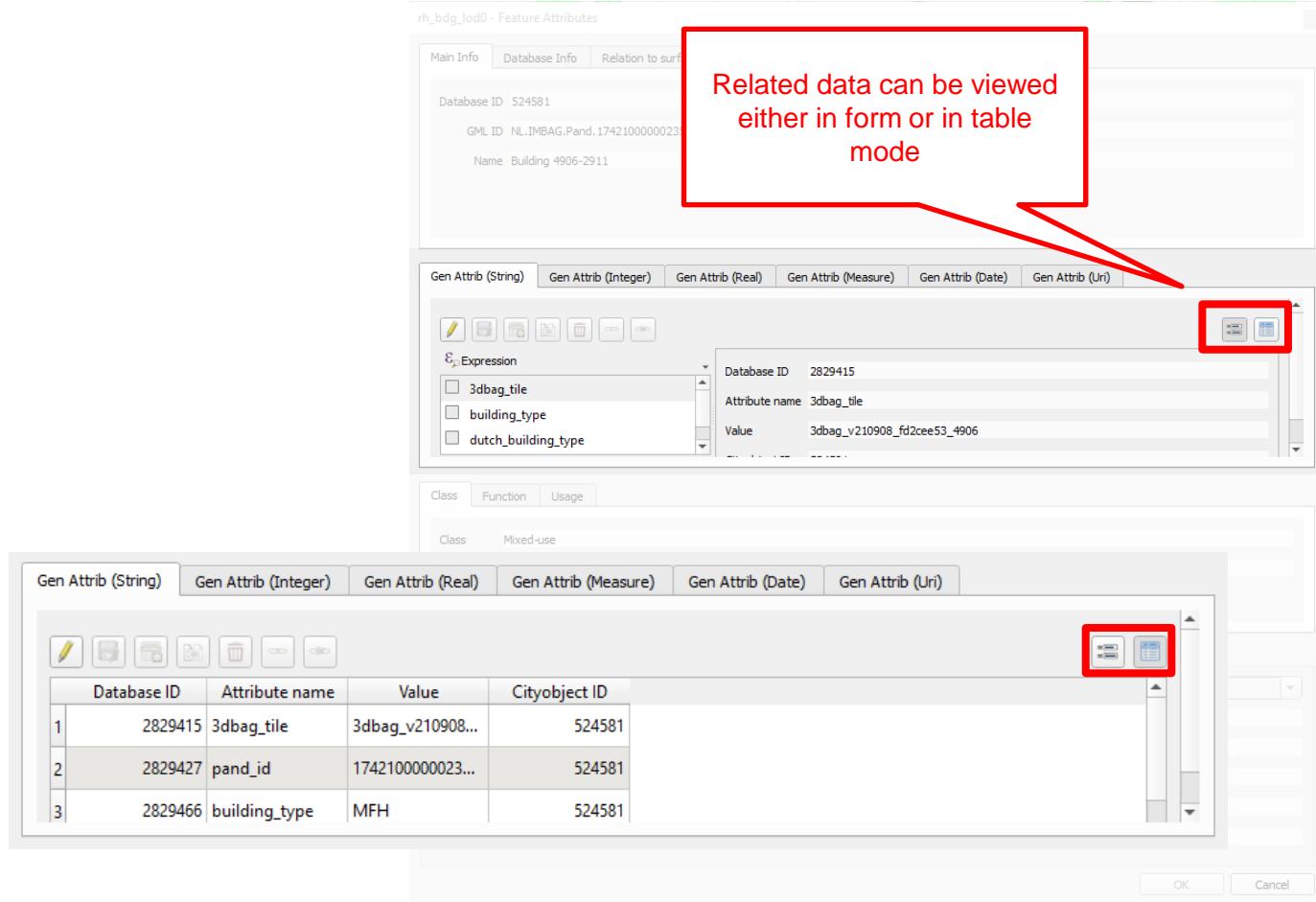
Additional related tables are connected (e.g. External References, Addresses, Generic Attributes)



The screenshot shows the QGIS Attribute Editor for a feature named 'rh_bdg_lod0'. The top navigation bar includes tabs for 'Main Info', 'Database Info', 'Relation to surface', 'Ext ref (Name)', 'Ext ref (Uri)', and 'Addresses'. The 'Ext ref' tabs are highlighted with a red border. Below this, another set of tabs for 'Gen Attrib' is shown, also with a red border. The 'Gen Attrib (String)' tab is active, displaying an expression builder with three items: '3dbag_tile', 'building_type', and 'dutch_building_type'. To the right, detailed information for '3dbag_tile' is provided: Database ID 2829415, Attribute name 3dbag_tile, and Value 3dbag_v210908_fd2cee53_4906. Further down, the 'Feature-specific attributes' section contains fields like Year of construction (2010), Storeys above ground (5), Height (30.535), and Roof type (multiple horizontal). Buttons for 'OK' and 'Cancel' are at the bottom right.

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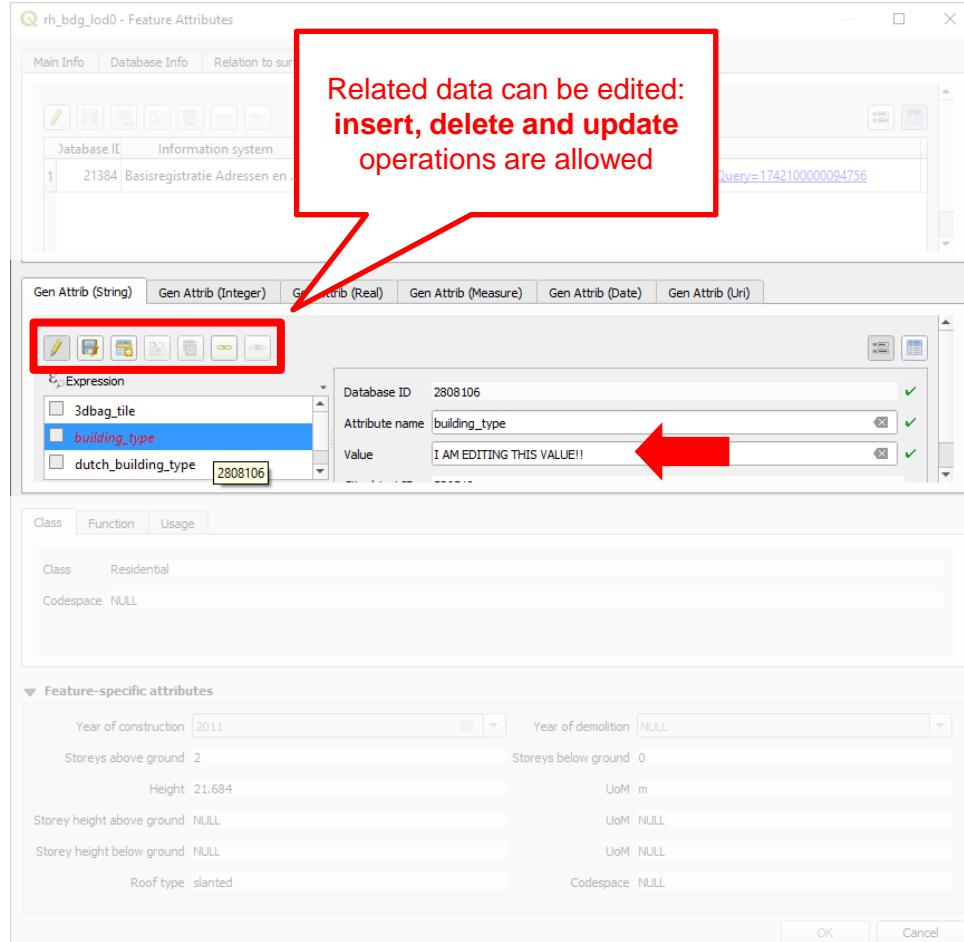
The screenshot shows the QGIS Attribute Editor for a feature named "Building 4906-2911". The top part displays "Main Info" with fields like Database ID (524581), GML ID (NL.IMBAG.Pand.1742100000023), and Name. A red box highlights the "Form" tab at the bottom right of the editor window. The bottom part shows a table view with columns: Database ID, Attribute name, Value, and Cityobject ID. A red box highlights the "Table" tab at the bottom right of the editor window. The table data is as follows:

	Database ID	Attribute name	Value	Cityobject ID
1	2829415	3dbag_tile	3dbag_v210908... fd2cee53_4906	524581
2	2829427	pand_id	1742100000023...	524581
3	2829466	building_type	MFH	524581

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

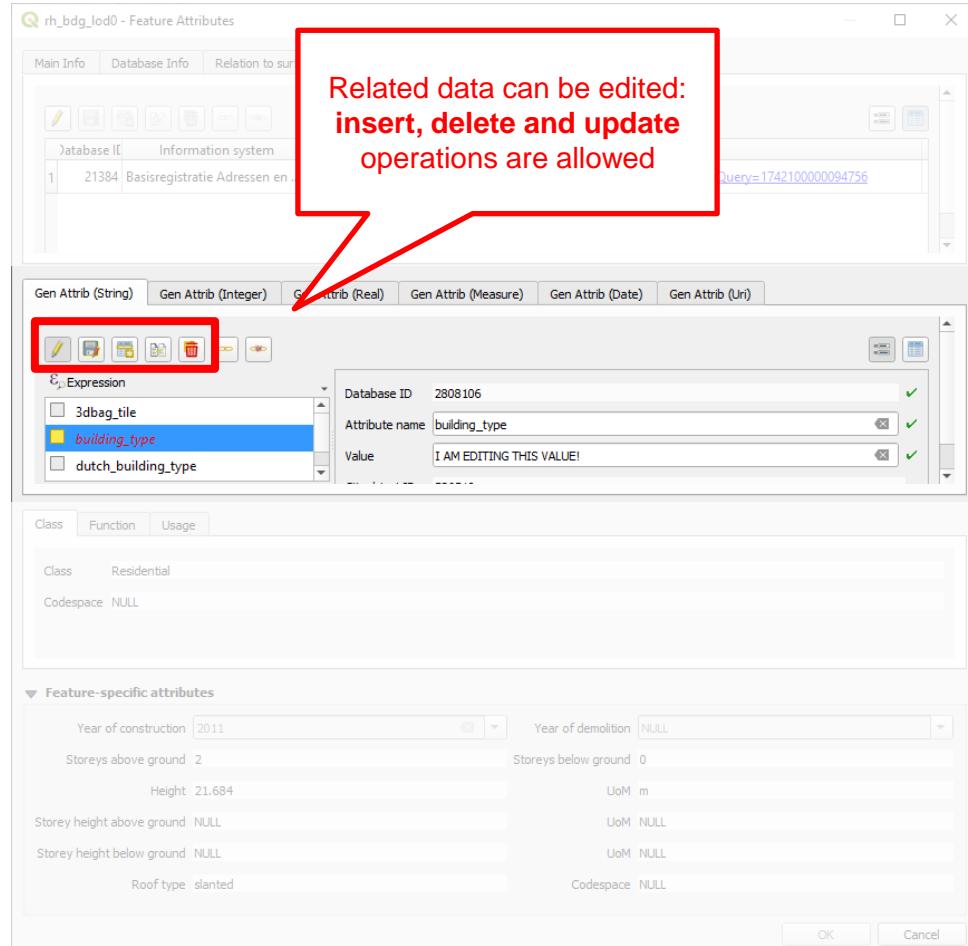
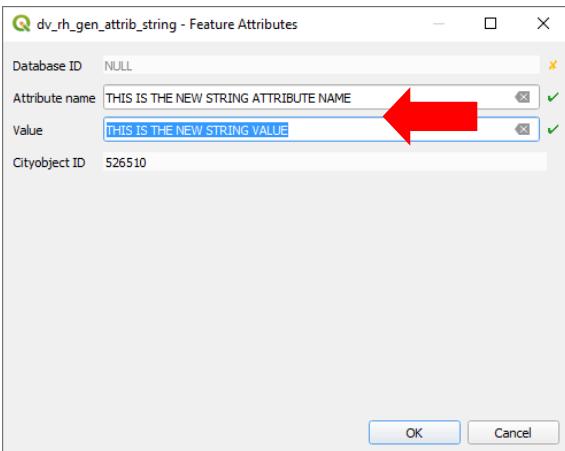
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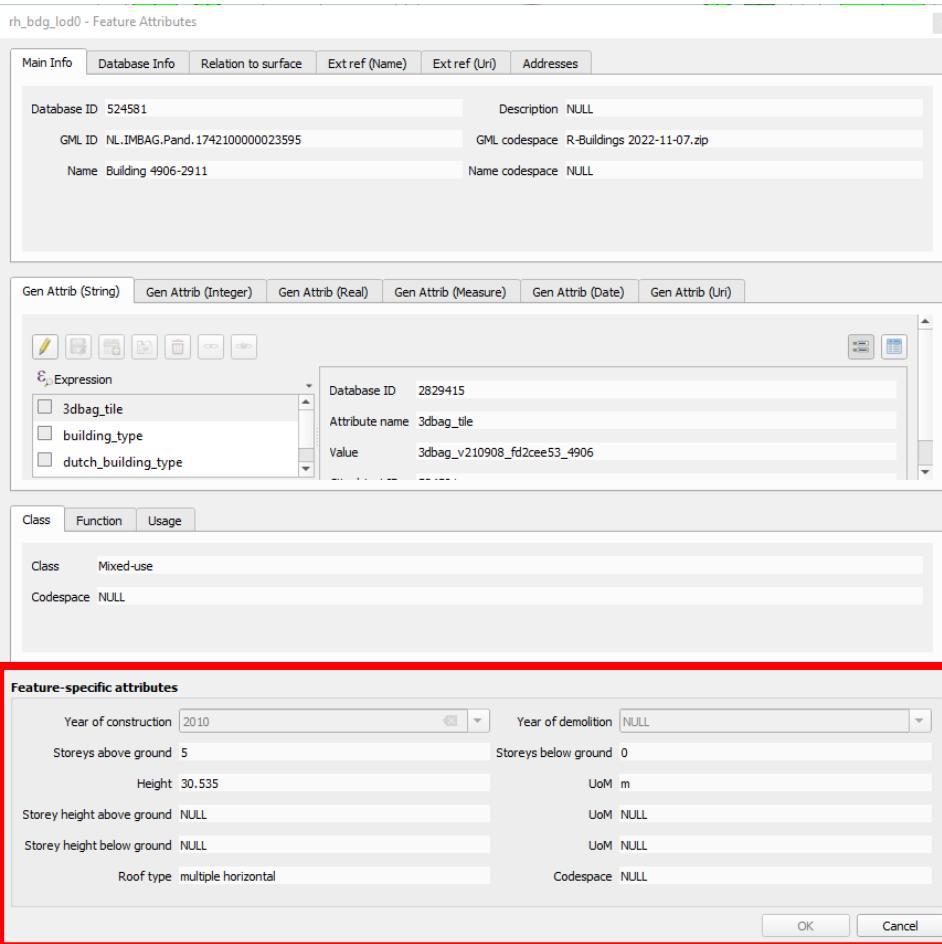


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Use in QGIS: Attributes



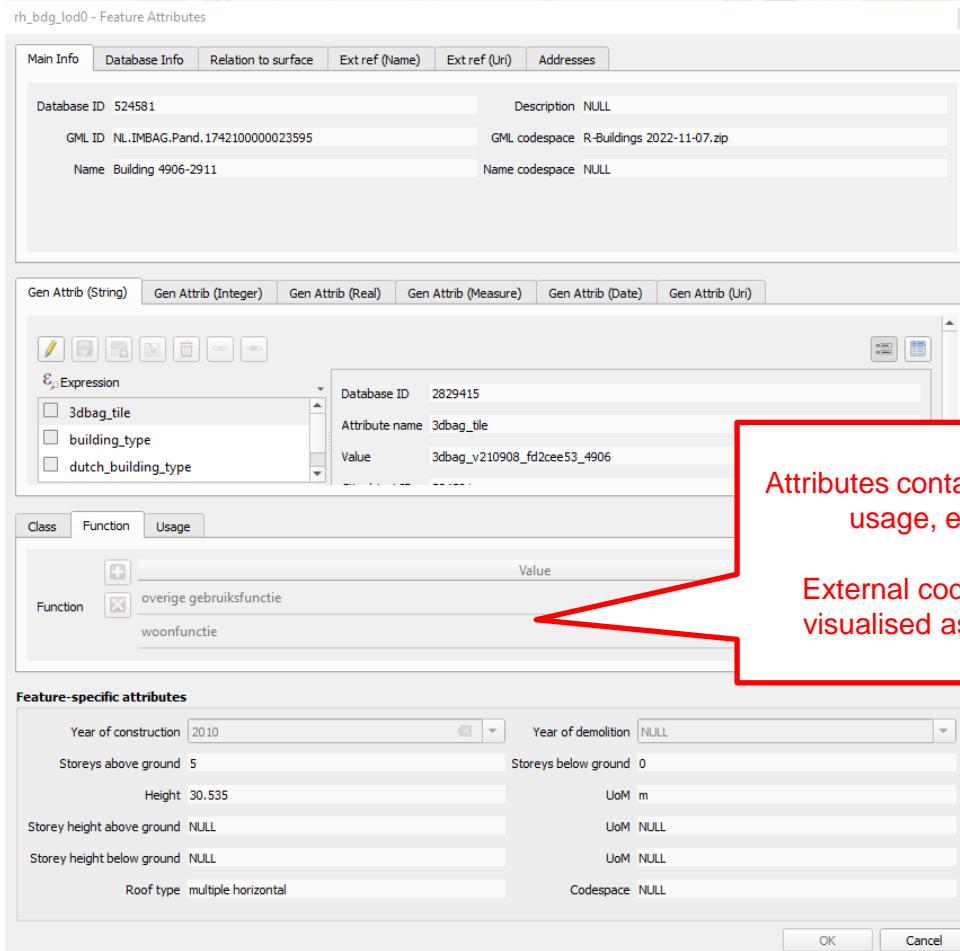
The screenshot shows the QGIS Attribute Editor for a feature named "Building 4906-2911". The top section displays general information such as Database ID (524581), GML ID (NL.IMBAG.Pand.1742100000023595), Description (NULL), and Name (Building 4906-2911). Below this, the "Gen Attrib (String)" tab is 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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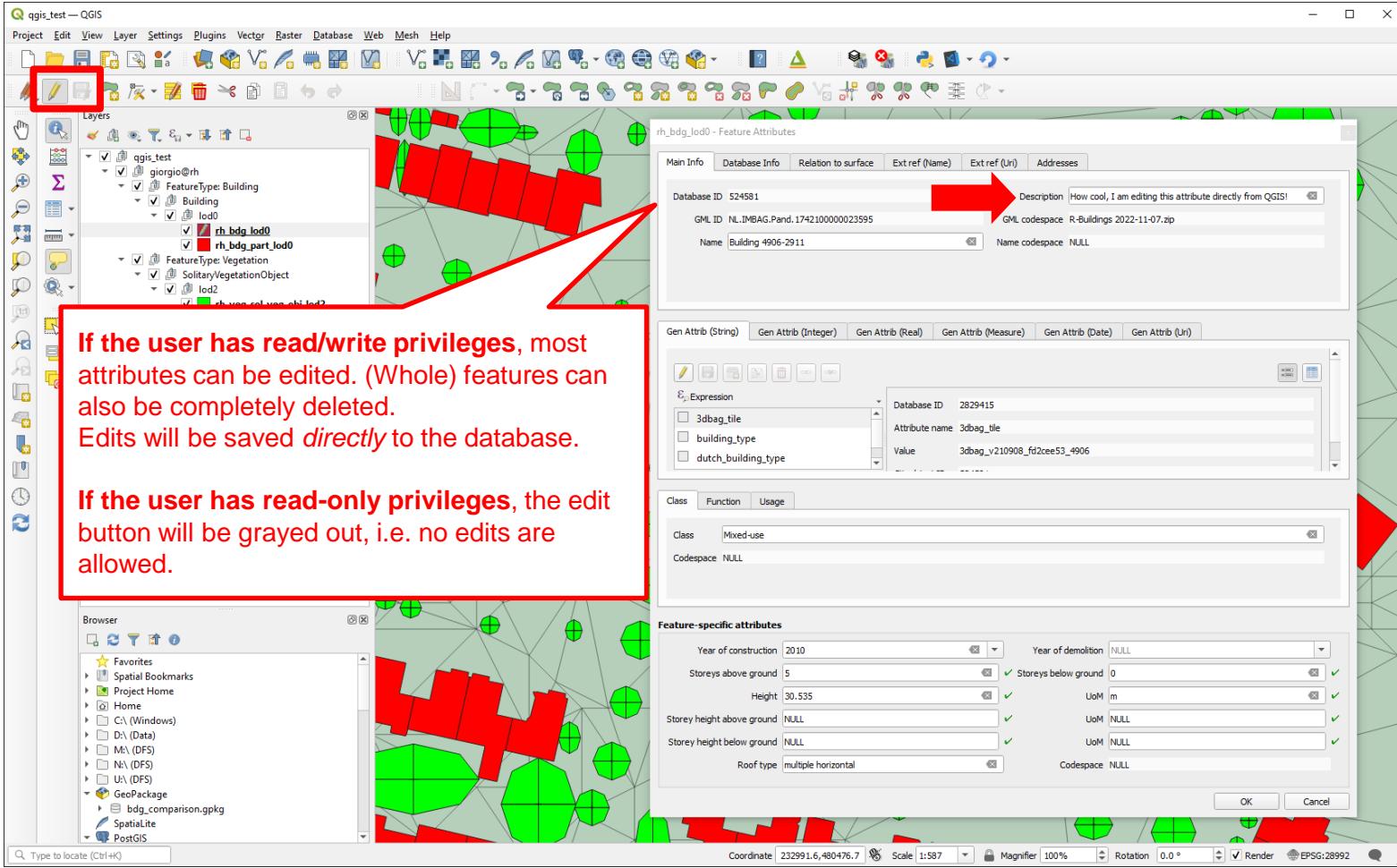


Attributes containing [0..*] entries (e.g. function, usage, etc.) are presented as lists.

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

Use in QGIS: Attribute editing

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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.

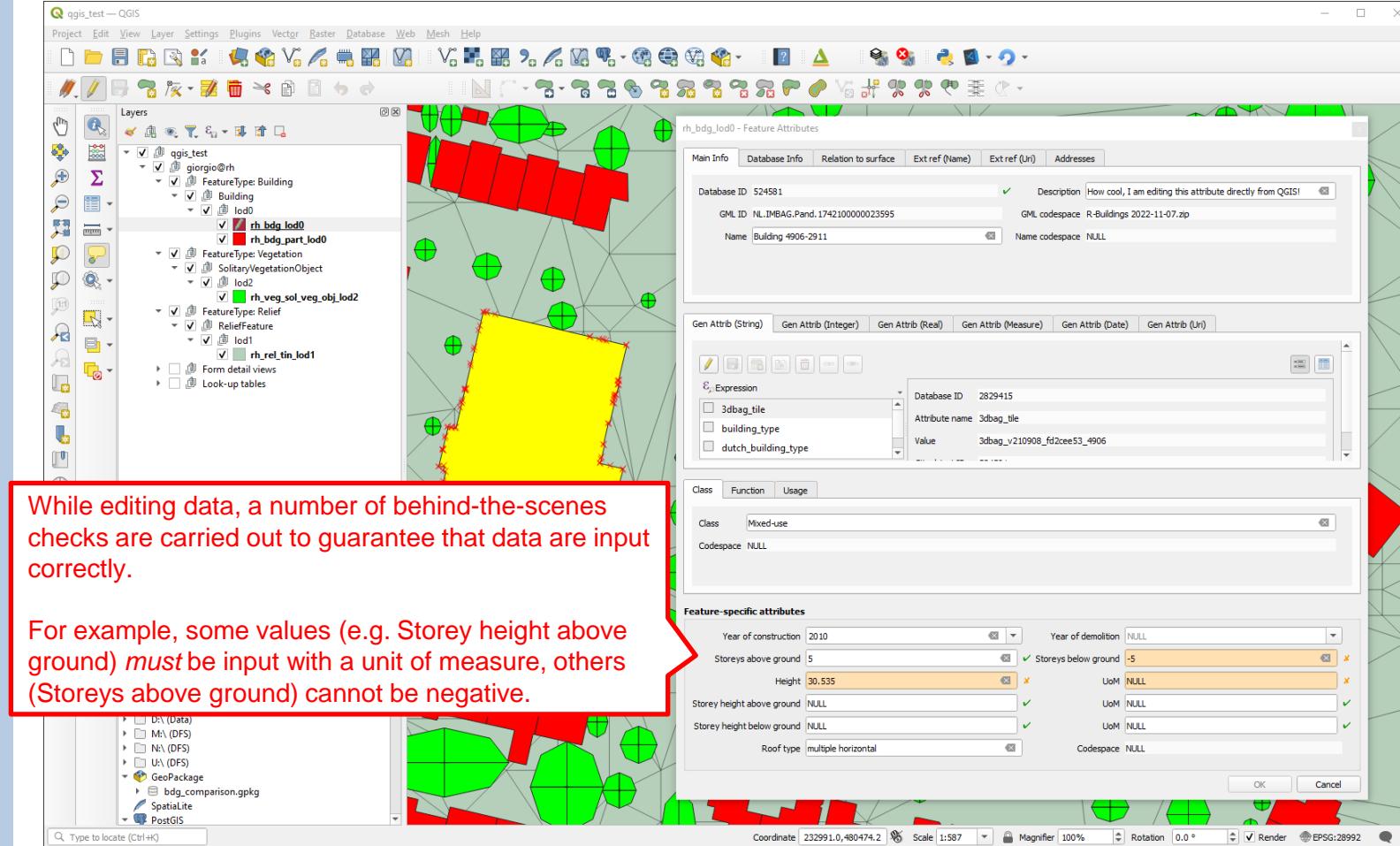
If the user has **read-only privileges**, the edit button will be grayed out, i.e. no edits are allowed.

The screenshot shows the QGIS interface with the 'Feature Attributes' dialog open for a building feature. The 'Edit' button in the toolbar is highlighted with a red box. A red arrow points from the 'Edit' button to the 'Feature Attributes' dialog. The 'rh_bdg_lod0' layer is selected in the layers panel. The 'Feature-specific attributes' table shows various building properties like year of construction, storeys above ground, and roof type.

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
Year of demolition	NULL
Storeys below ground	0
UoM	m
UoM	NULL
UoM	NULL
Codespace	NULL

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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 area, and a callout box points to it with the text: "While editing data, a number of behind-the-scenes checks are carried out to guarantee that data are input correctly." Another callout box points to the "Feature-specific attributes" section of the attribute editor, with the text: "For example, some values (e.g. Storey height above ground) *must* be input with a unit of measure, others (Storeys above ground) cannot be negative." The attribute editor window is open, showing fields like "Database ID", "Attribute name", "Value", and "UoM".

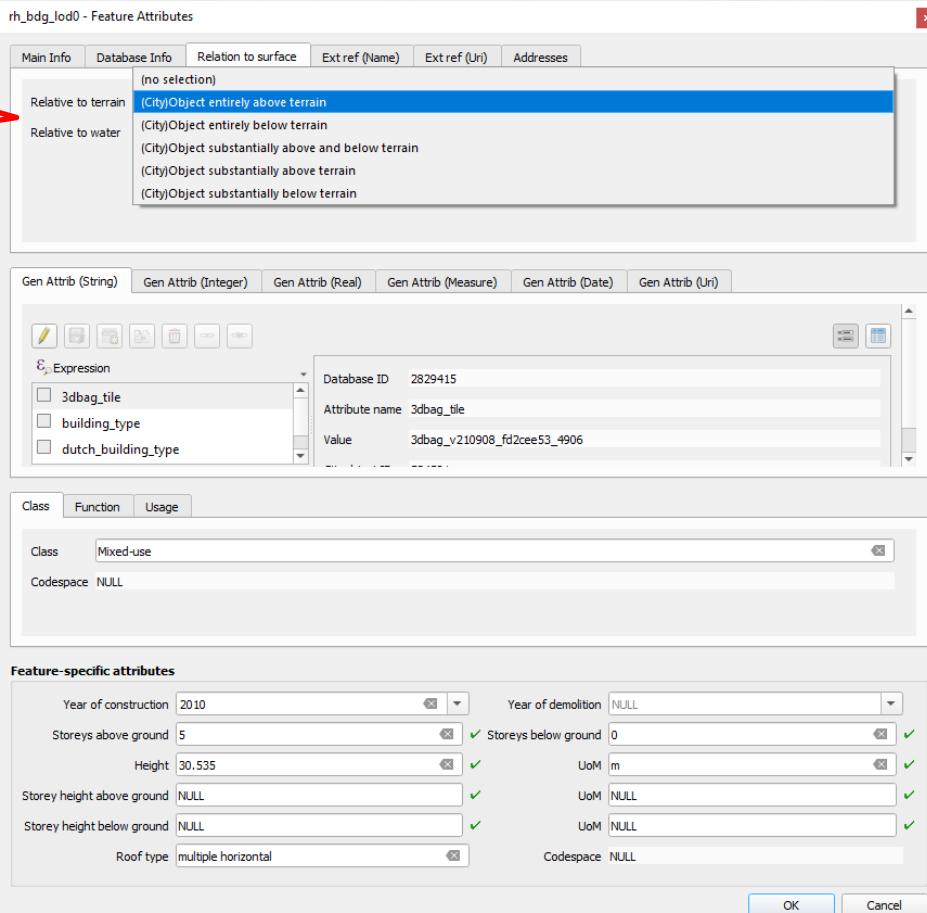
While editing data, a number of behind-the-scenes checks are carried out to guarantee that data are input correctly.

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



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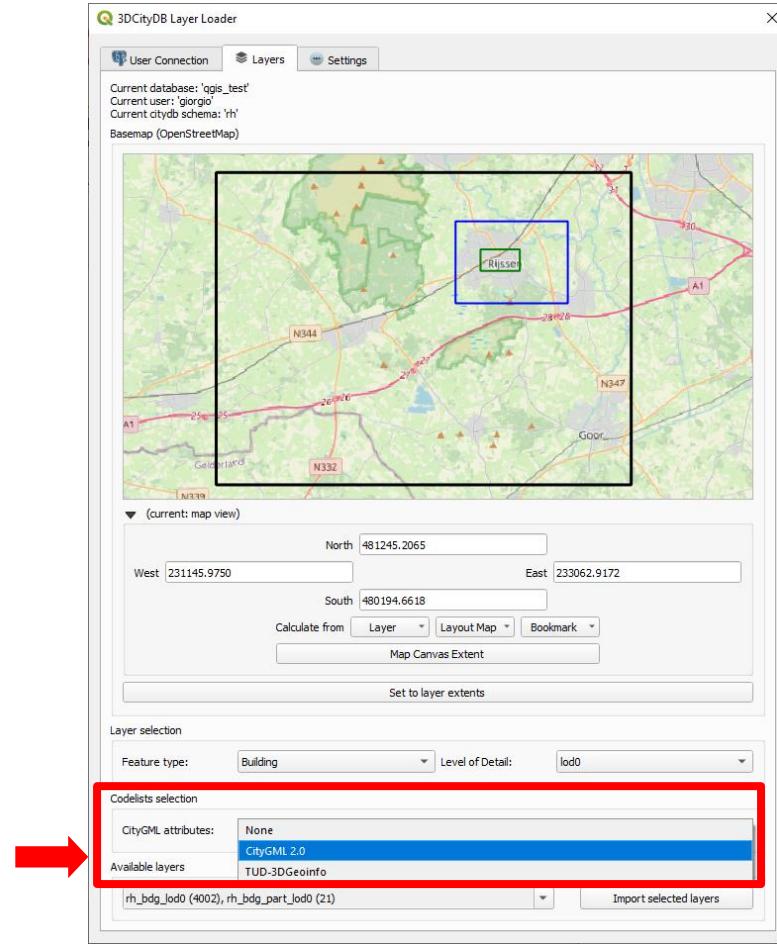
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Codelists can be selected upon layer import

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

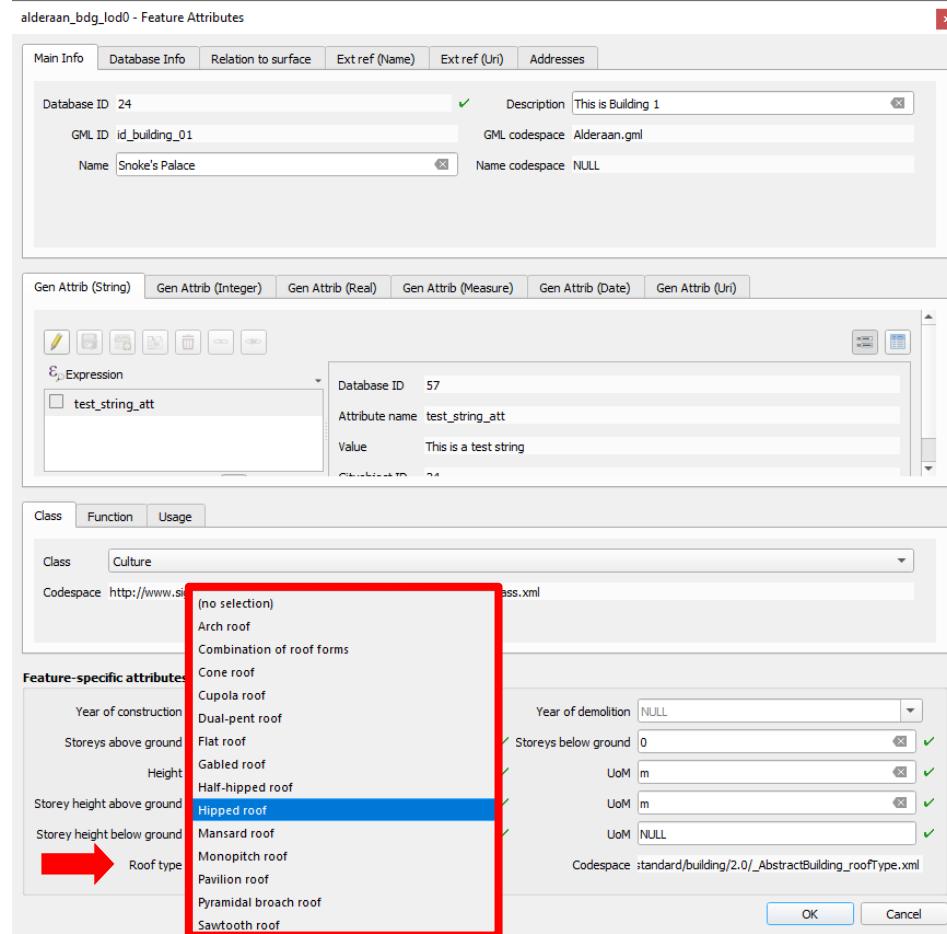
Codelists can be added and customised either by the database administrator or by the user (see **Advanced options**)



Use in QGIS: Codelist support

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**



The screenshot shows the 'Feature Attributes' dialog for a building feature in QGIS. 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 active.

Key fields shown in the main info section:

- Database ID: 24
- Description: This is Building 1
- GML ID: id_building_01
- GML codespace: Alderaan.gml
- Name: Snake's Palace
- Name codespace: NULL

The 'Gen Attrib (String)' tab is selected in the bottom navigation bar. A dropdown menu is open under the 'Expression' button, showing a list of roof types. One item, 'Hipped roof', is highlighted with a blue selection bar and has a red arrow pointing to it from the bottom left.

Other visible items in the dropdown list include:

- (no selection)
- Arch roof
- Combination of roof forms
- Cone roof
- Cupola roof
- Dual-pent roof
- Flat roof
- Gabled roof
- Half-hipped roof
- Hipped roof
- Mansard roof
- Monopitch roof
- Pavilion roof
- Pyramidal broach roof
- Sawtooth roof

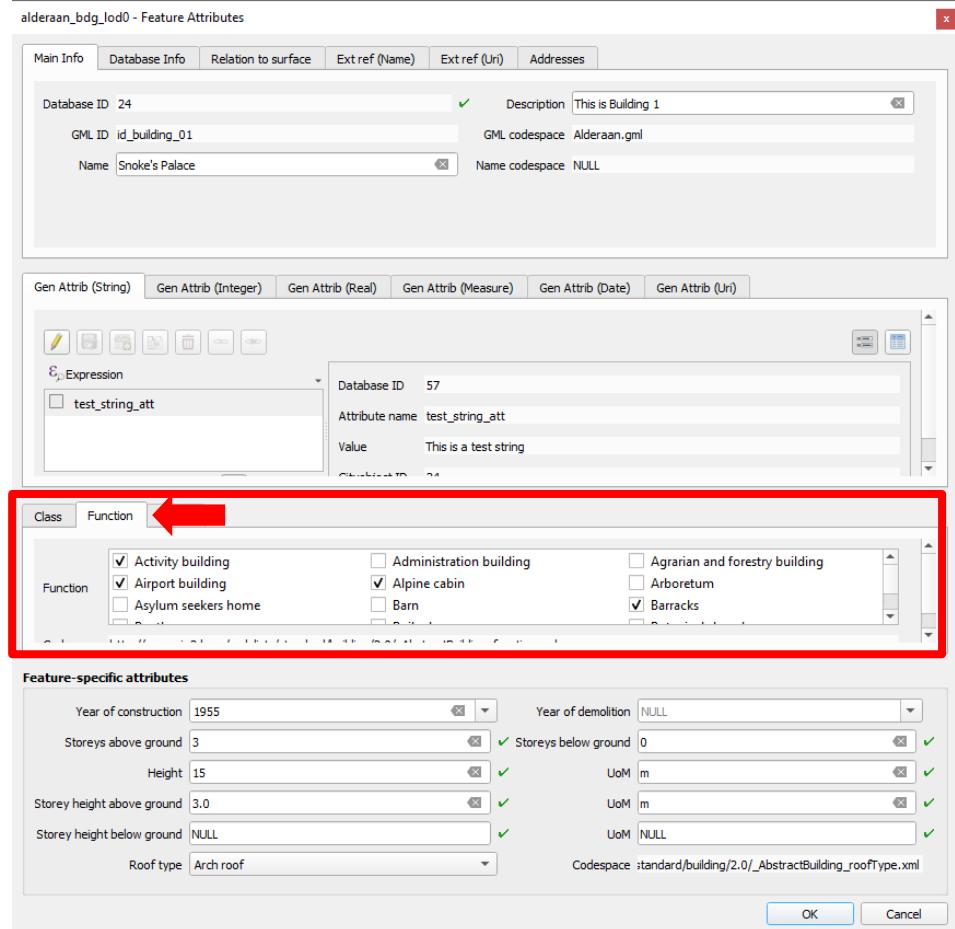
On the right side of the dialog, there are other attribute fields like 'Year of construction', 'Storeys above ground', 'Height', 'Storey height above ground', 'Storey height below ground', 'Roof type', 'Year of demolition', 'Storeys below ground', 'UoM', and 'Codespace'. Buttons for 'OK' and 'Cancel' are at the bottom right.

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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

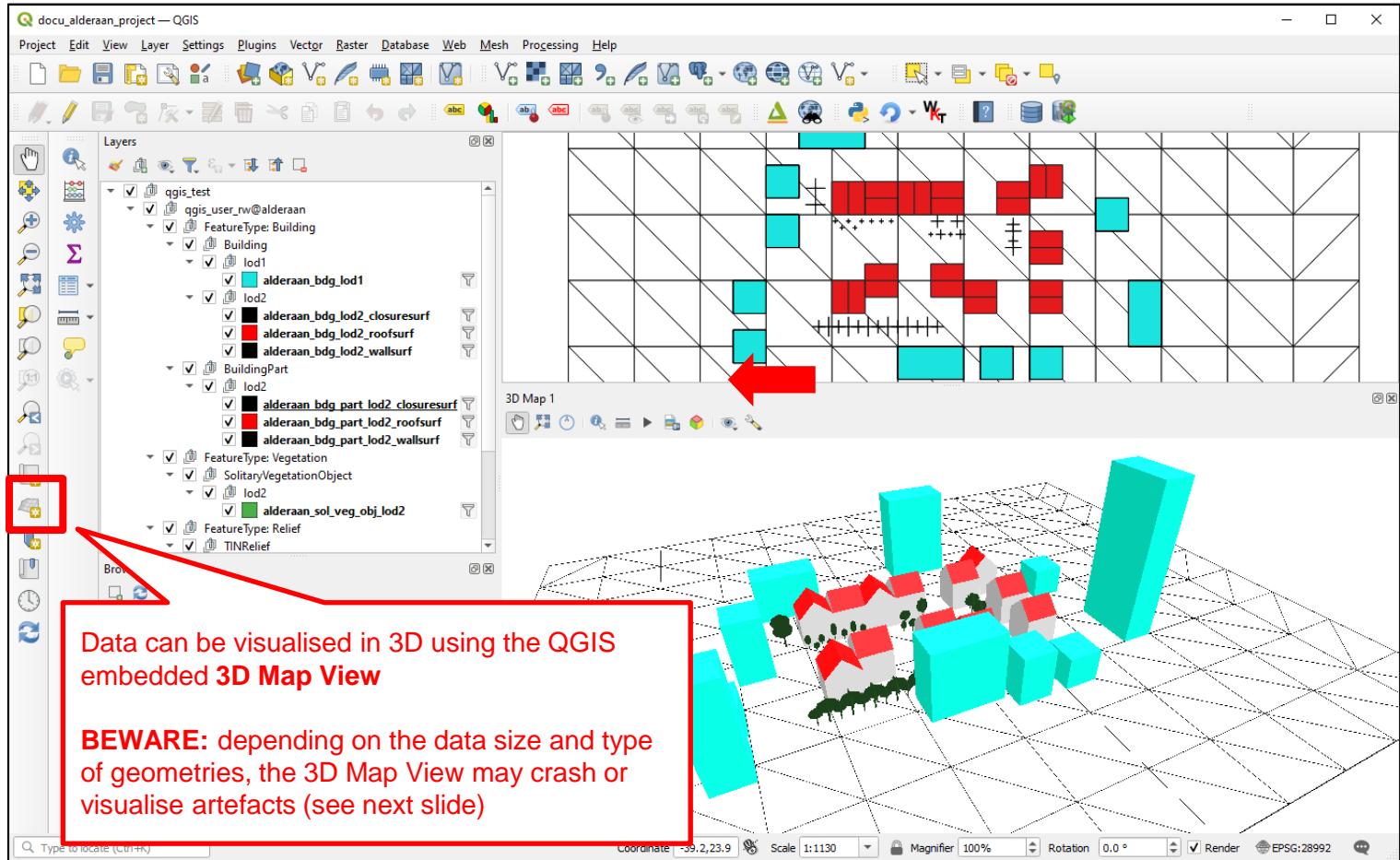


Use in QGIS: 3D visualisation

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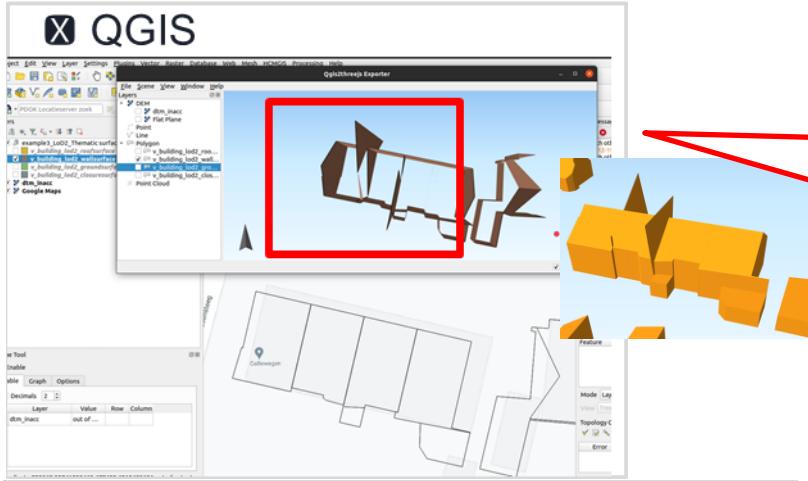
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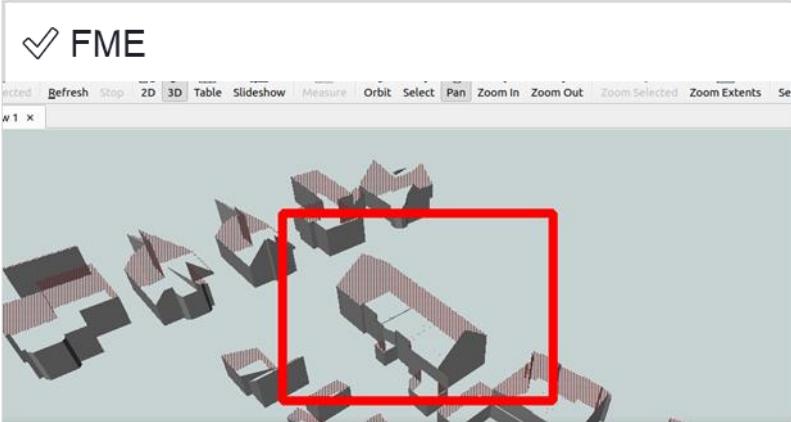


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In our tests, such artefacts are however a 3D visualisation issue (QGIS 3D renderer?) and *not* related to the actual data. 3D visualisation in FME and in Google Earth show indeed correct results.



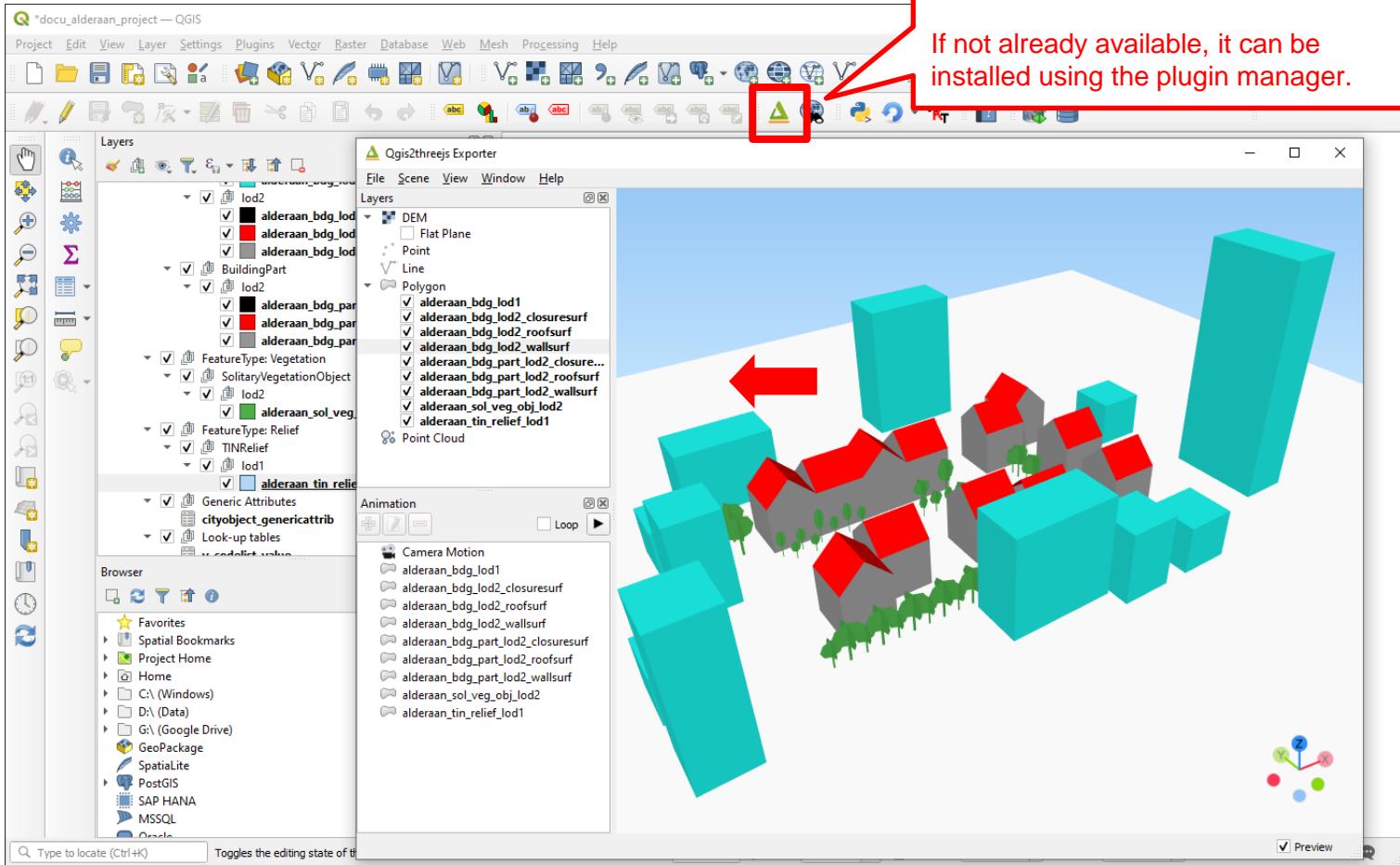
✓
 Google
 earth
 (as KML)

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.

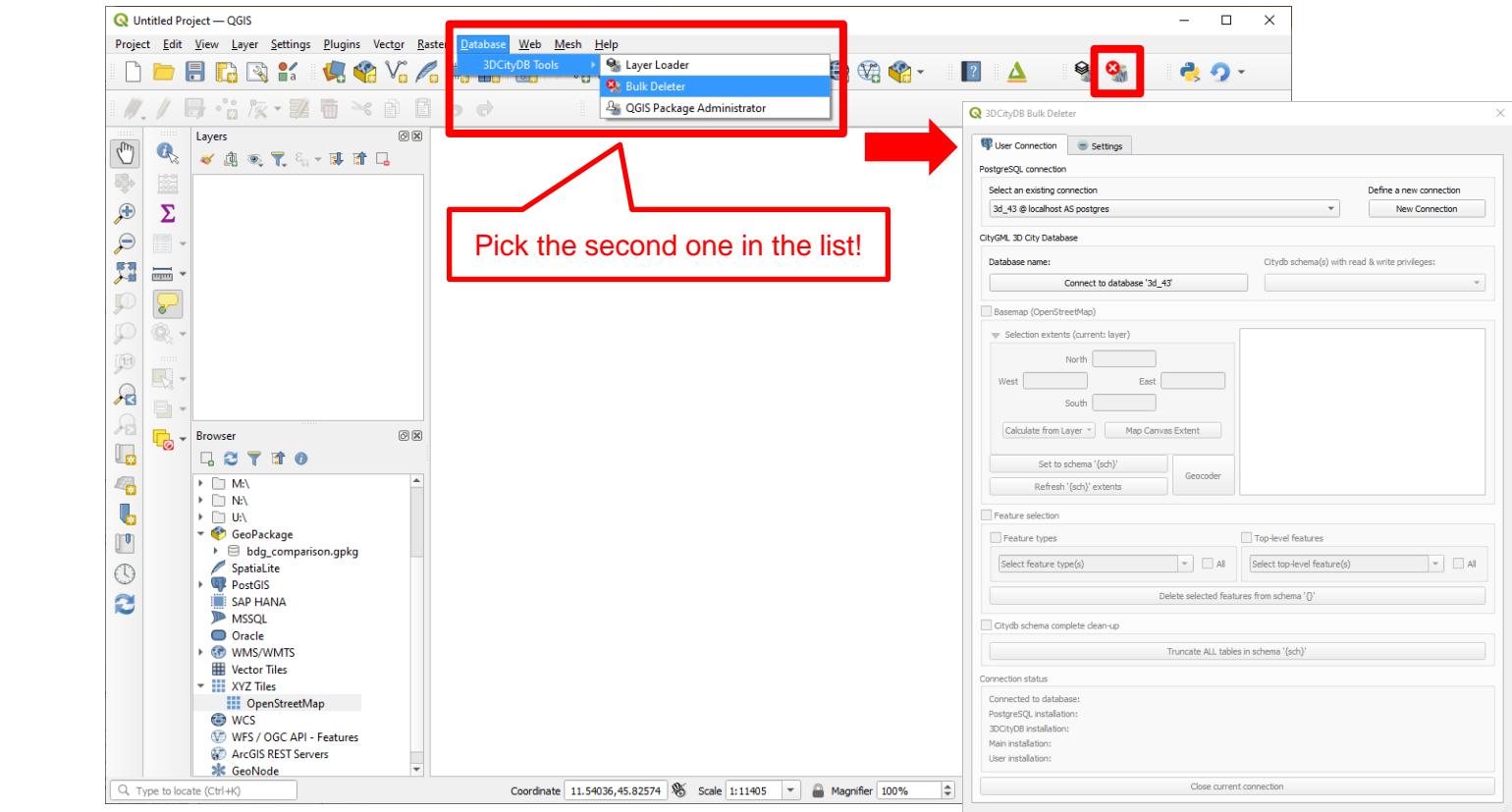
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Bulk Deleter



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



Pick the second one in the list!

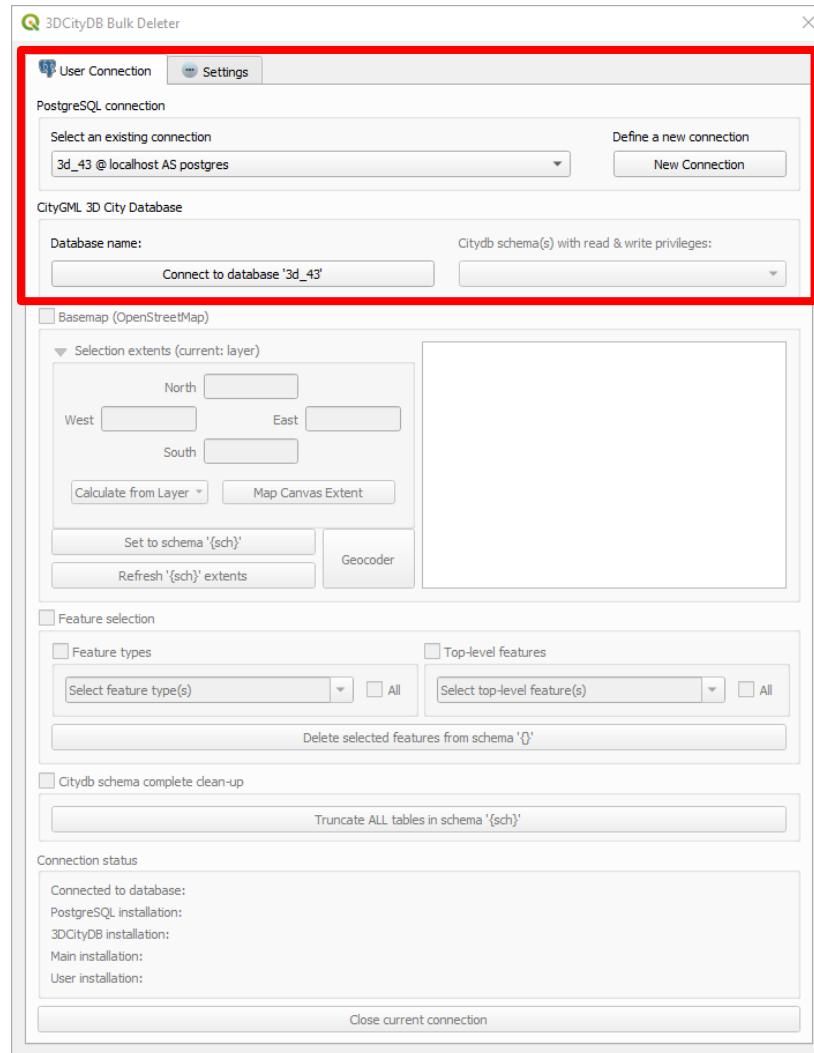
The screenshot shows the QGIS interface with the 3DCityDB Tools plugin loaded. The 'Database' tab is selected in the top menu bar. A red box highlights the '3DCityDB Tools' dropdown menu, which contains four options: 'Layer Loader', 'Bulk Deleter' (highlighted with a red box), and 'QGIS Package Administrator'. A red arrow points from this highlighted box to another red box containing the text 'Pick the second one in the list!'. To the right of the main QGIS window, the '3DCityDB Bulk Deleter' dialog box is open, showing connection settings and selection criteria for a PostgreSQL database.

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")

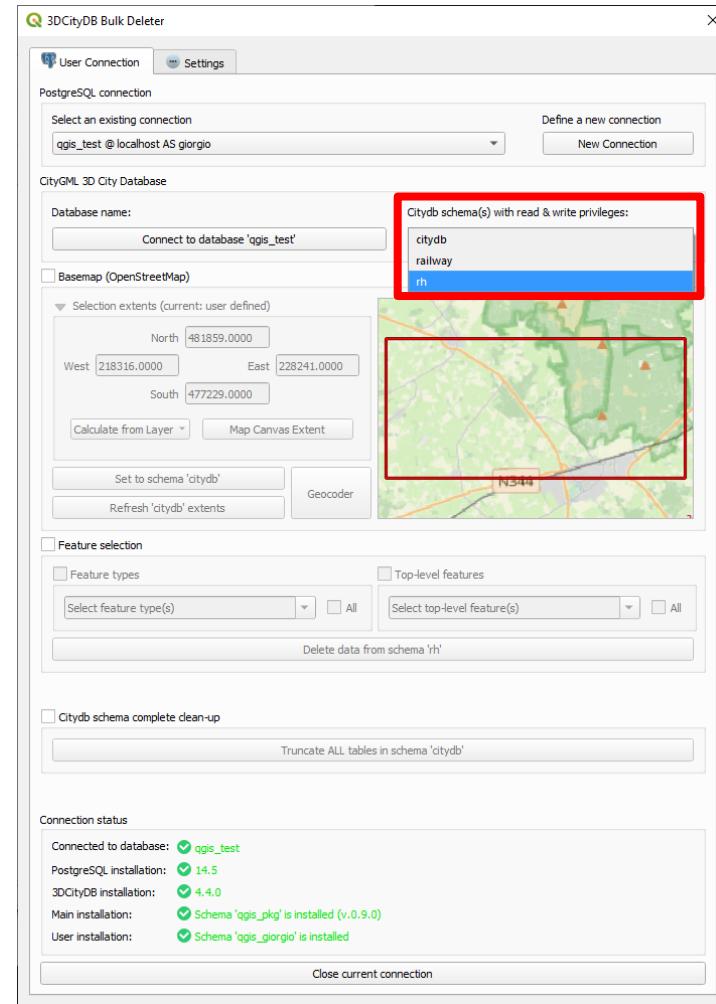
2) Connect to the chosen database



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

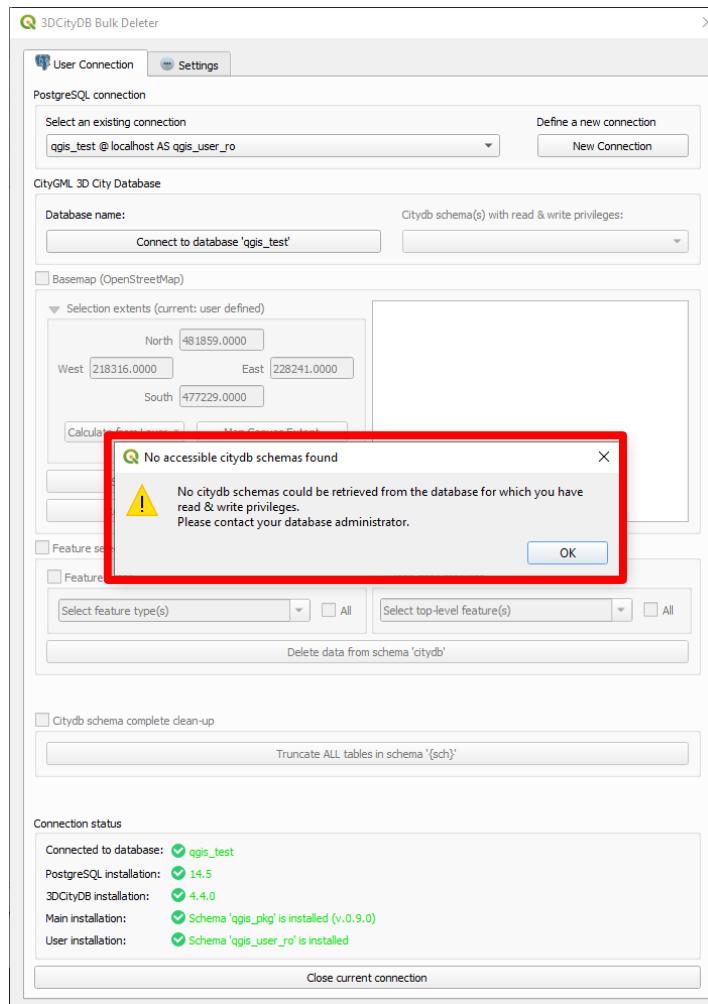


Bulk Deleter

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.

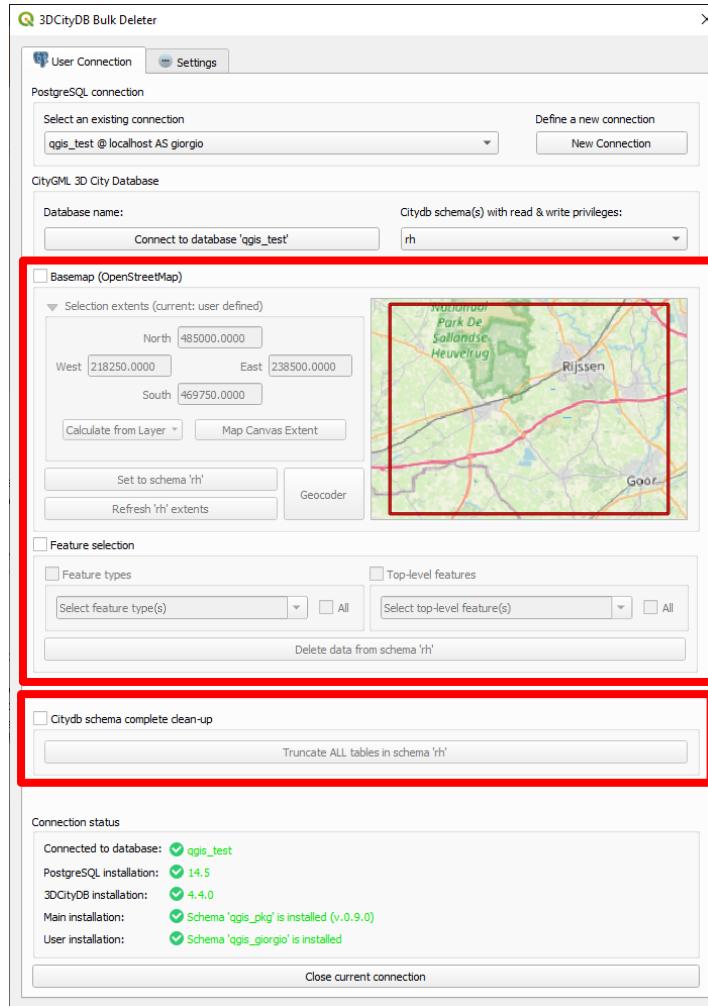


Bulk Deleter

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



Bulk Deleter

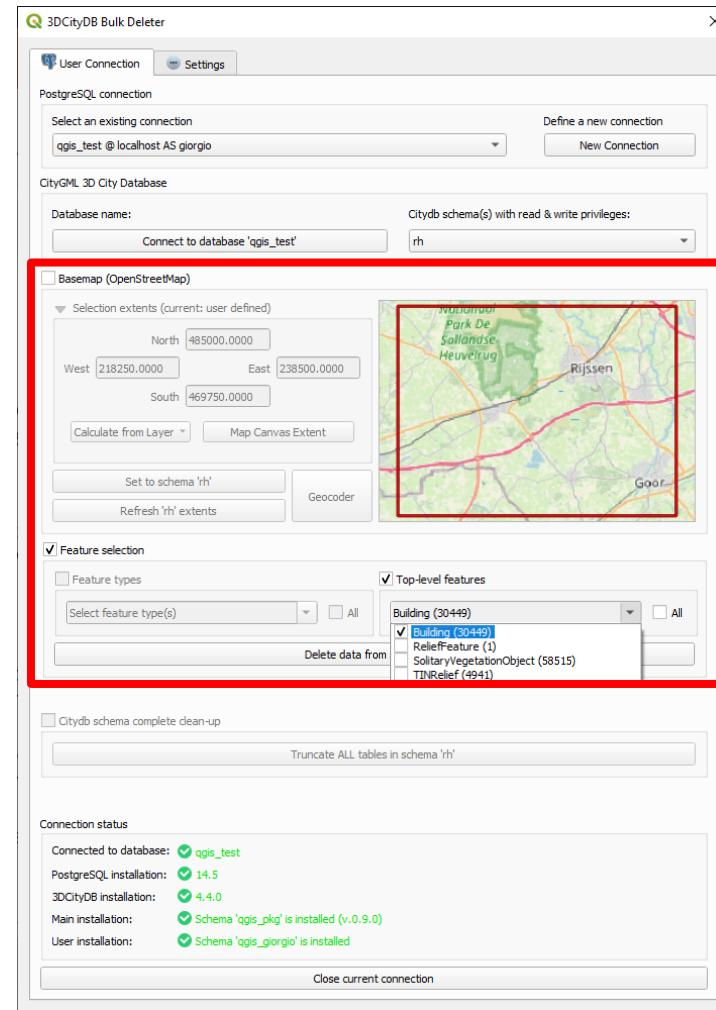
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5a) Select the features to delete. Activate the **Feature selection box**. You can now select:

- 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



Bulk Deleter

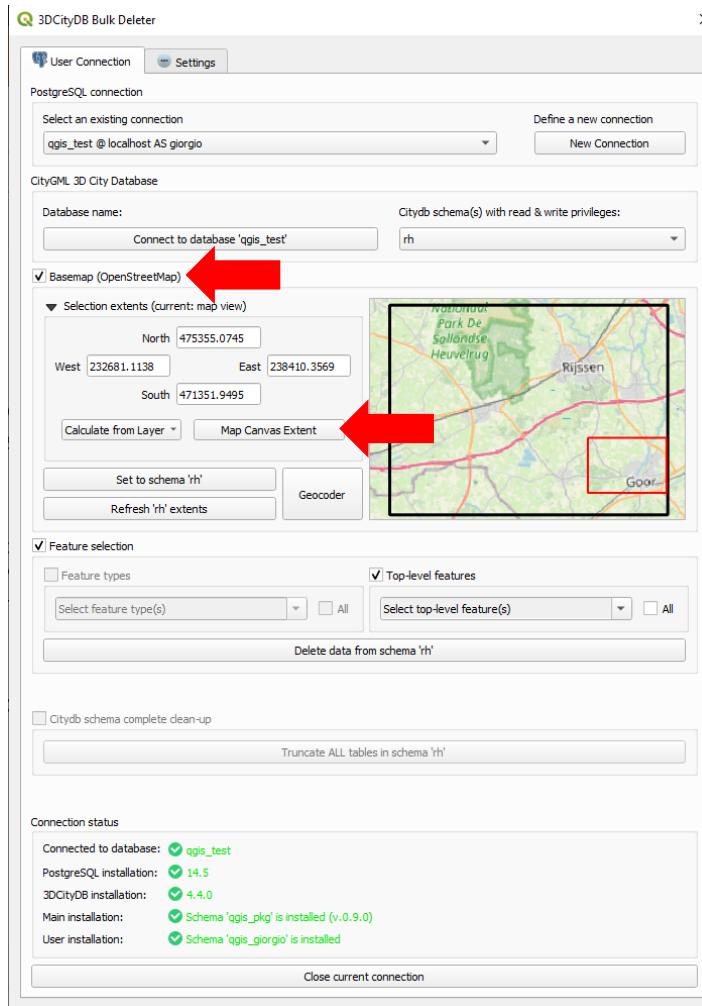
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5a) Select the features to delete. Activate the **Feature selection box**. You can now select:

- 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



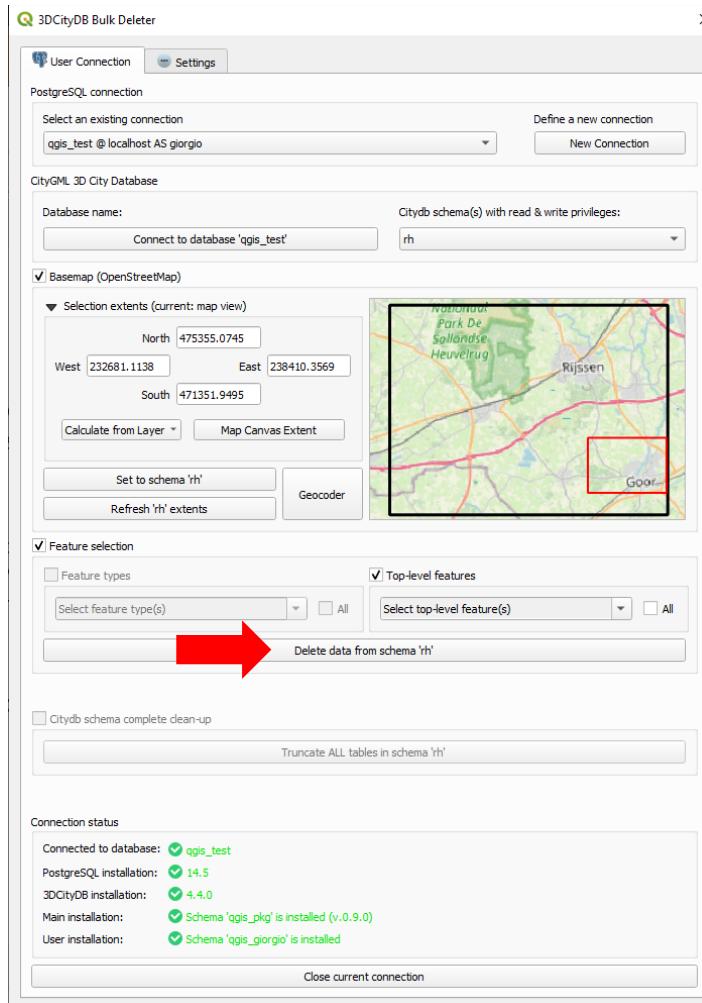
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6a) Press the **Delete data from schema {cdb_schema}** button

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

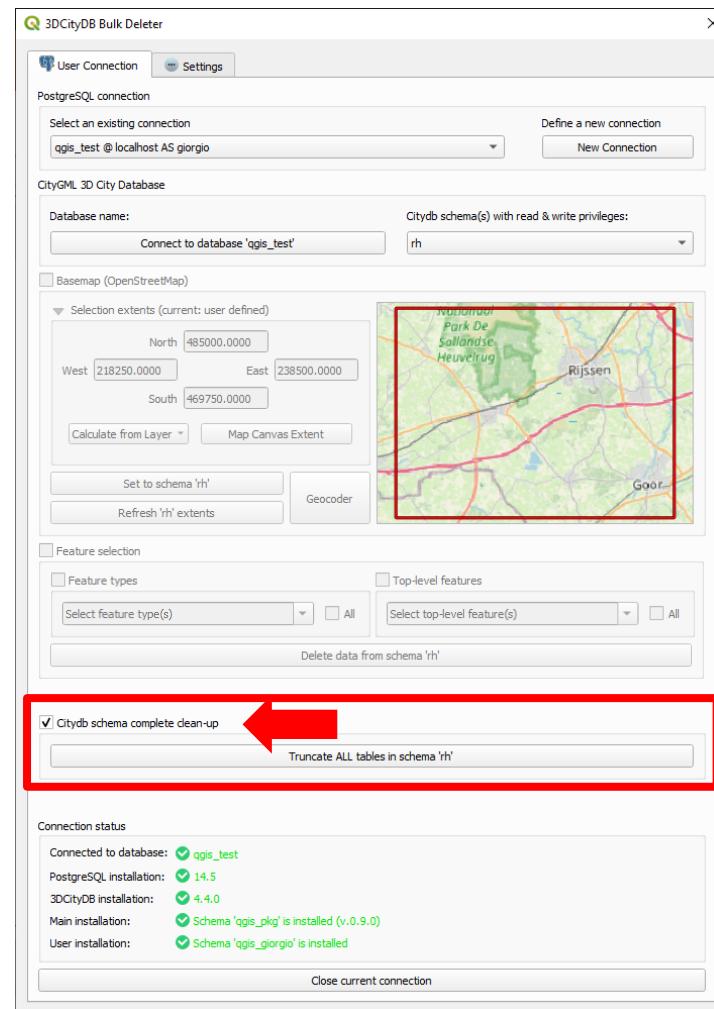
If you want to completely delete the database, you are recommended to use the other option (see next slides) which is **much faster!**



Bulk Deleter

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)

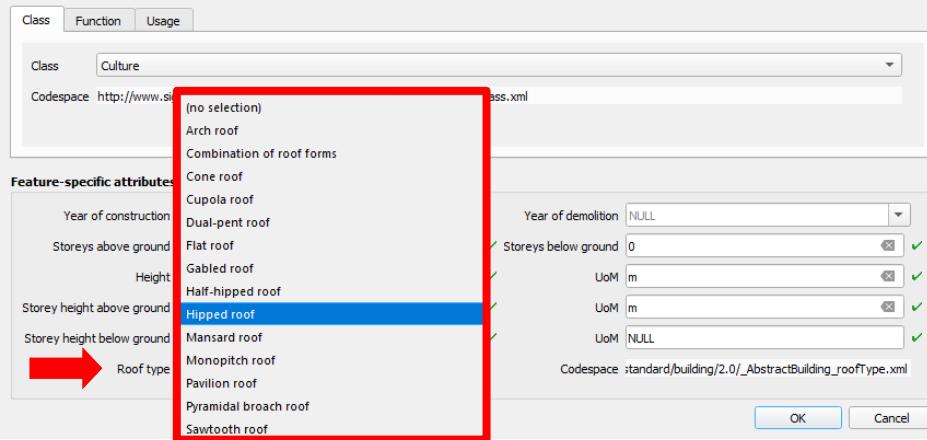
In this way the user does not have to "remember" specific codes when typing, thus reducing the chances of wrong data input

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

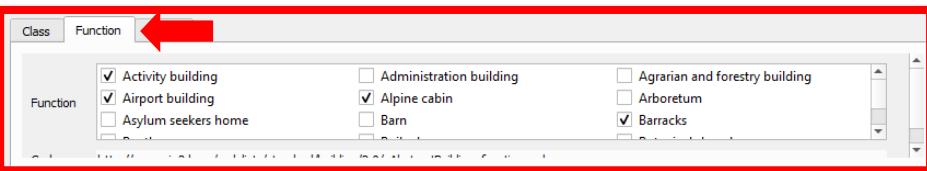
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Property with cardinality [0..1]:
 drop-down list



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

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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
> codelist_value
> enumeration
> enumeration_value
> extents
> layer_metadata
> settings

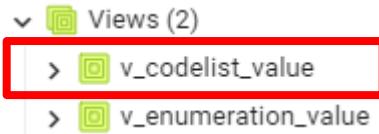
Table CODELIST (excerpt)

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

Table CODELIST_VALUE (excerpt)

[PK] id bigint	code_id integer	value character varying	description 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)

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

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

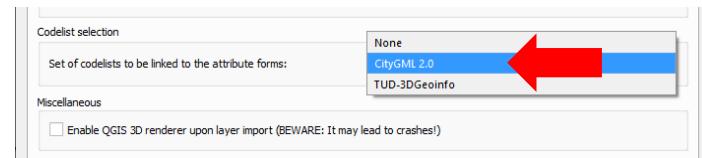
Tables (8)	
>	codelist
>	codelist_lookup_config
>	codelist_value
>	enumeration
>	enumeration_value
>	extents
>	layer_metadata
>	settings

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.

id [PK]	name character varying	ade_prefix character var	source_class character varying	source_table character varying	source_column character varying	target_table character varying	key_column character var	value_column character varyir	filter_expression 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

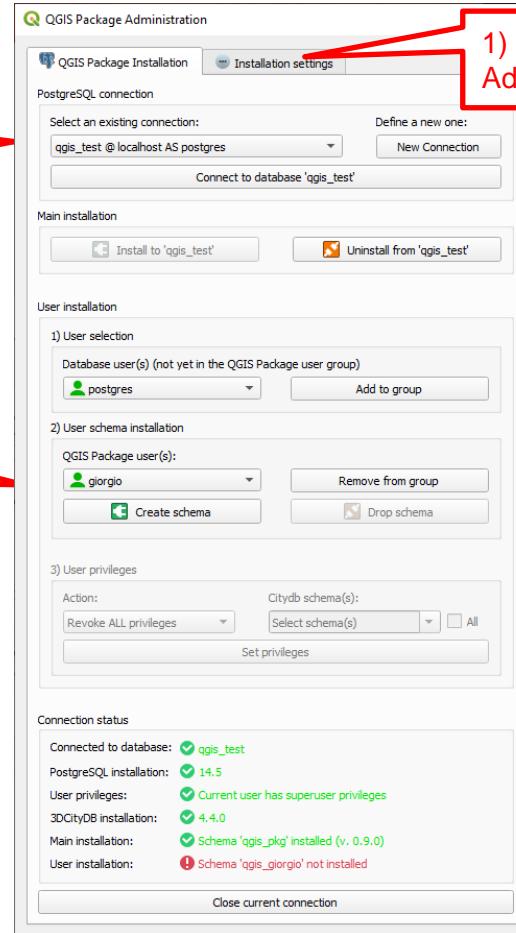
2) **Removal of the 3DCityDB-Tools plugin** from QGIS

- 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



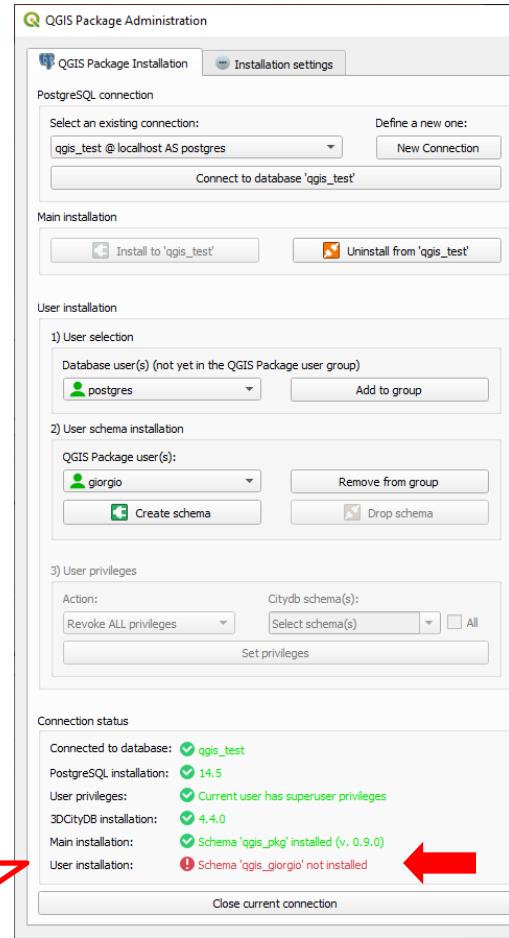
1) Load the "QGIS Package Administration" GUI

3) Select the user

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

Drop user schema

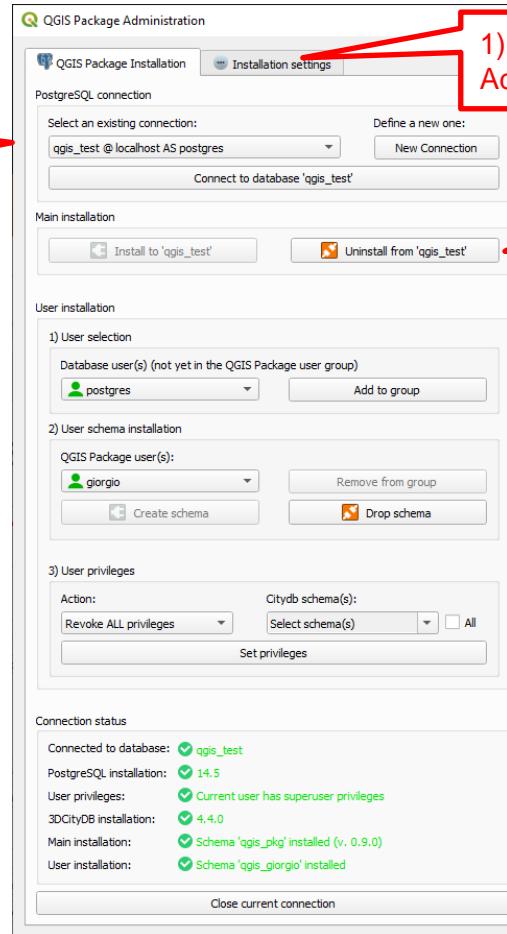
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Software uninstall: Uninstall QGIS Package

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2) Connect as administrator

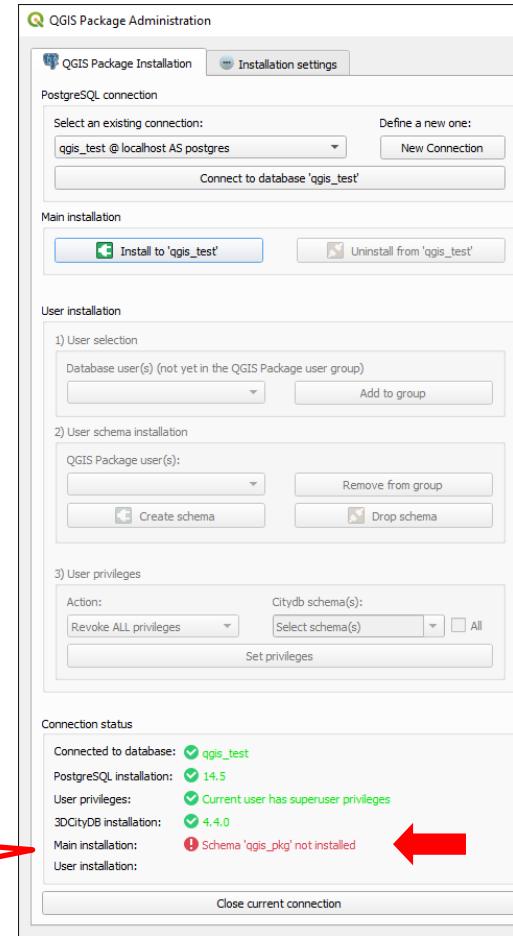


1) Load the "QGIS Package Administration" GUI

3) Uninstall the QGIS Package from the current database

Uninstall QGIS Package

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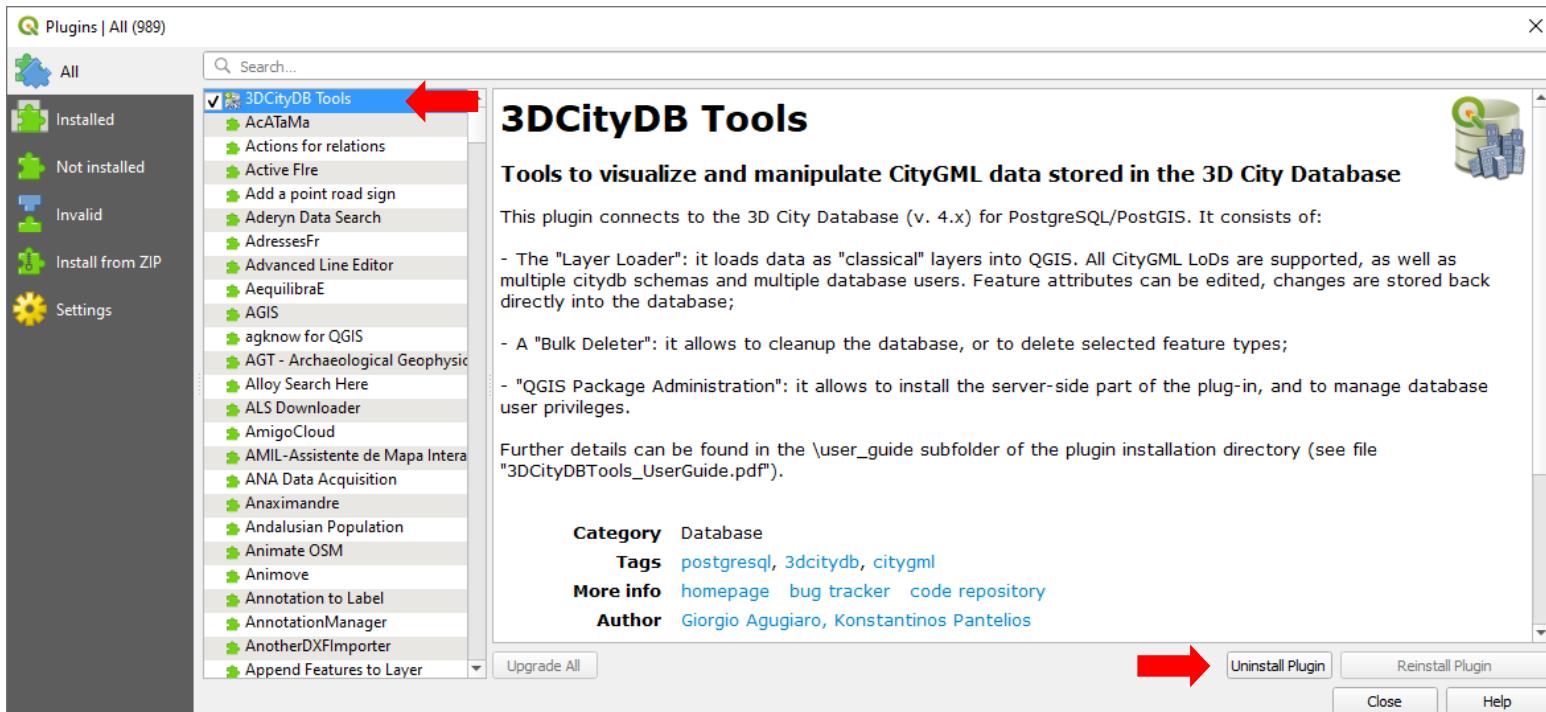


4) The main installation field is now red again

Uninstall 3DCityDB-Tools

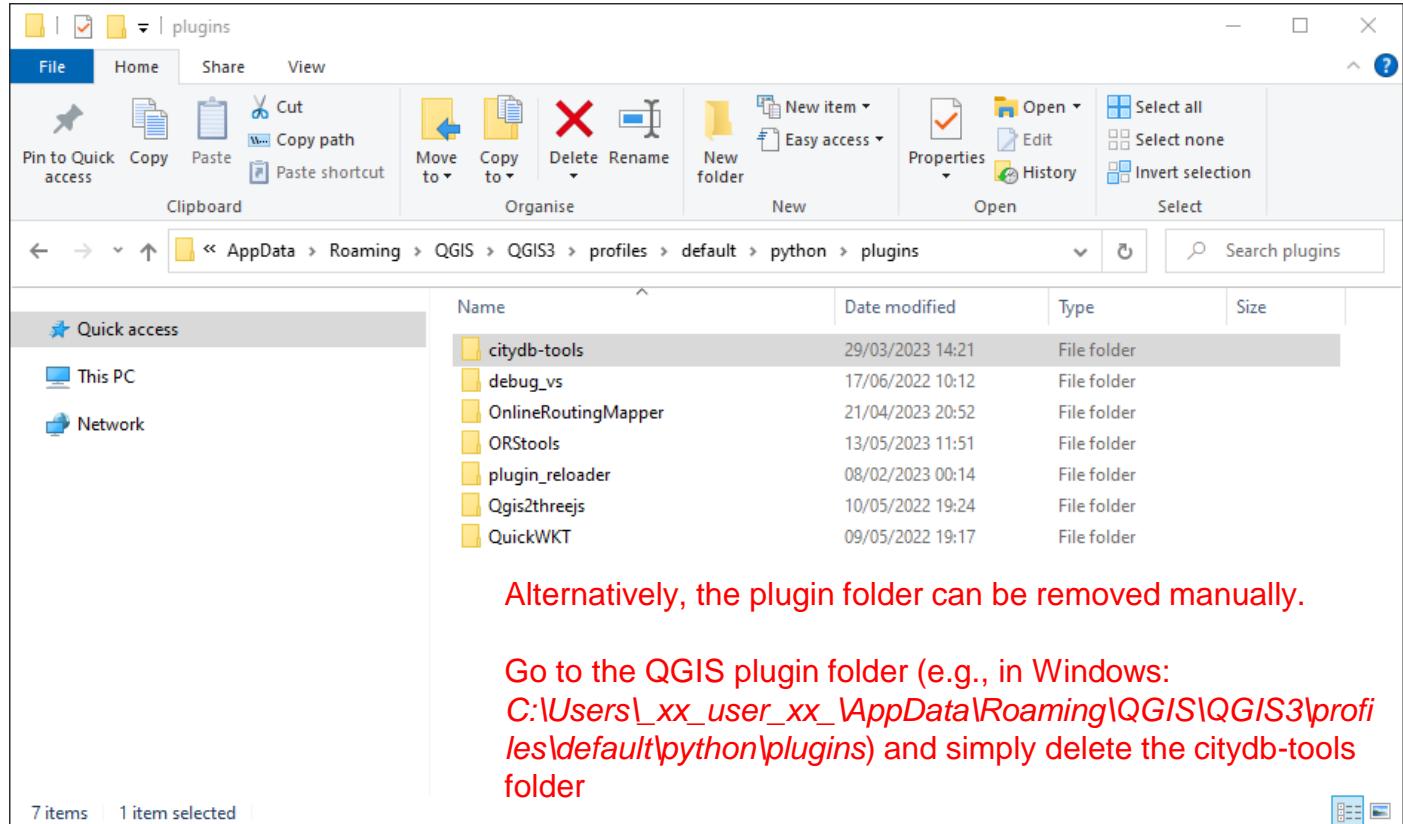
The plugin can be uninstalled from the \Plugins\Manage and Install Plugins... Menu in QGIS

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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

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');
```

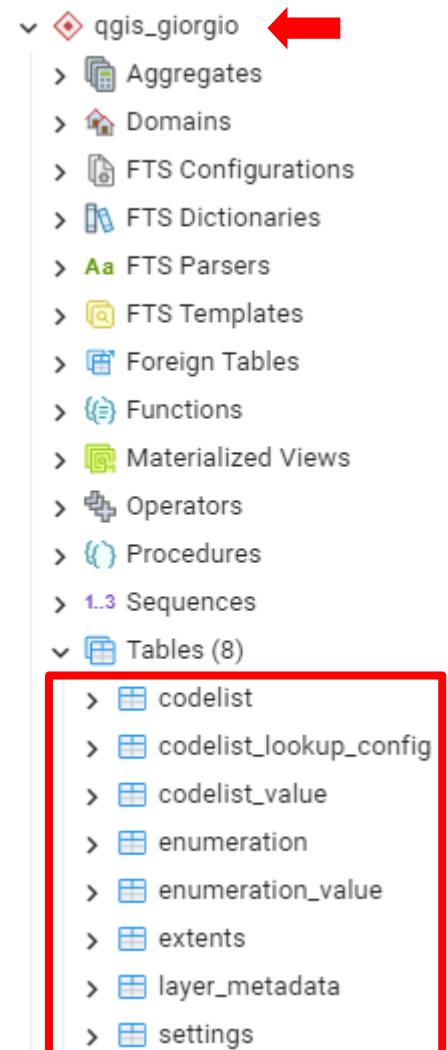
QGIS Package: Create user schemas

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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	
> FTS Parsers	
> FTS Templates	
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> Functions	
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> enumeration	
> enumeration_value	
> extents	
> layer_metadata	
> settings	

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

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
usr_schema	varchar	The database user schema, e.g. "qgis_giorgio".
cdb_schema	varchar	the citydb schema where data are stored, e.g. "citycb", or "citydb2".
perform_snapping	integer	DEFAULT 0 (i.e. disabled). If 1, geometry simplification is performed. Unused if perform_snapping is set to 0.
digits	integer	DEFAULT 3. Number of decimal positions to keep during geometry simplification. Unused if perform_snapping is set to 0.
area_poly_min	numeric	DEFAULT 0.001 [m ²]. Minimum polygon area during geometry simplification. Unused if perform_snapping is set to 0.
bbox_corners_array	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> !
is_geographic	boolean	DEFAULT False. True is the coordinate system of the citydb schema has geographic coordinates, False if it has projected coordinates.
force_layer_creation	boolean	DEFAULT False. Otherwise: force creation of all layers, also the empty ones.

QGIS Package: Layer management

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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 m² 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}');
```

QGIS Package: Layer management

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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

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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

Function

qgis_pkg.refresh_layers(usr_schema, cdb_schema)

Parameter	Type	Description
usr_schema	varchar	The database user schema, e.g. "qgis_giorgio".
cdb_schema	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
usr_schema	varchar	The database user schema, e.g. "qgis_giorgio".
cdb_schema	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.)

They can be created 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.

Important: they must be created with the same extents (bounding box) used for the layers

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');

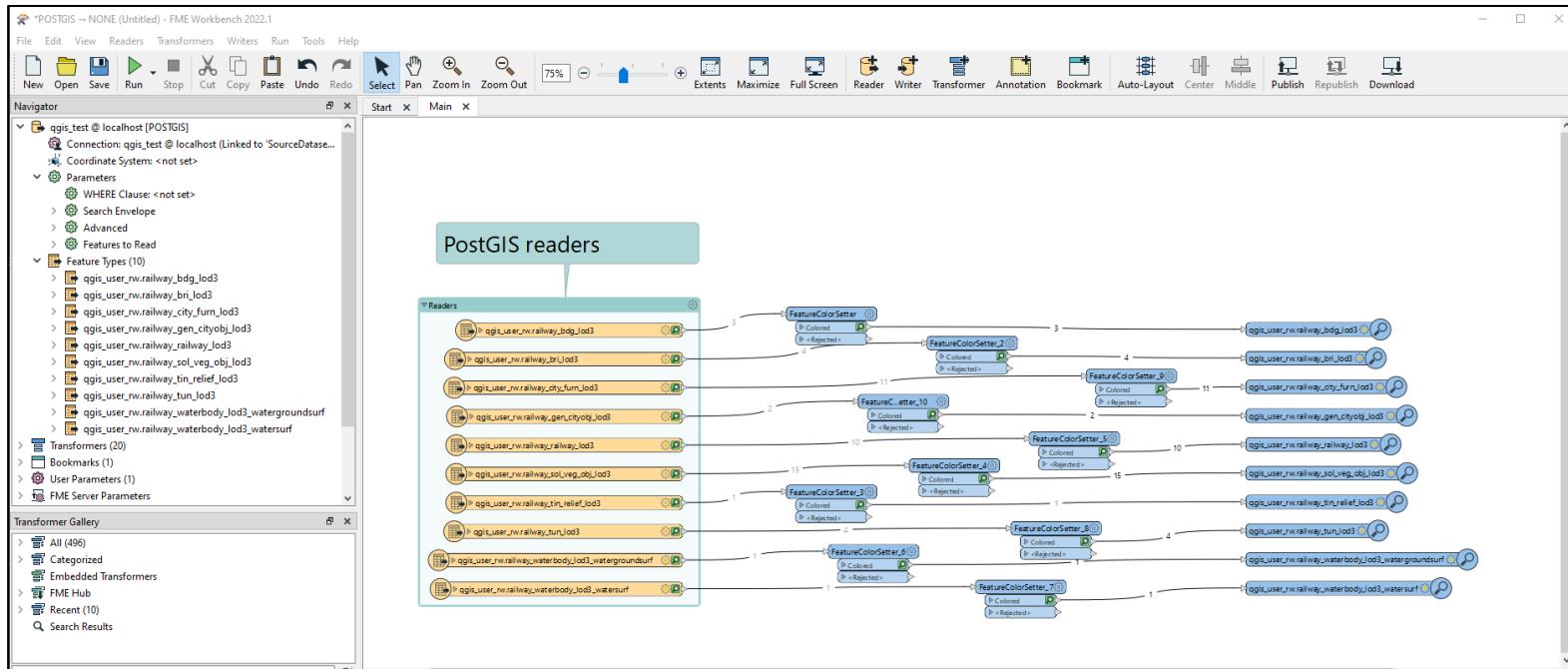
...
-- Then drop the user schema
DROP SCHEMA qgis_giorgio CASCADE;
-- Optionally (if necessary) remove user "giorgio" from the "qgis_pkg_usrgroup_qgis_test" associated to database
-- "qgis_test"
REVOKE qgis_pkg_usrgroup_qgis_test FROM giorgio;
```

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**

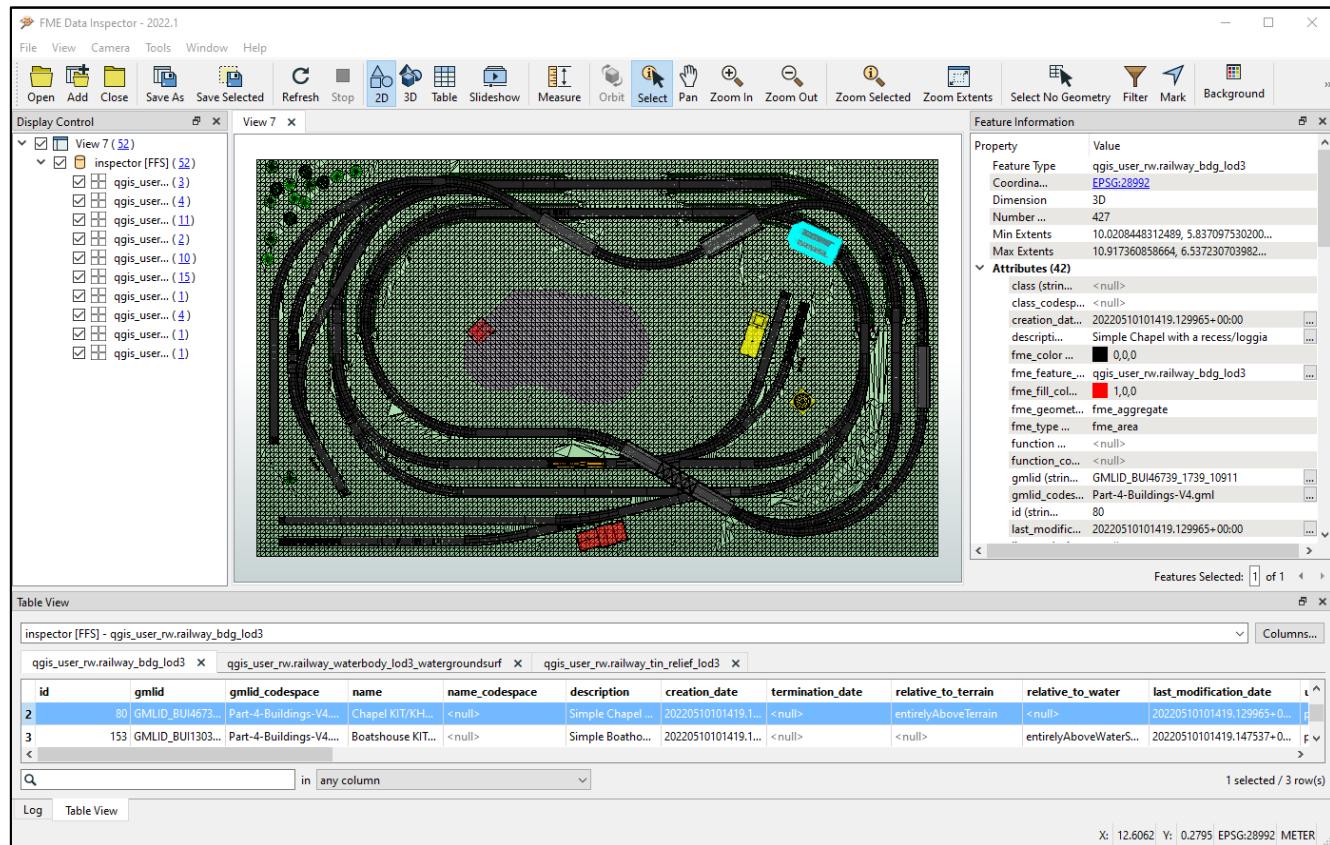
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QGIS Package via FME

- 2D visualisation via FME Data Inspector

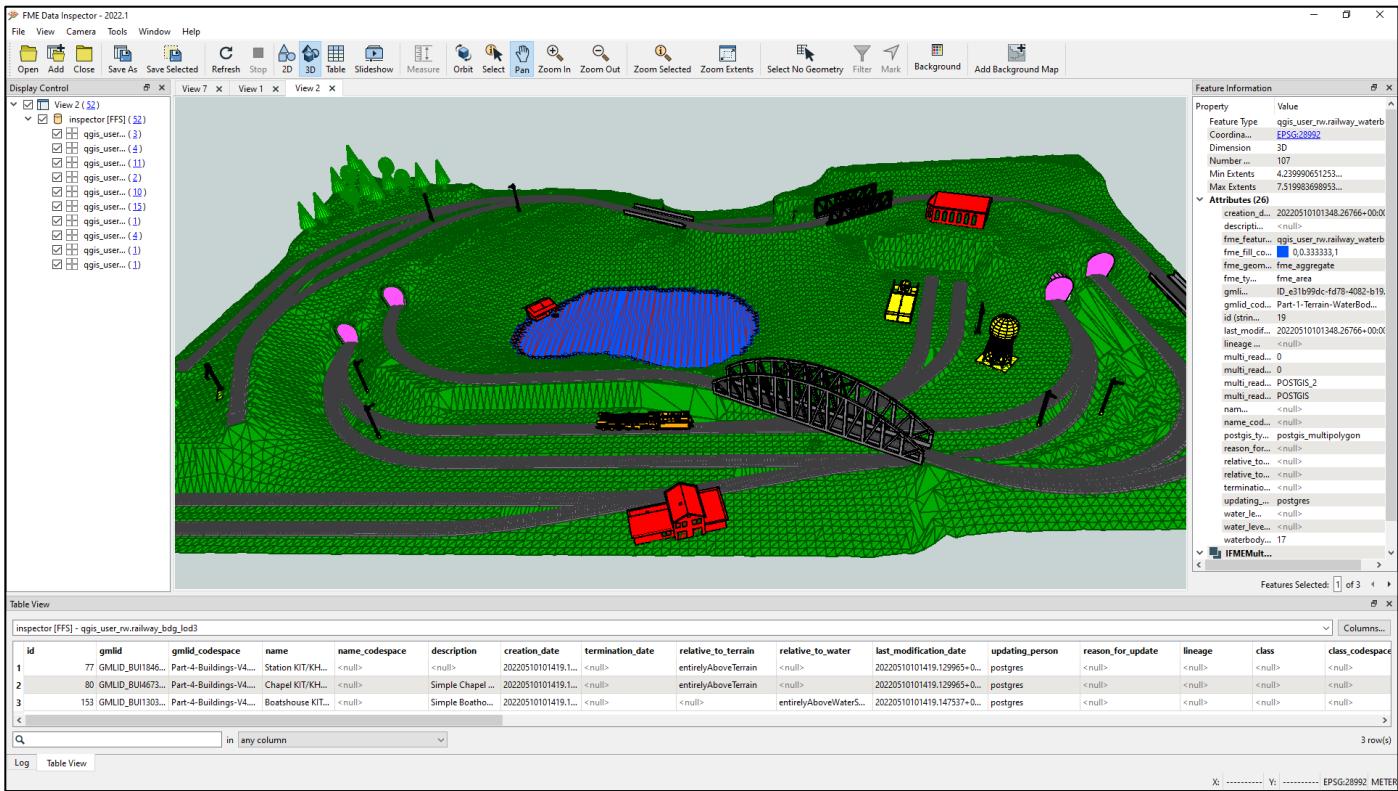
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QGIS Package via FME

- 3D visualisation via FME Data Inspector

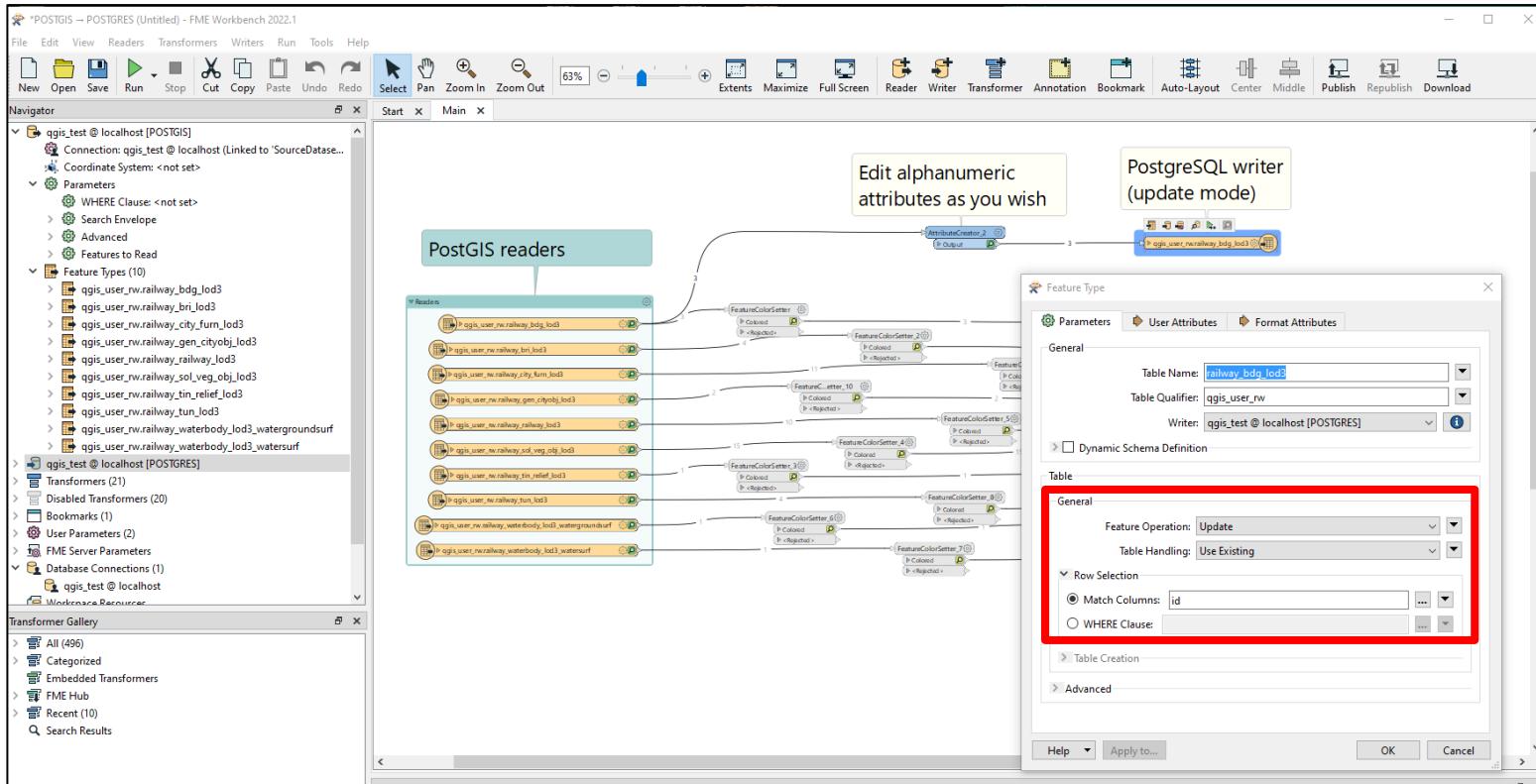
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QGIS Package via FME

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

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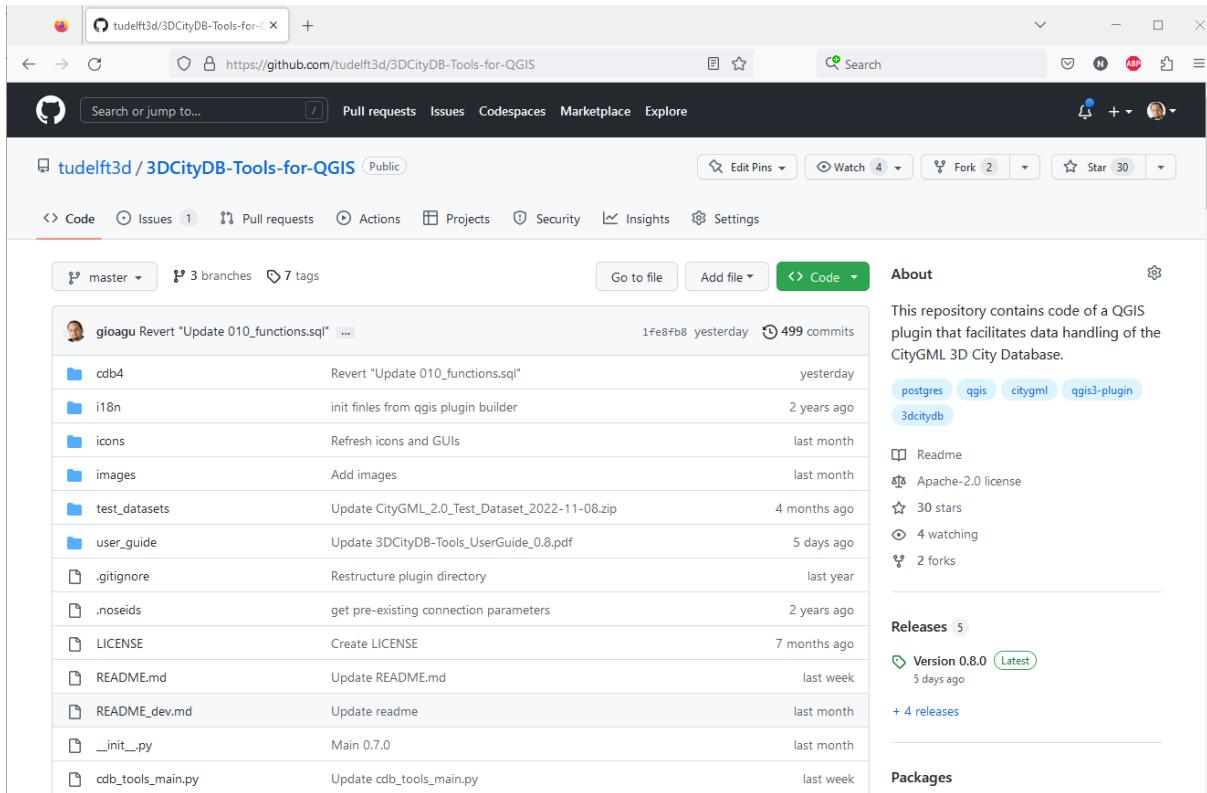
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Source code and GitHub repository

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



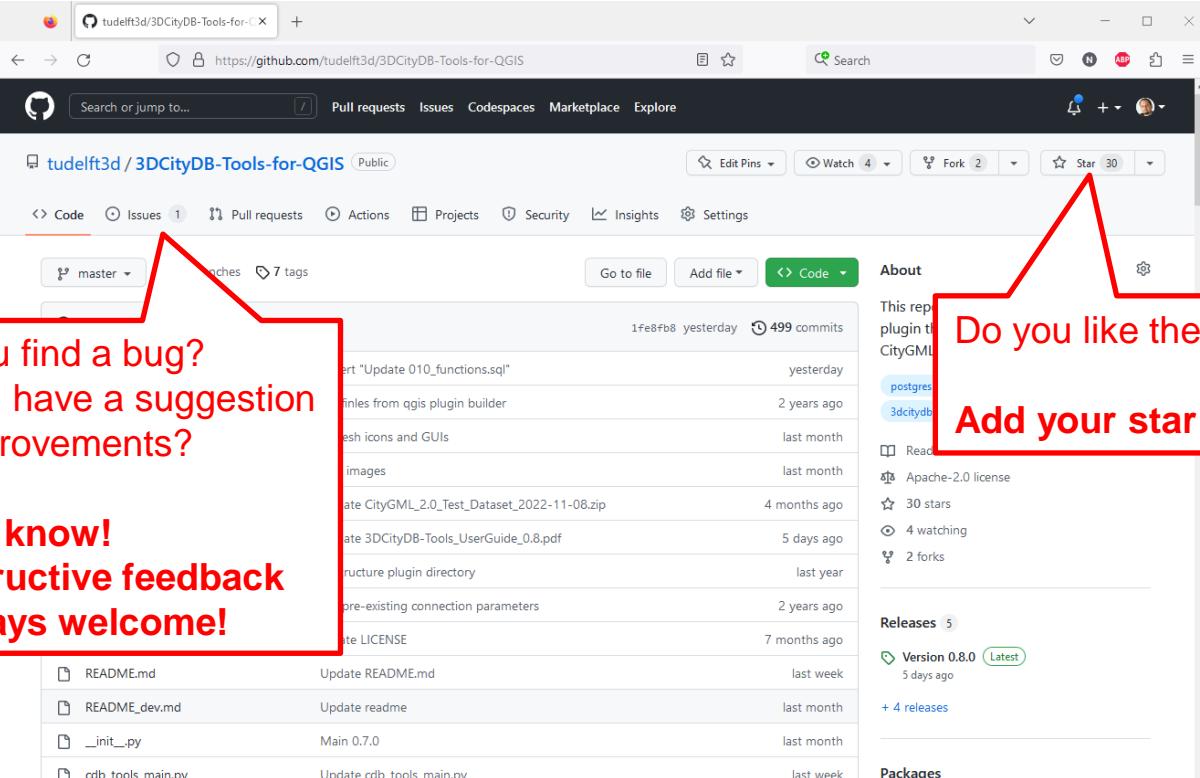
The screenshot shows the GitHub repository page for `tudelft3d / 3DCityDB-Tools-for-QGIS`. The repository is public and has 499 commits. The main page displays a list of recent commits, including updates to functions.sql, i18n files, icons, images, test datasets, user guides, and plugin restructuring. The repository is associated with PostgreSQL, QGIS, CityGML, and QGIS3-Plugin. It has 30 stars, 4 forks, and 4 watchers. A release section shows Version 0.8.0 (Latest) and four other releases. A packages section is also present.

Commit	Message	Date
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! ☺

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QGIS Plug-in repository

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



The screenshot shows a web browser window 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 icon with "(52) votes", 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 "About" tab is selected. The "About" content lists the plugin's purpose: "This plugin connects to the 3D City Database (v. 4.x) for PostgreSQL/PostGIS. It consists of:" followed by three bullet points detailing its 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;"; "A 'Bulk Deleter': it allows to cleanup the database, or to delete selected feature types;"; and "'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."

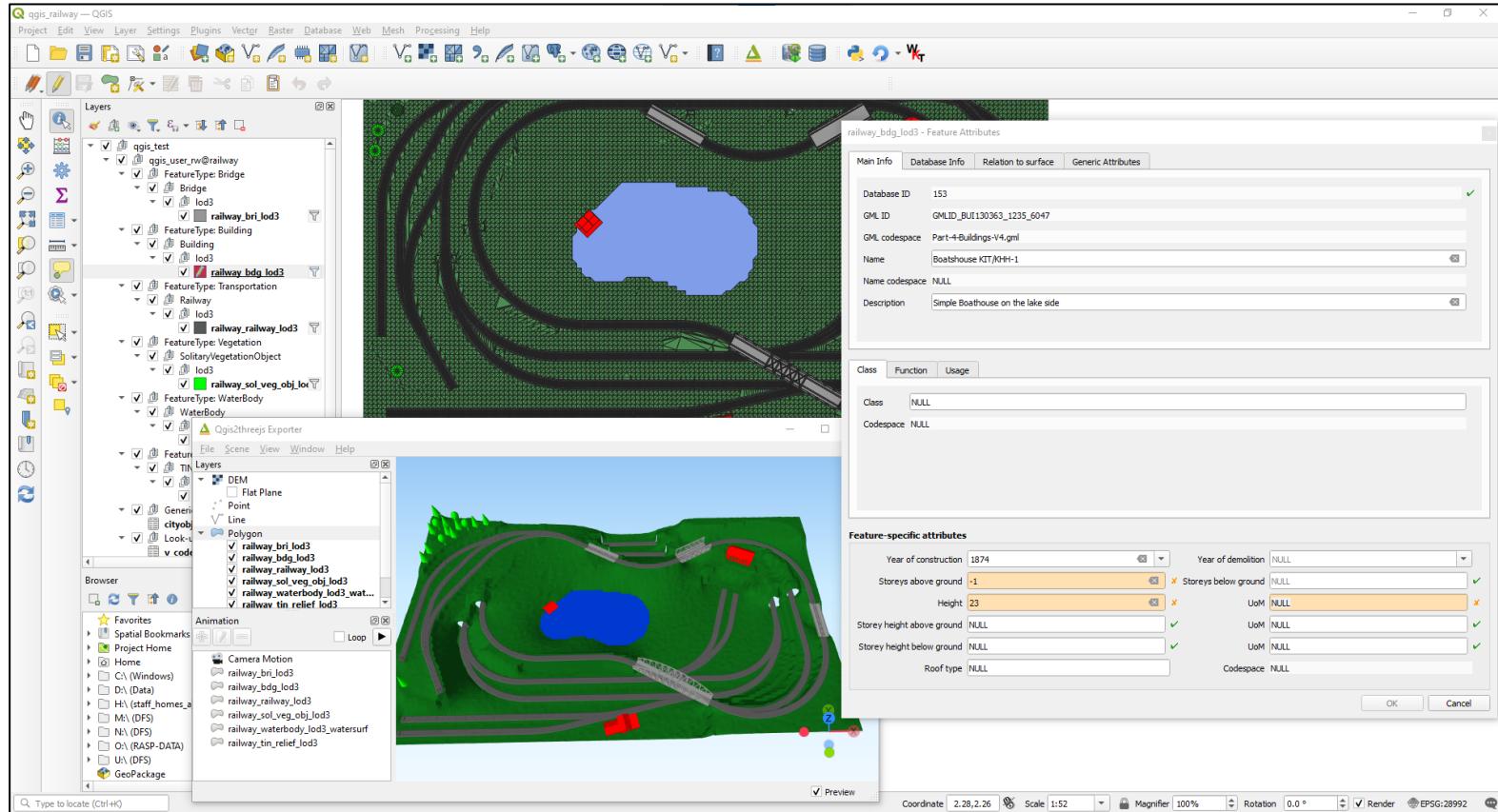
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Test datasets

- 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/>

Enjoy! ☺



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3DCityDB Tools

for



QGIS