



3DCityDB Tools

for

QGIS

Quick installation and user guide

Version 0.8

Last update: 21 March 2023

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What's new?

ChangeLog for version 0.8

Client-side: Layer Loader

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

Client side: Bulk Deleter

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

What's new?

ChangeLog for version 0.8 (ctd)

Client-side: QGIS Package Administration

- Minor bug fixes and code clean-up

Server-side (QGIS Package):

- New version 0.10
- Updates to layer_metadata table
- Updates to layer creation functions
- Added support for (updatable) Detail Views
- Added support for look-up tables metadata
- Improved support to datasets with geographic coordinates (bbox precision)
- Minor code clean-up and bug fixes

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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!)

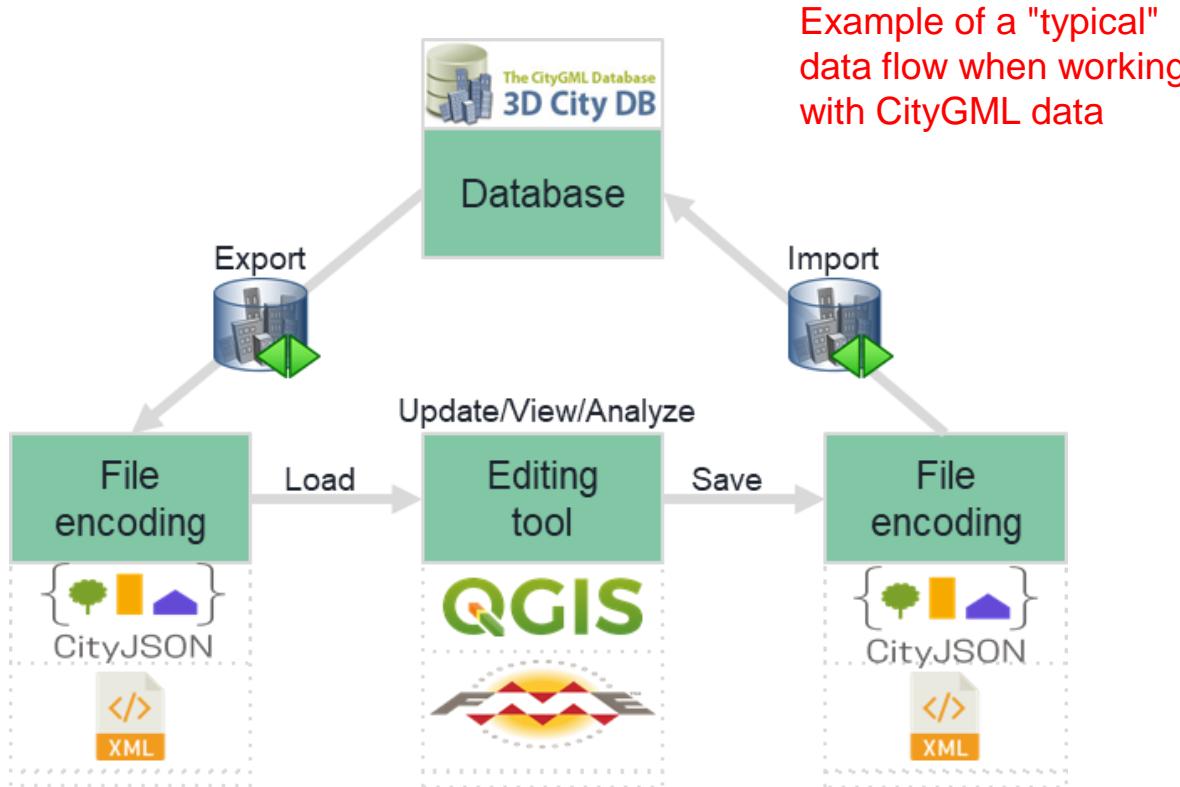
Motivation

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

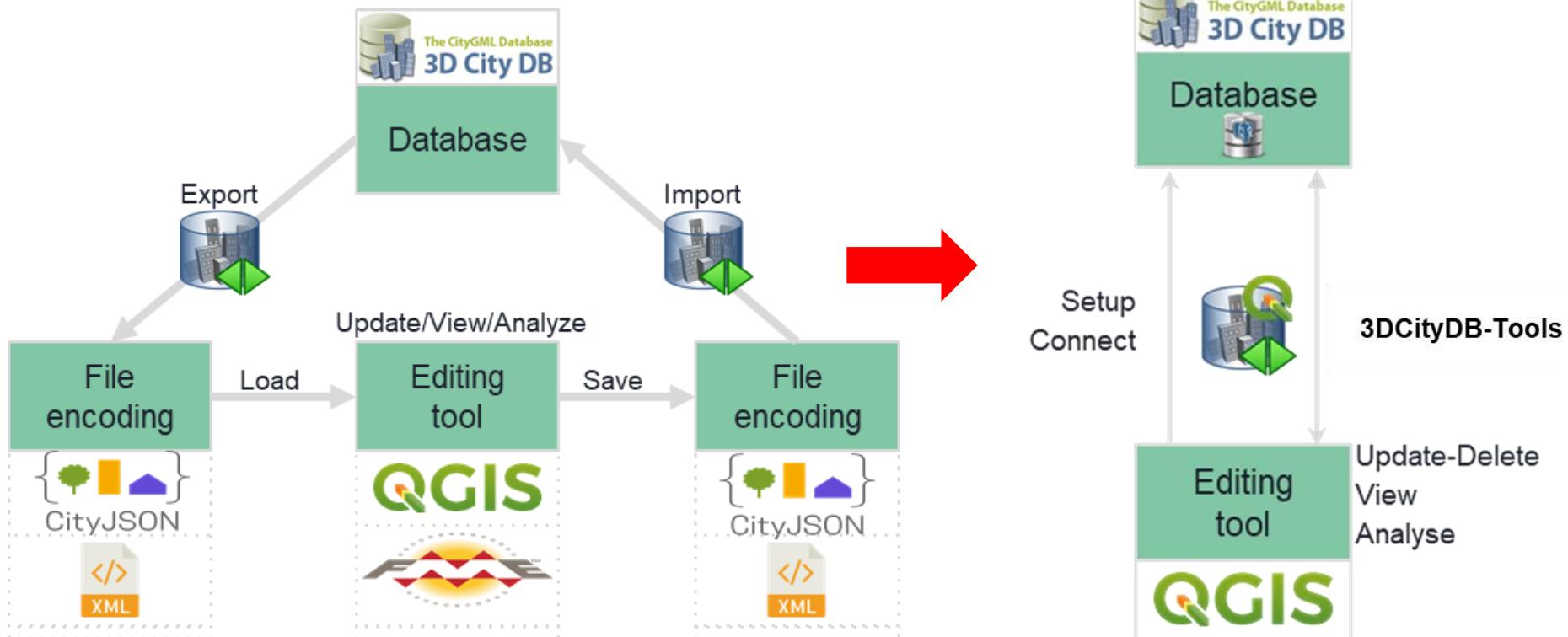


Motivation



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

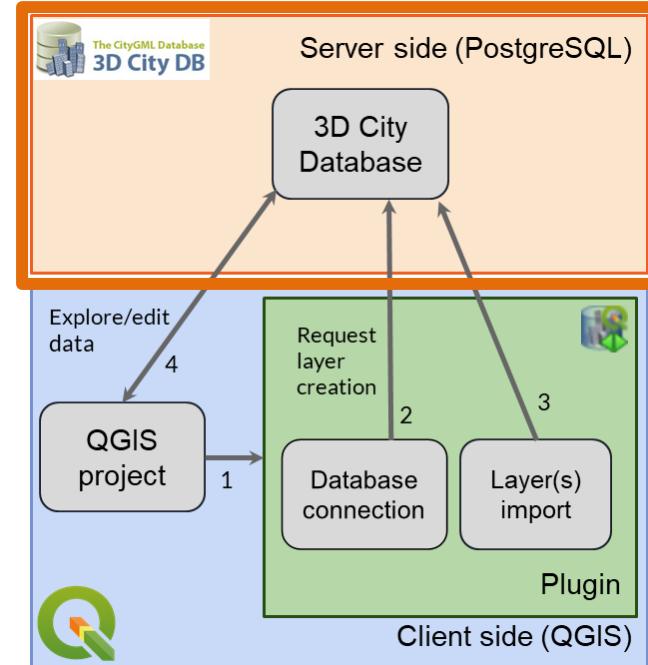
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Server-side

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



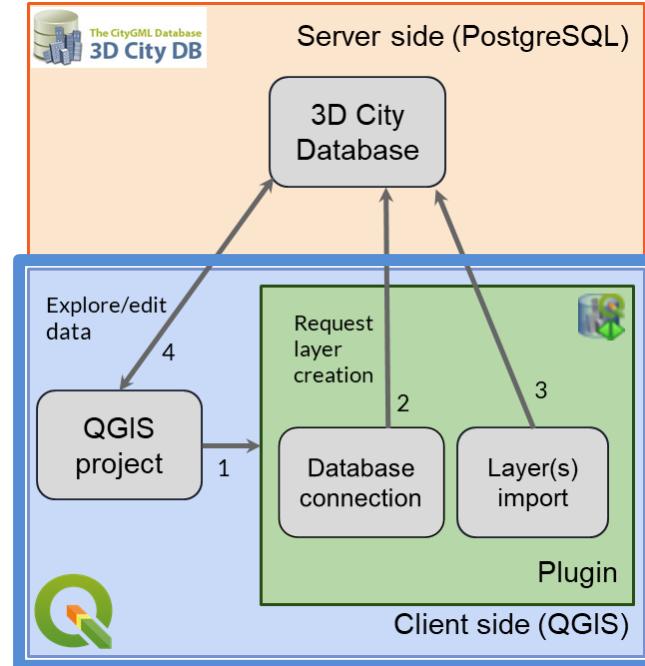
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Client-side

QGIS plugin “3DCityDB-Loader”

- Manages db 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

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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 higher**
 - <https://qgis.org/en/site/forusers/download.html>
 - **BEWARE:** NOT compatible with older versions
- PgAdmin (suggested, not required)
 - <https://www.pgadmin.org/download/>

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3DCityDB-Tools compatibility matrix

QGIS version	3DCityDB-Tools works?	Comments
QGIS 3.30	✓	Works, but not supported
QGIS 3.28 LTR	✓	Works
QGIS 3.26	✓	Should work, but not supported
QGIS 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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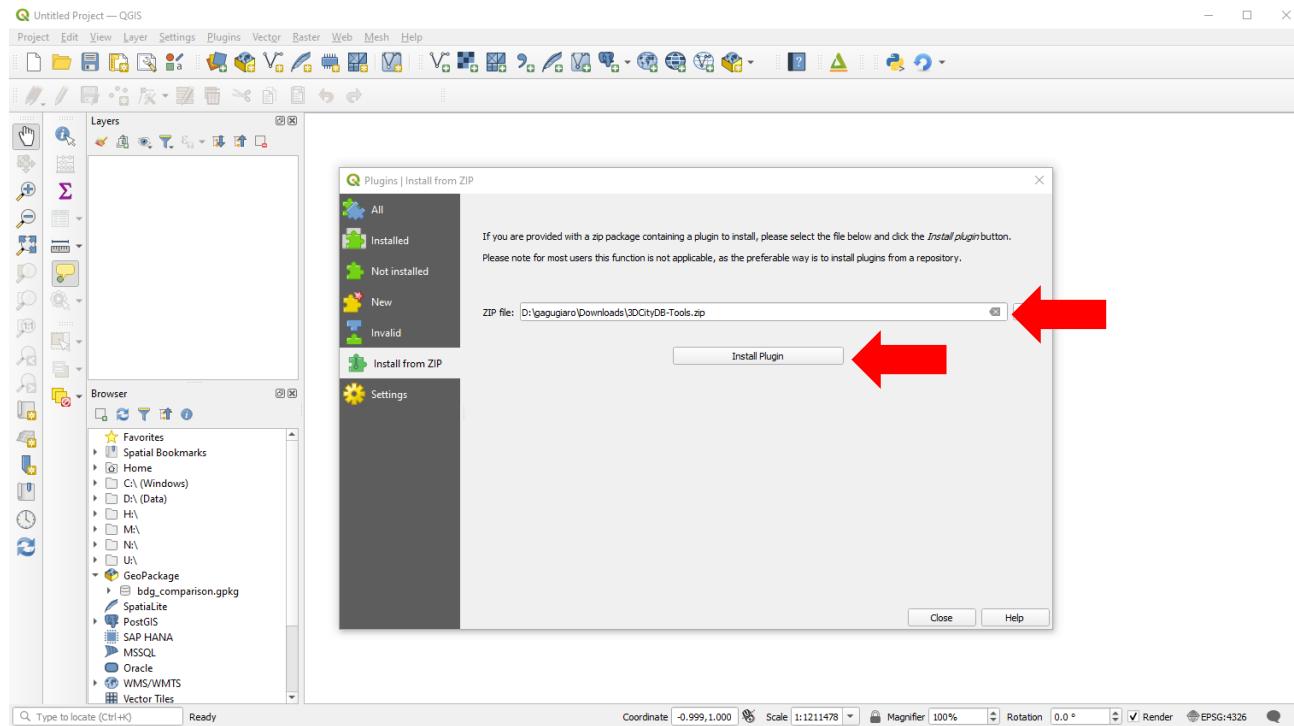
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Front-end installation

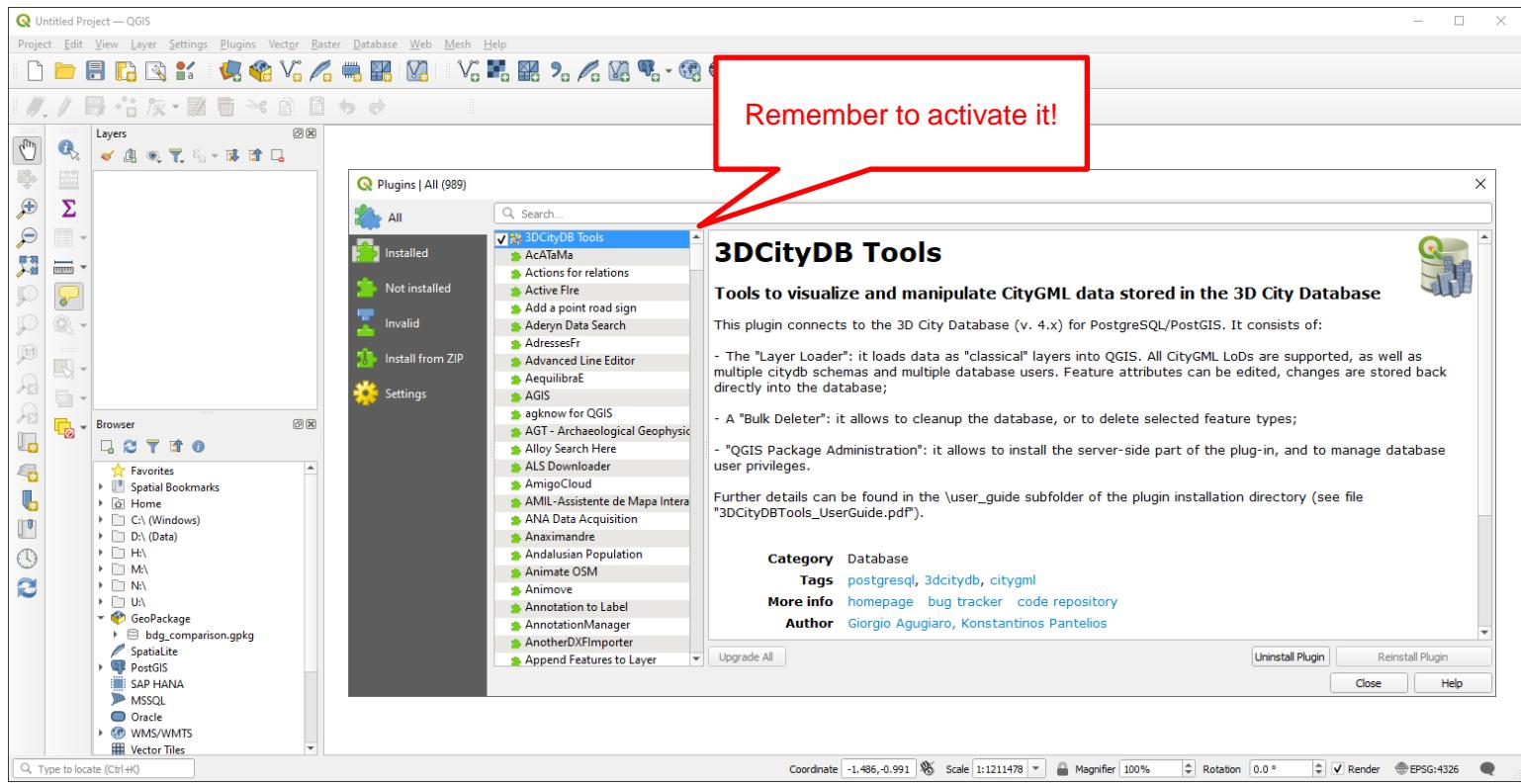
- The "**3DCityDB-Tools**" plugin for QGIS is currently available as **zip file**
- In QGIS, open the Plugins\Manage and install plugins window, and choose "Install from ZIP". Select the provided zip file and click the "Install Plugin" button



Front-end installation

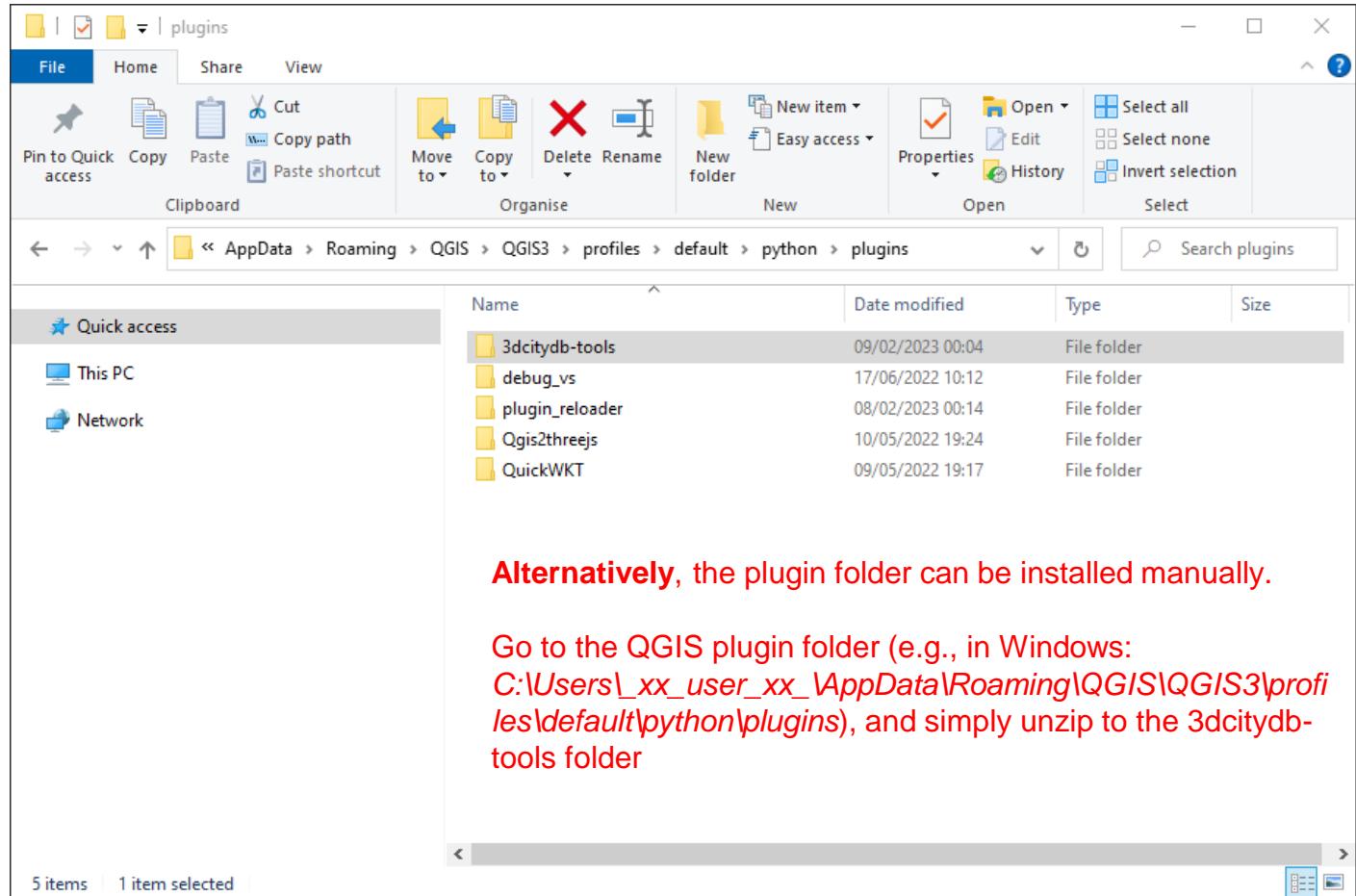
- Upon installation, you must activate the plugin

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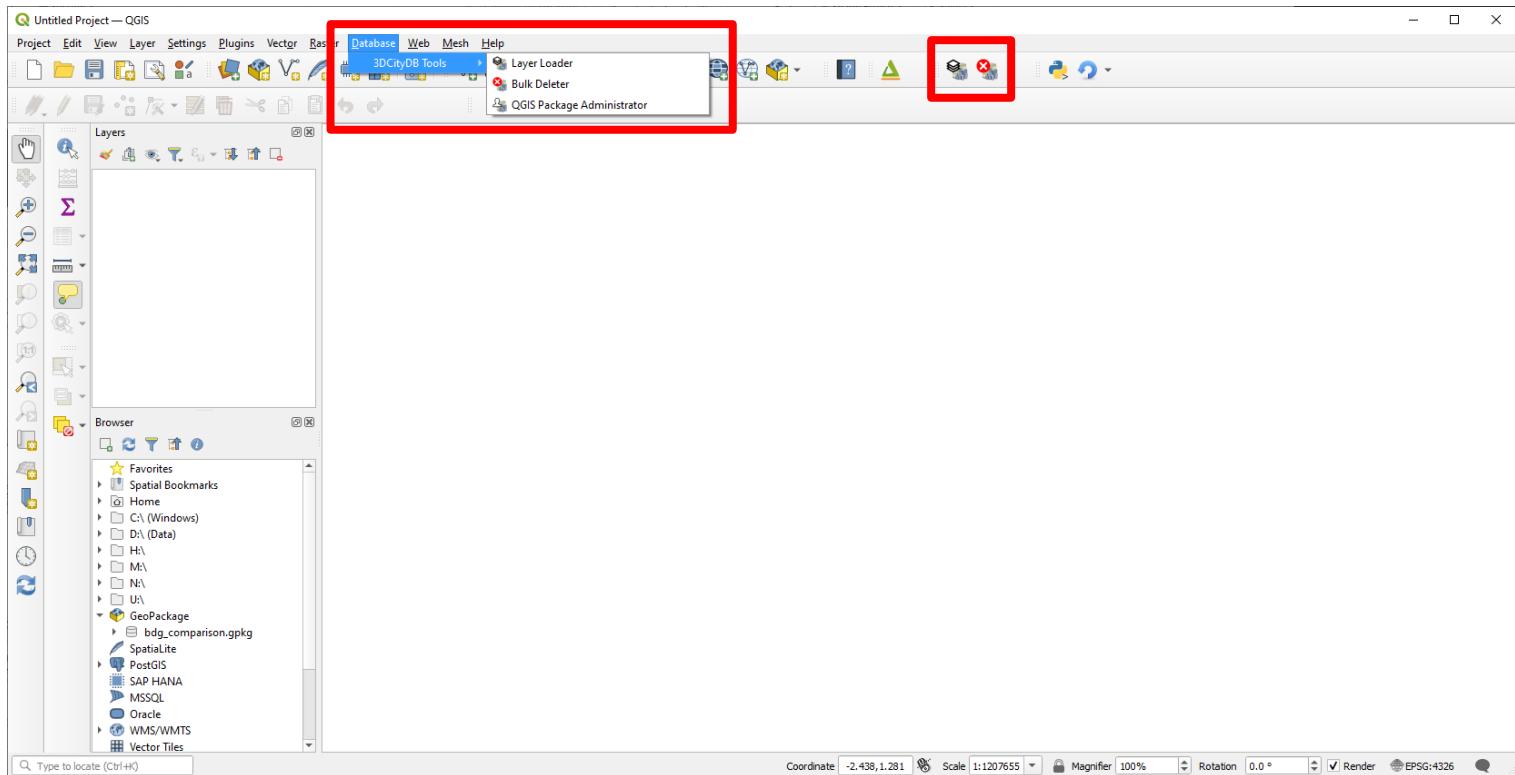
Front-end installation

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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 Installation" GUI of the front-end. The **database administrator** is responsible for setting up in advance the server-side for *any* database user.

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

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

It is possible to perform:

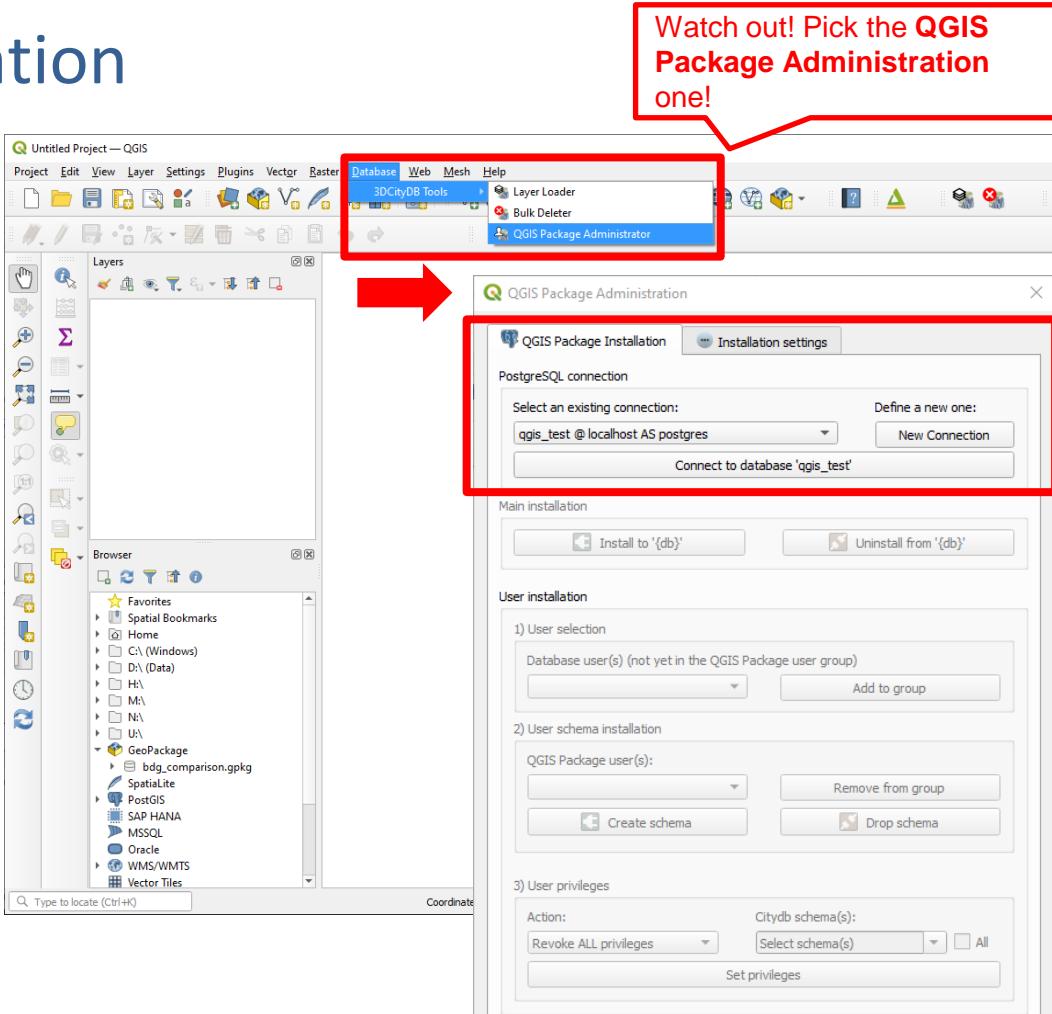
- A "**simplified installation**", which carries out all 4 operation at once and automatically installs 2 default users
- A "**normal installation**", where the administrator has complete control over each step

Back-end installation

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

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



Watch out! Pick the **QGIS Package Administration** one!

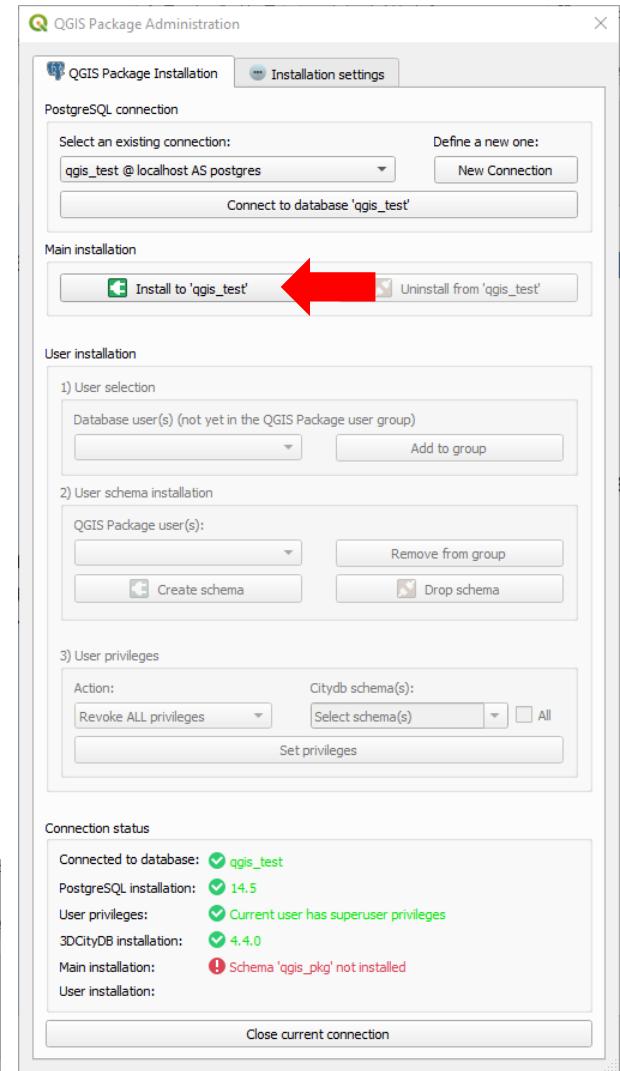
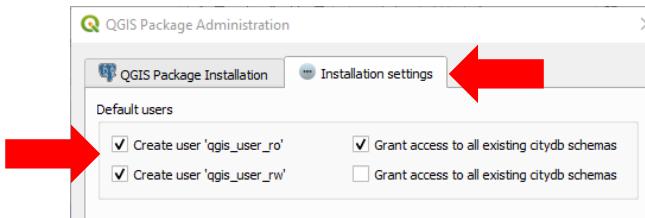
Back-end installation

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" window, specifically the "QGIS Package Installation" tab. It shows a "PostgreSQL connection" section with a dropdown set to "qgis_test @ localhost AS postgres" and a "Connect to database 'qgis_test'" button. Below this is a "Main installation" section with "Install to 'qgis_test'" and "Uninstall from 'qgis_test'" buttons, with the "Install to" button highlighted by a red arrow. The window also includes sections for "User selection", "User schema installation", "User privileges", and "Connection status".

Back-end installation

2.1) "Simplified" installation

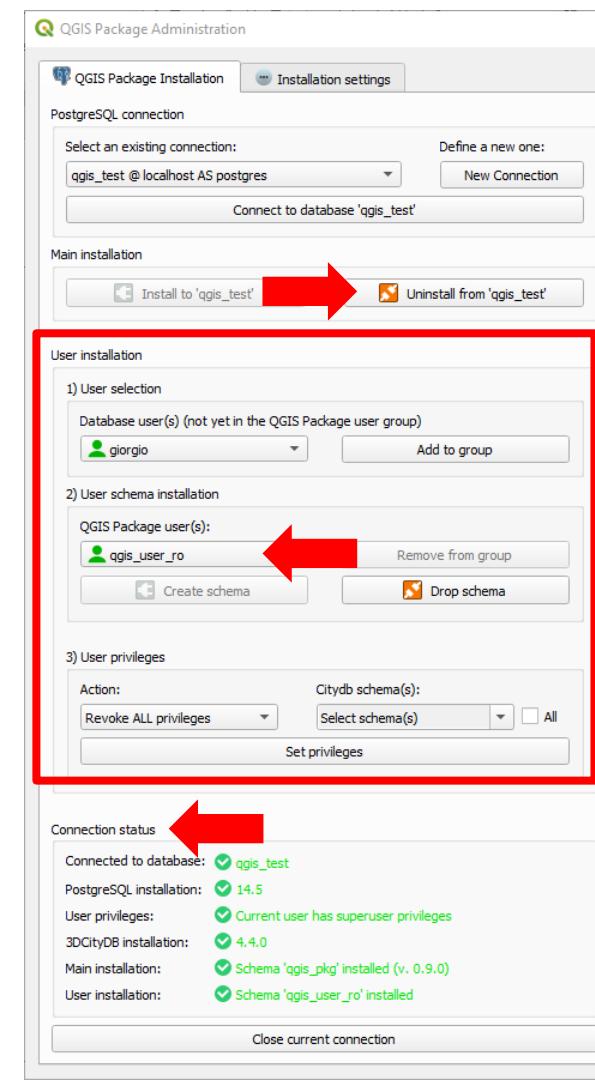
Upon successful installation:

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

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

Please observe that:

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



Back-end installation

2.1) "Simplified" installation

In the 3DCityDB, the **qgis_pkg** schema is added and, depending on the chosen options, the **qgis_user_ro** and/or the **qgis_usr_rw** schemas are created, too

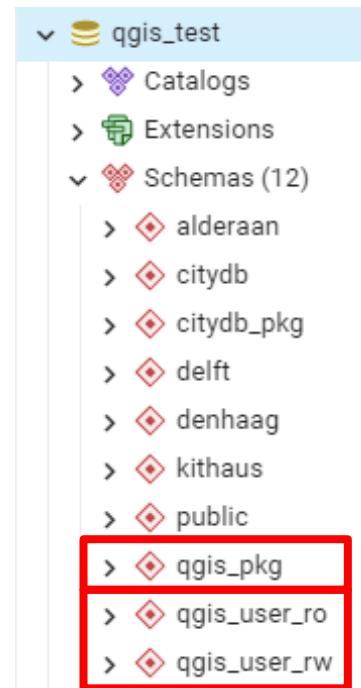
The credentials for the default users are:

User "qgis_user_ro":

- user name: **qgis_user_ro**
- password: **qgis_user_ro**

User "qgis_user_rw":

- user name: **qgis_user_rw**
- password: **qgis_user_rw**



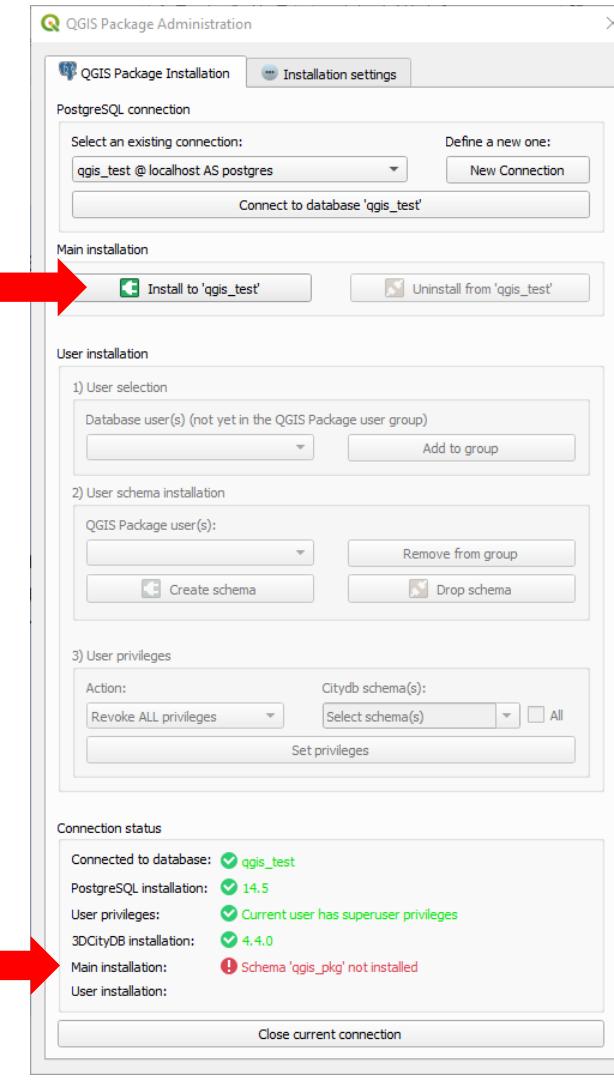
Back-end installation

2.2) "Normal" installation

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

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

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



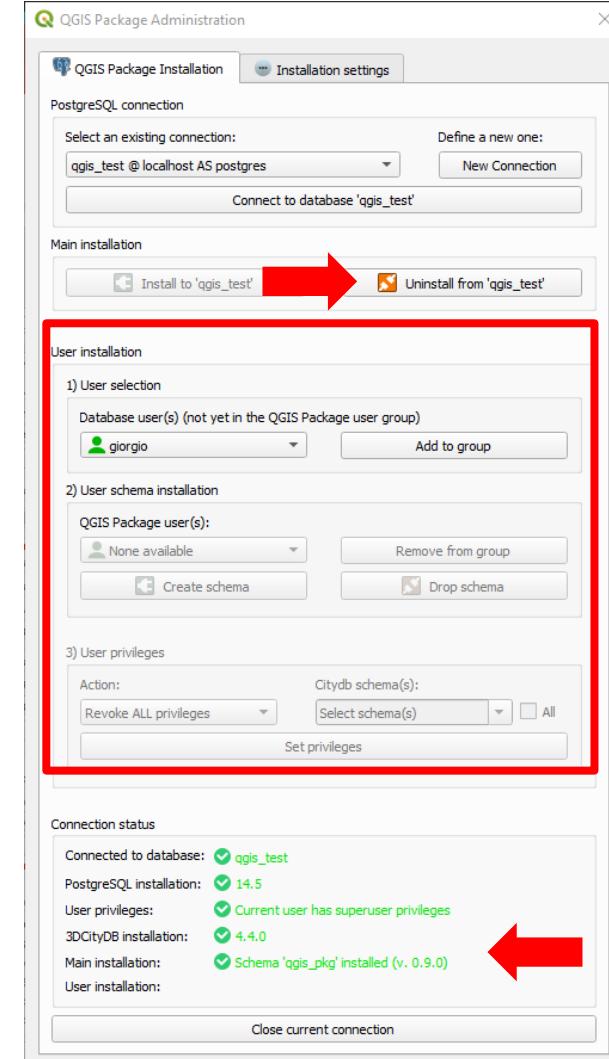
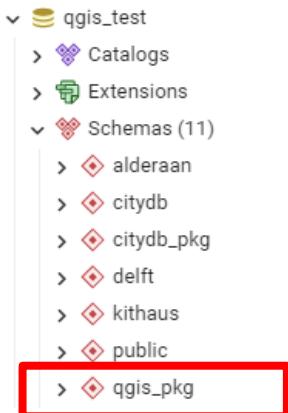
Back-end installation

2.2) "Normal" installation

Upon successful installation:

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

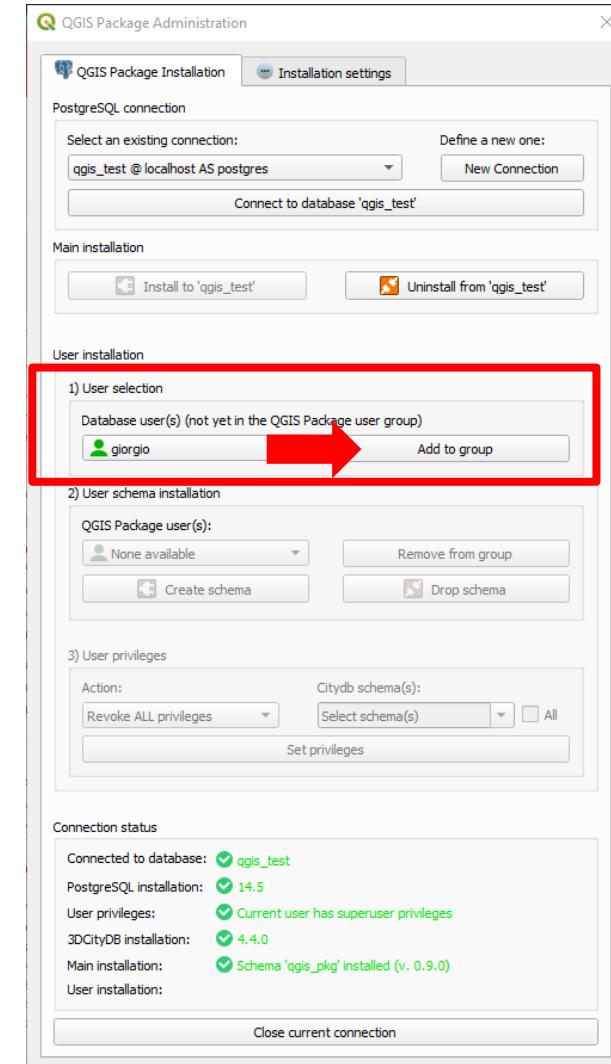
The "**qgis_pkg**" schema is created in the the selected current database



Back-end installation

2.2) "Normal" installation

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



The screenshot shows the 'QGIS Package Administration' window. In the 'User selection' section, 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 'User selection' section is also highlighted with a red box.

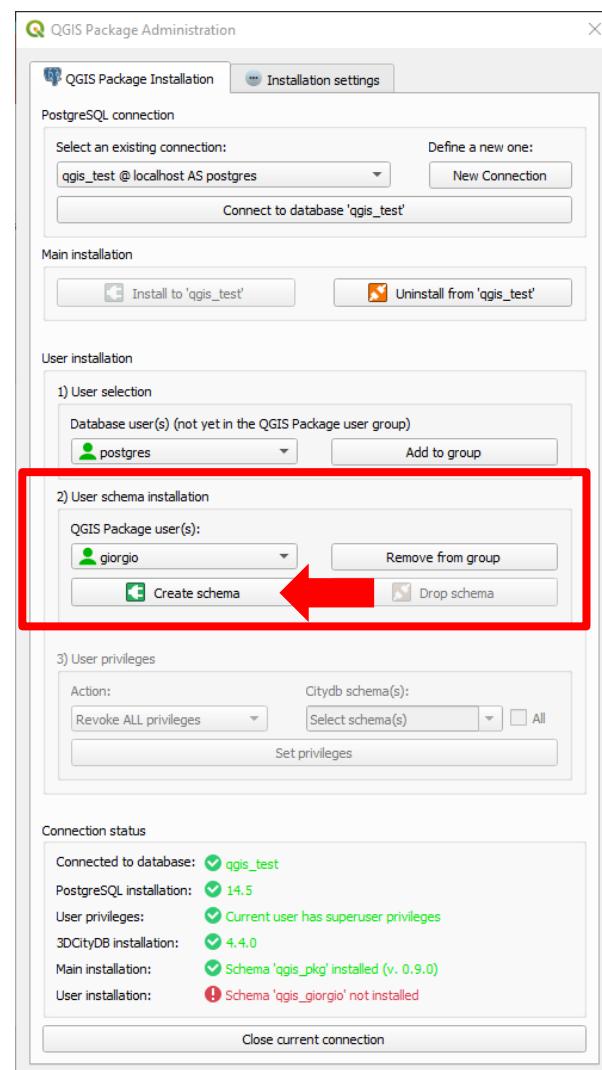
For each 3DCityDB there group named "**qgis_pkg_usrgroup_**" + **database name** is created. It contains those users that will be allowed to interact with the database from the front-end.
Example: for database "qgis_test" there is a group called "qgis_pkg_usrgroup_qgis_test".

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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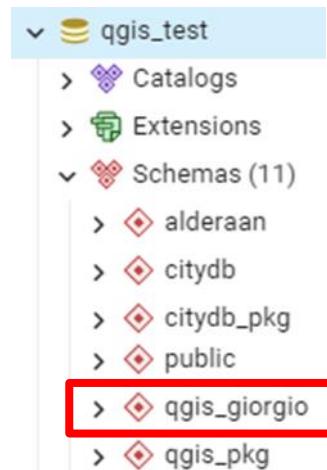


Back-end installation

2.2) "Normal" installation

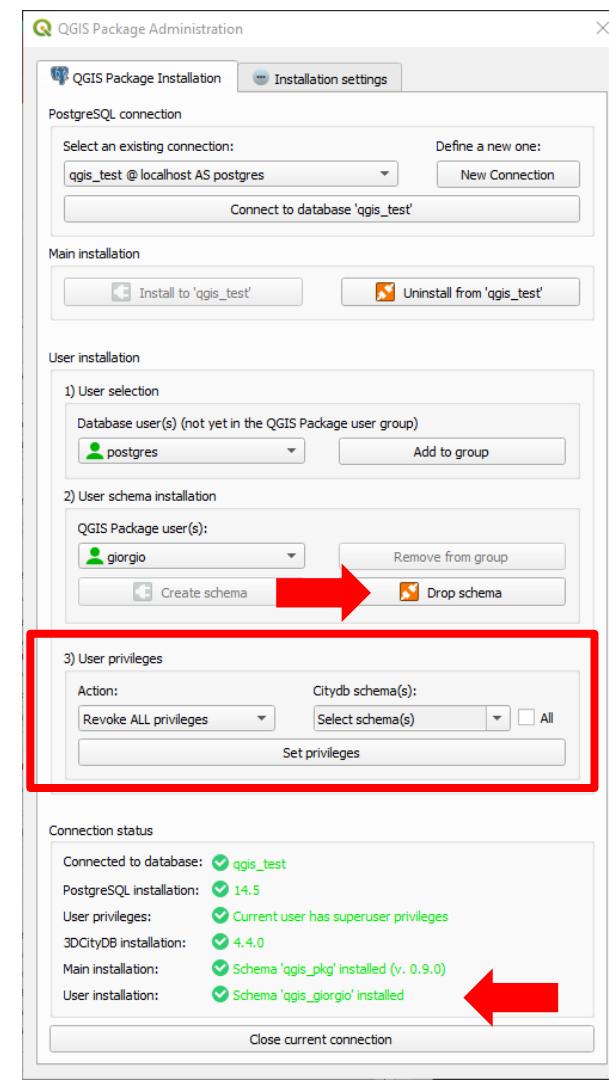
Upon successful creation of the user schema:

- 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

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

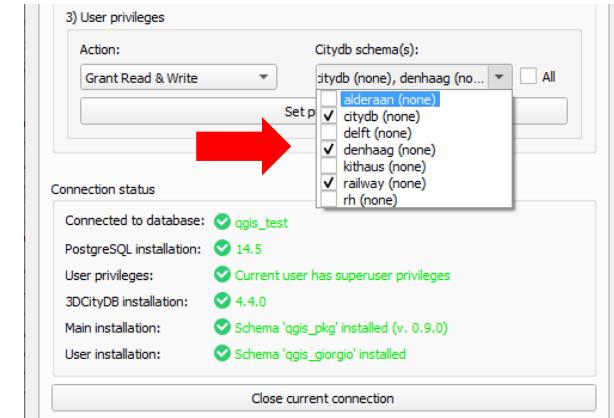
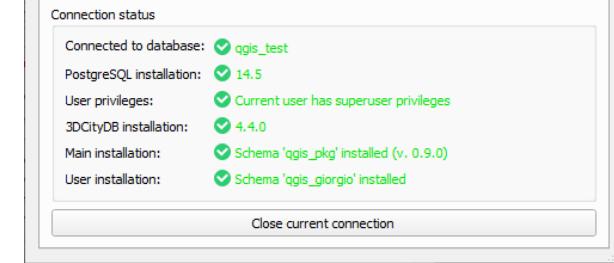
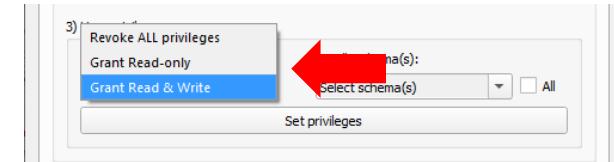
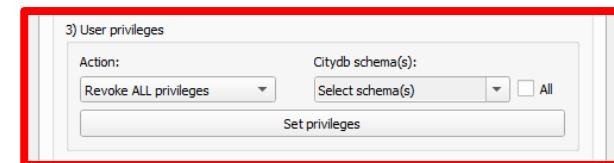
Back-end installation

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

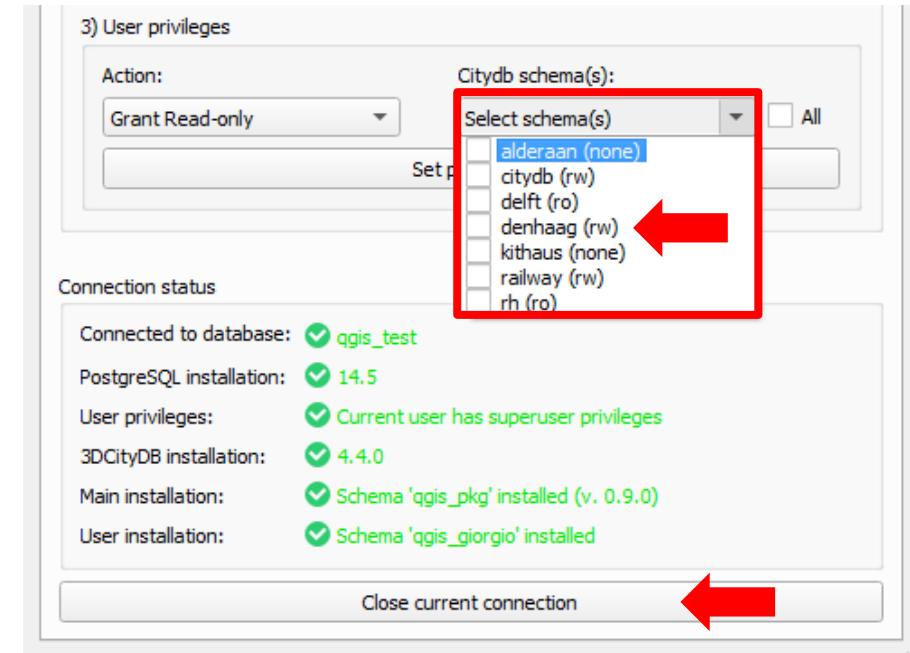
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Every time new privileges are set, the status in the drop down menu is updated with "ro" (read-only), "rw" (read & write) or "none".

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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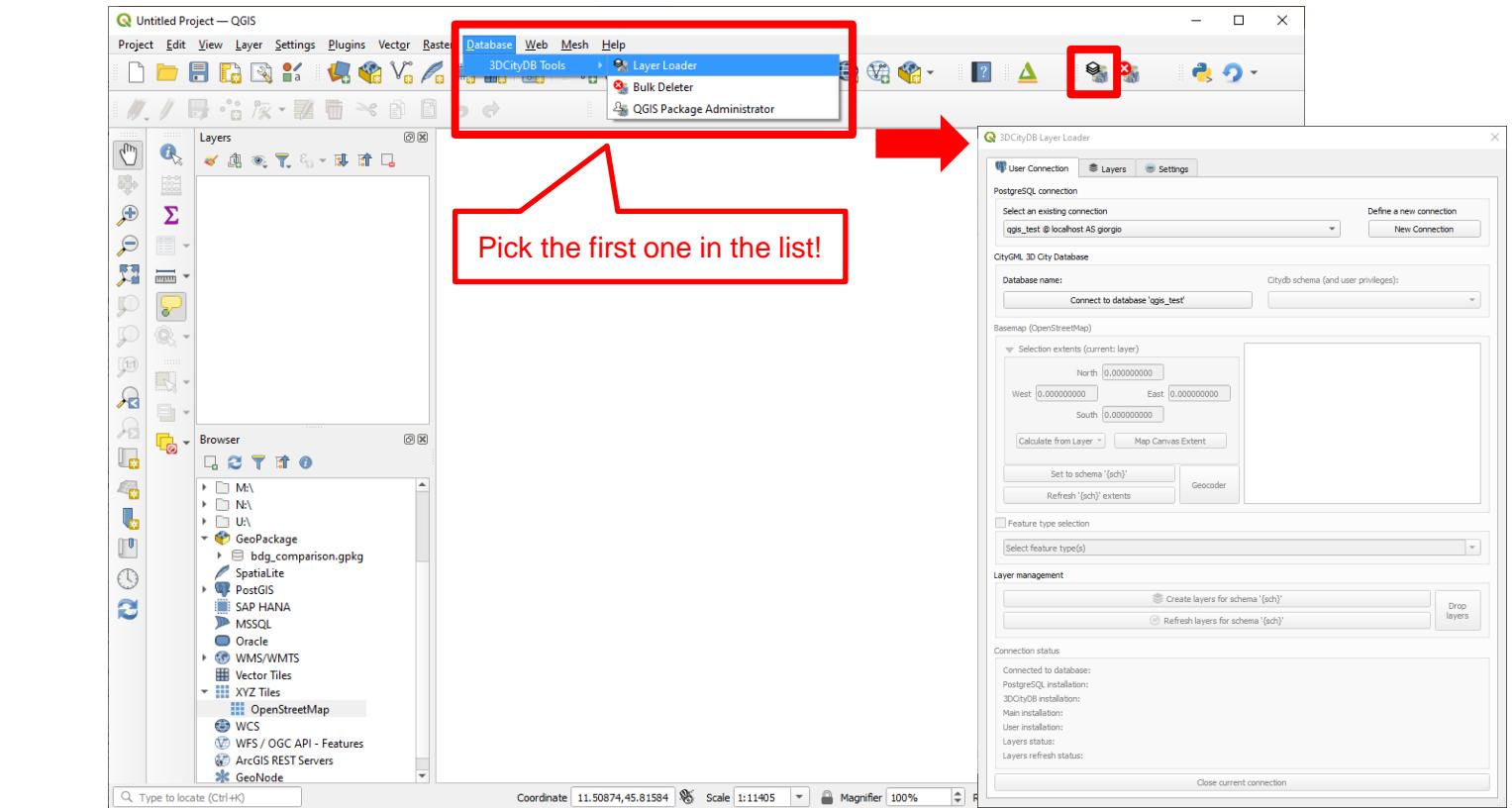
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Layer Loader



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

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The screenshot shows the QGIS application window. The top menu bar is visible with several tabs: Project, Edit, View, Layer, Settings, Plugins, Vector, Raster, Database, Web, Mesh, and Help. The 'Database' tab is currently selected. A red box highlights the 'Layer Loader' option under the '3DCityDB Tools' submenu. Another red box highlights the 'Layer Loader' icon in the toolbar, which is a small building-like icon with a gear and a '3'. A large red arrow points from the 'Layer Loader' icon in the toolbar to the 'Layer Loader' dialog box. A red callout box with the text 'Pick the first one in the list!' points to the first item in the list of available connections in the 'User Connection' section of the dialog.

Q Untitled Project — QGIS

Project Edit View Layer Settings Plugins Vector Raster Database Web Mesh Help

3DCityDB Tools > Layer Loader

Bulk Deleter

QGIS Package Administrator

Layers

Browser

Type to locate (Ctrl+K)

Coordinate 11.50874, 45.81584 Scale 1:11405 Magnifier 100%

3DCityDB Layer Loader

User Connection Layers Settings

Select an existing connection qgis_test @ localhost AS giorgio Define a new connection New Connection

CityGML 3D City Database

Database name: Connect to database 'qgis_test'

Basemap (OpenStreetMap)

Selection extents (current: layer)

North: 0.00000000 East: 0.00000000
West: 0.00000000 South: 0.00000000

Calculate from Layer Map Canvas Extent

Set to schema '(sch)' Refresh '(sch)' extents Geocoder

Feature type selection

Select feature type(s)

Layer management

Create layers for schema '(sch)' Refresh layers for schema '(sch)' Drop layers

Connection status

Connected to database: PostgreSQL installation: 3DCityDB installation: Main installation: User installation: Layers status: Layers refresh status:

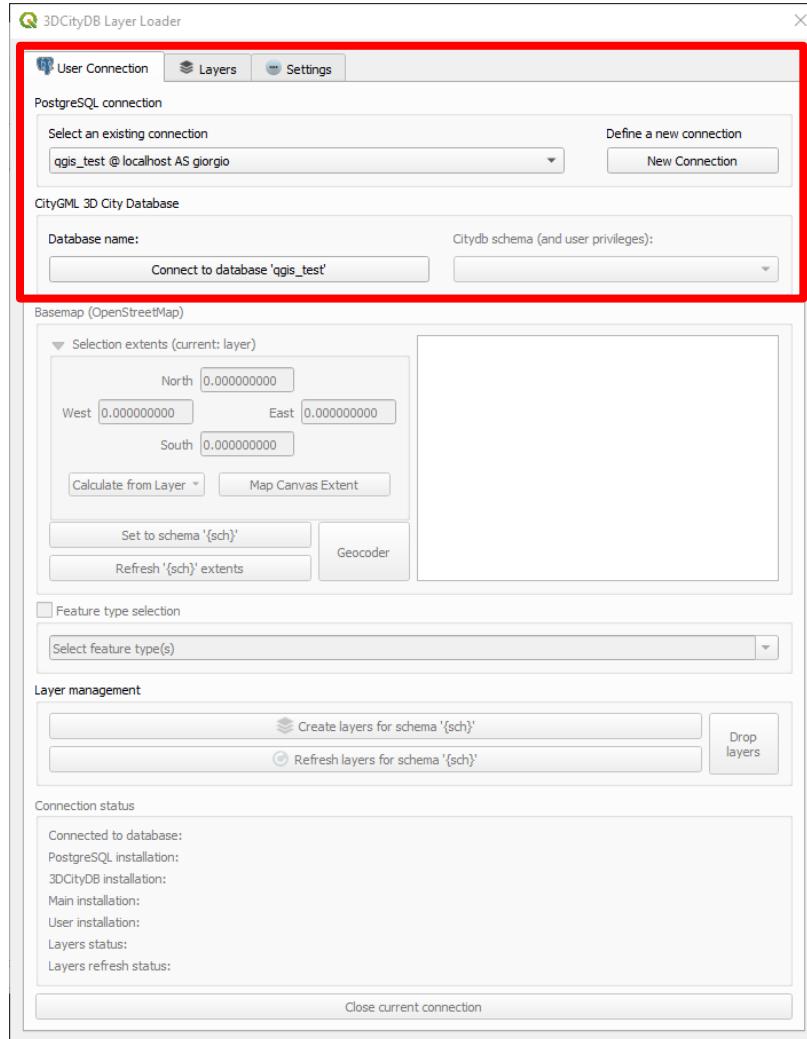
Close current connection

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)



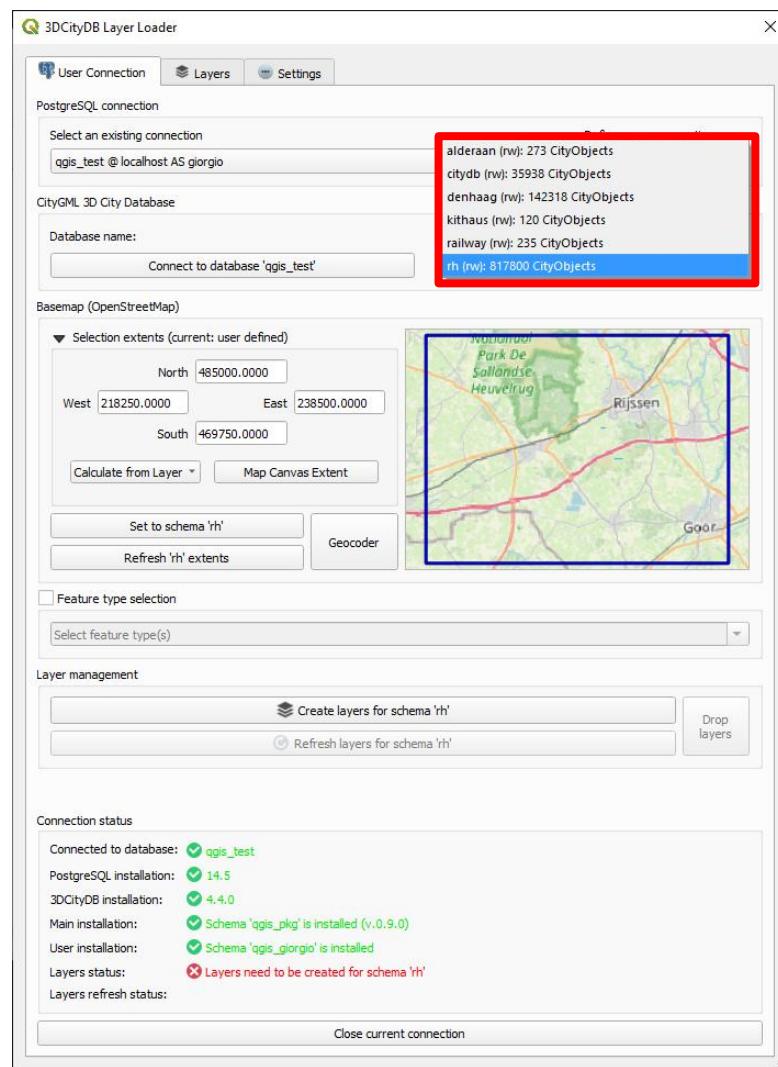
Layer Loader

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") and the number of CityGML CityObjects in that schema.

Nota bene: Generally, "**citydb**" is the default, and, very often, the only one citydb schema! Nevertheless, the next slides refer to the "**rh**" schema

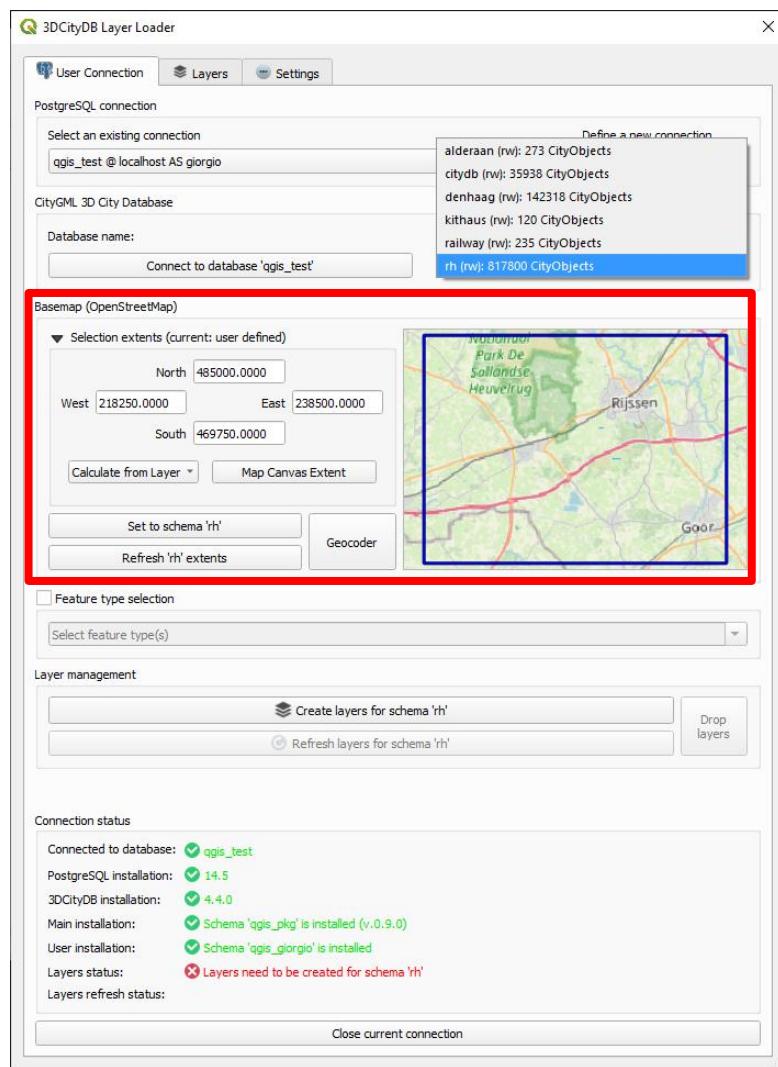
How to create additional citydb schemas
<https://3dcitydb-docs.readthedocs.io/en/latest/3dcitydb/multi-schema.html>



Layer Loader

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.

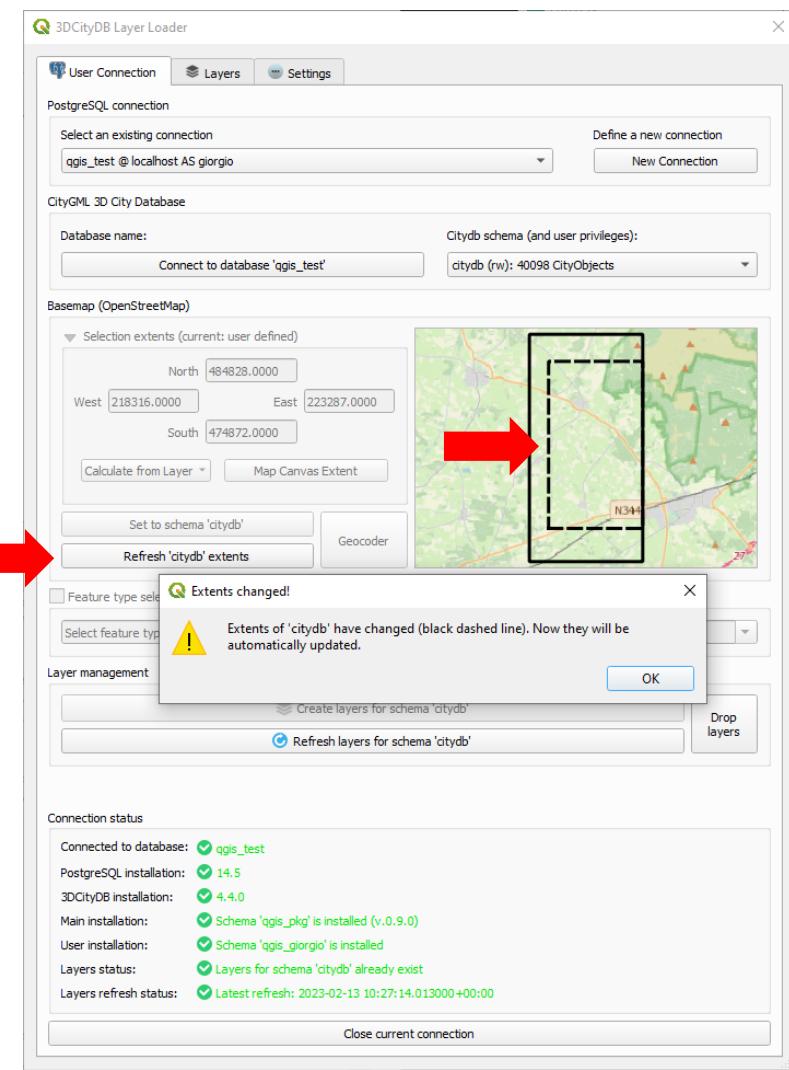


Layer Loader

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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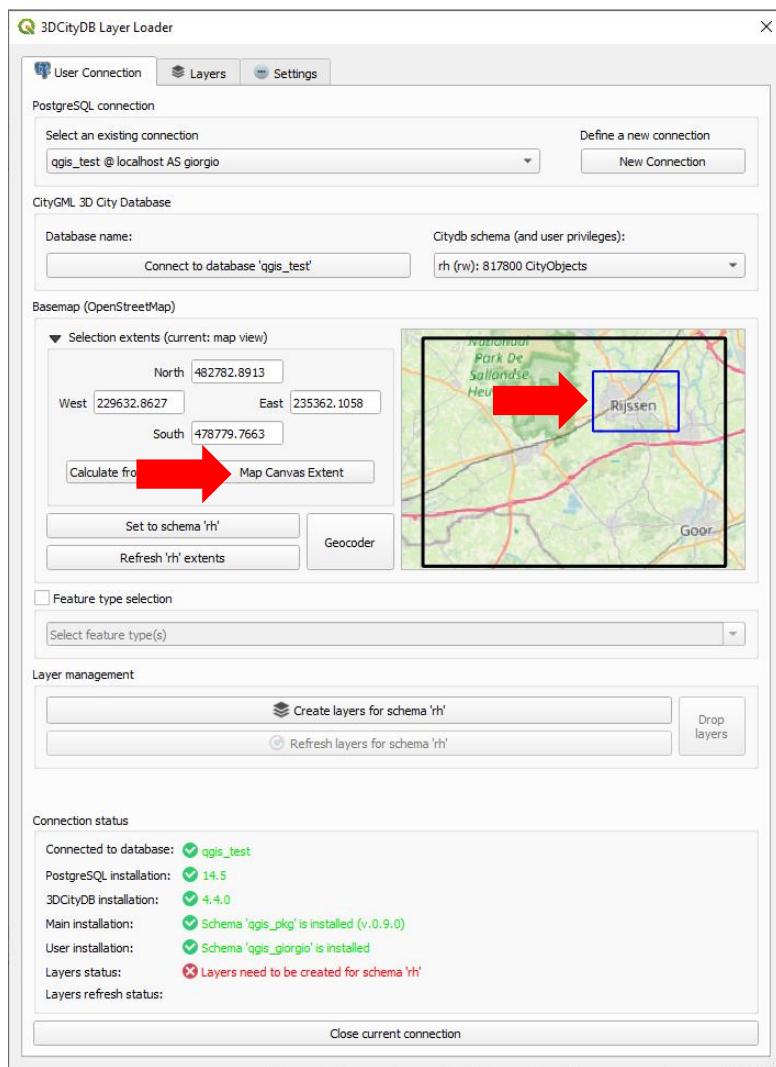
Layer Loader

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.

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

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



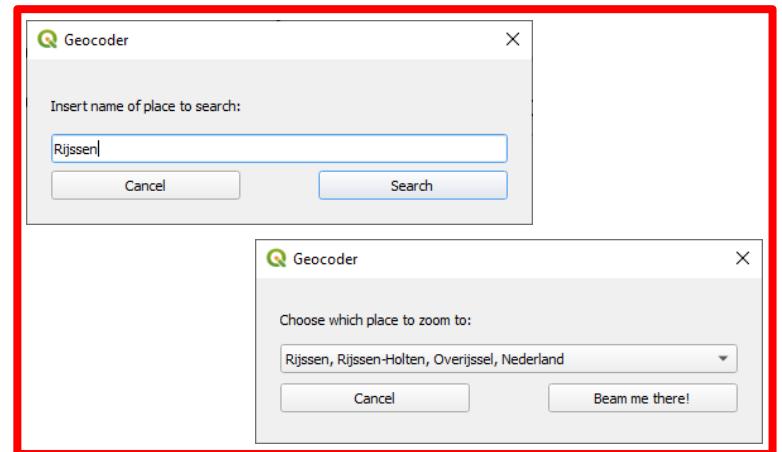
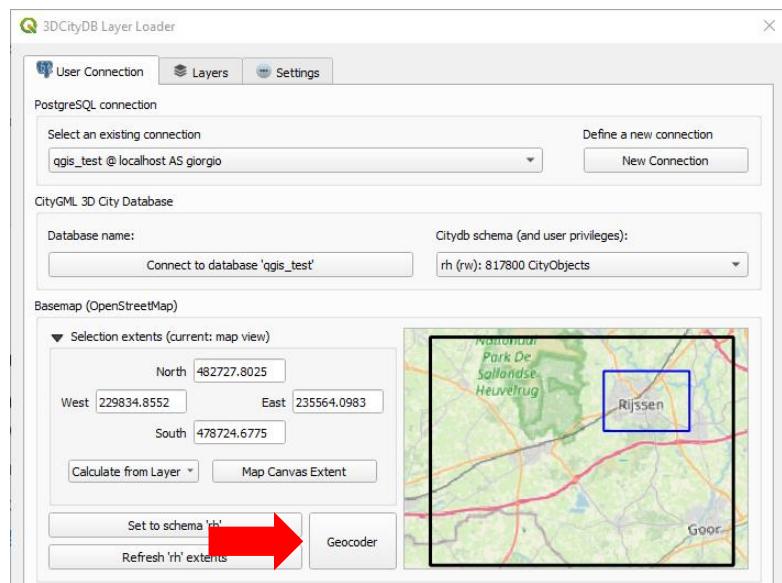
Layer Loader

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

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

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

Simply click the **Geocoder button**.



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

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

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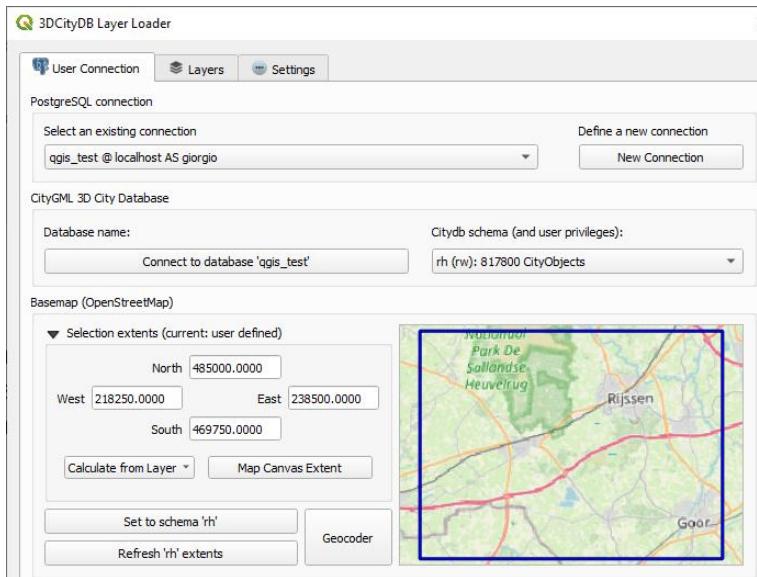
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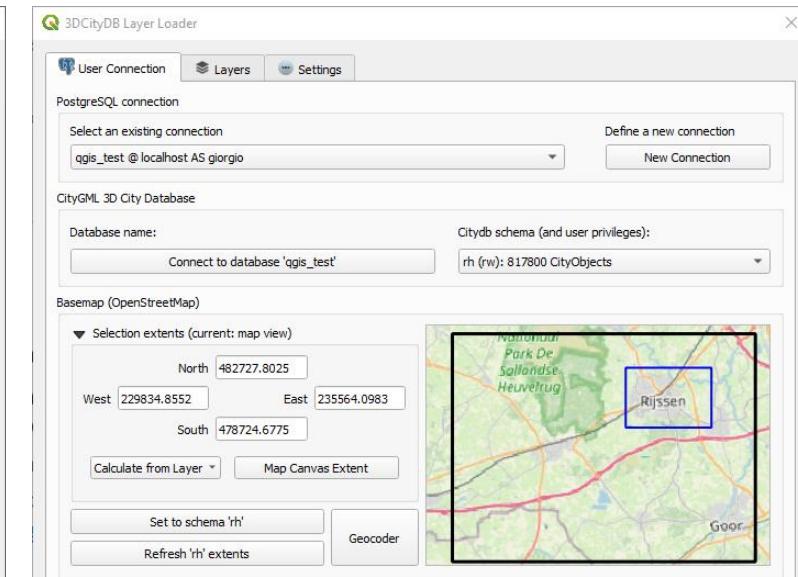
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Both areas coincide (default)



User-selected layers extents

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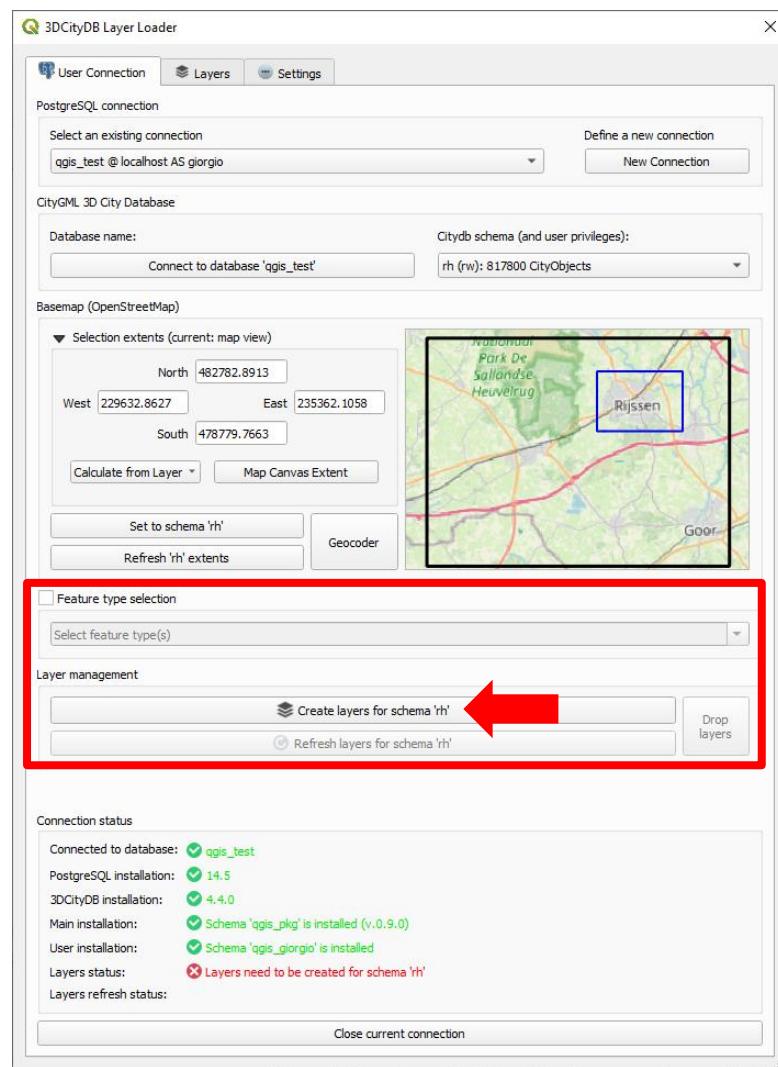
Layer Loader

6a) Create the layers

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

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

Only layers for *existing* data will be created.



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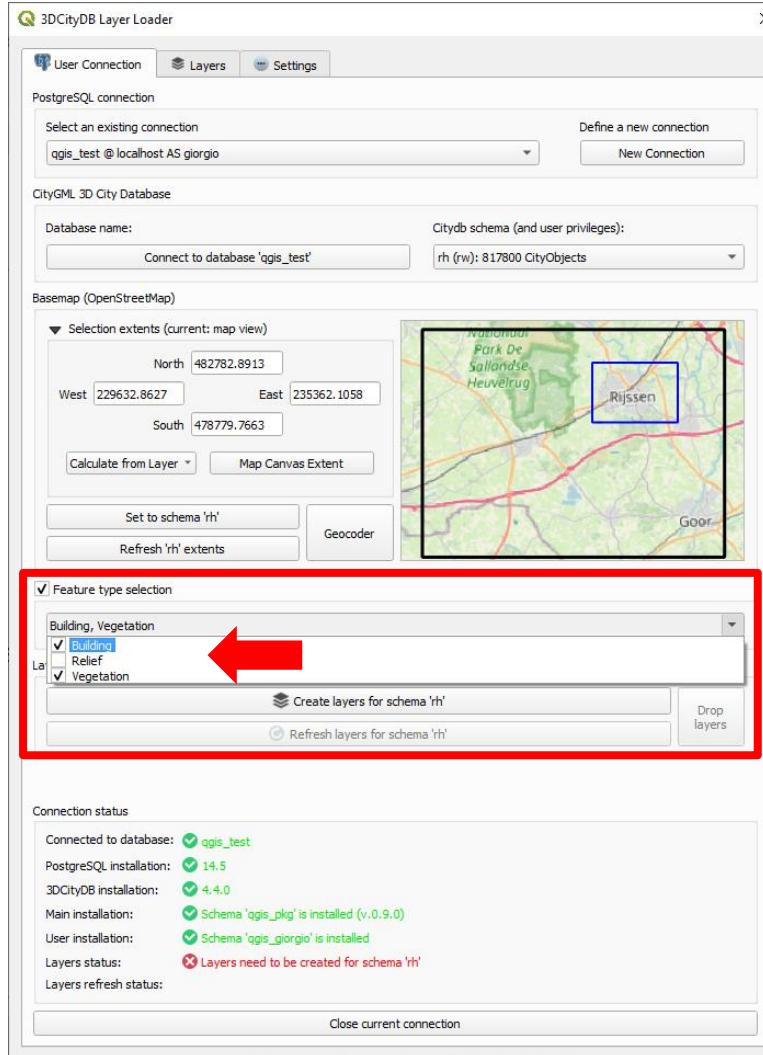
Layer Loader

6a) Create the layers

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

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

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

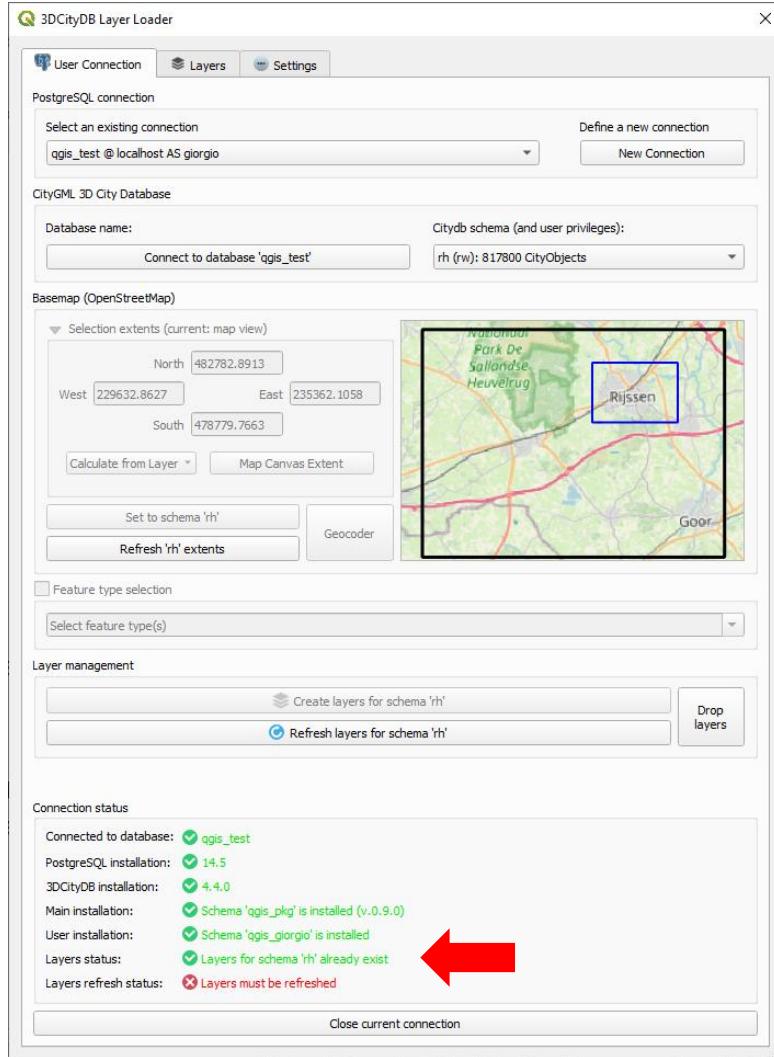


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6b) Create the layers

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



The screenshot shows the 3DCityDB Layer Loader interface. At the top, there are tabs for User Connection, Layers, and Settings. Under User Connection, it says "PostgreSQL connection" and "Select an existing connection: qgis_test @ localhost AS giorgio". There are buttons for "Define a new connection" and "New Connection". Below this, under "CityGML 3D City Database", the "Database name:" is set to "qgis_test" and the "Citydb schema (and user privileges):" is "rh (rw): 817800 CityObjects".

In the center, there's a "Basemap (OpenStreetMap)" section with a map view of a rural area. A blue rectangle highlights a specific location near a road and some buildings. To the left of the map are coordinates: North 482782.8913, West 229632.8627, East 235362.1058, South 478779.7663. Buttons for "Calculate from Layer", "Map Canvas Extent", "Set to schema 'rh'", and "Refresh 'rh' extents" are present. A "Geocoder" button is also visible.

Below the map, there's a "Feature type selection" section with a dropdown menu labeled "Select feature type(s)".

On the right side, under "Layer management", there are buttons for "Create layers for schema 'rh'" and "Refresh layers for schema 'rh'".

At the bottom, the "Connection status" section displays the following information:

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

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

At the very bottom, there's a "Close current connection" button.

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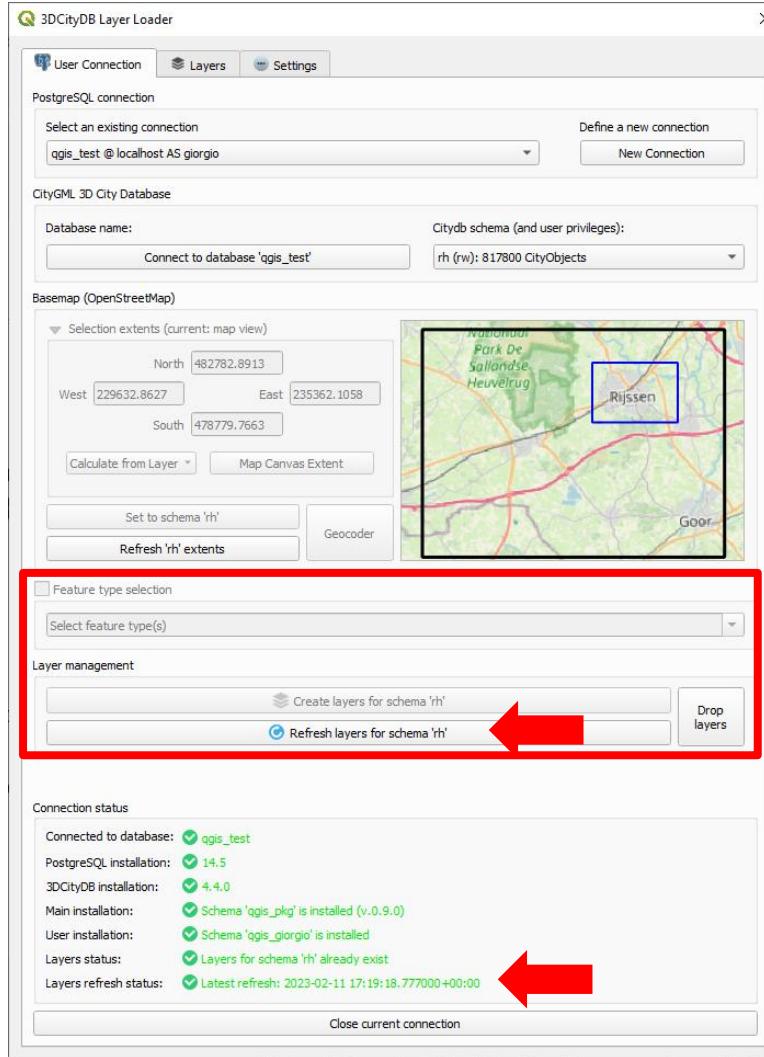
7) Populate/refresh the layers

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:

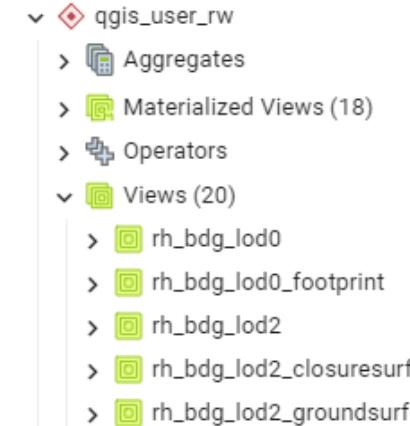
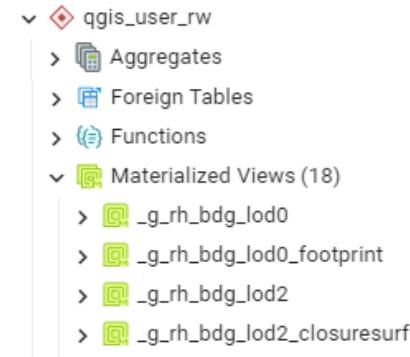
In the database user schema, both materialised views (containing the feature geometries) and the layers (as updatable views, containing the feature attributes linked to the corresponding geometries in the materialised views) can be accessed.

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)

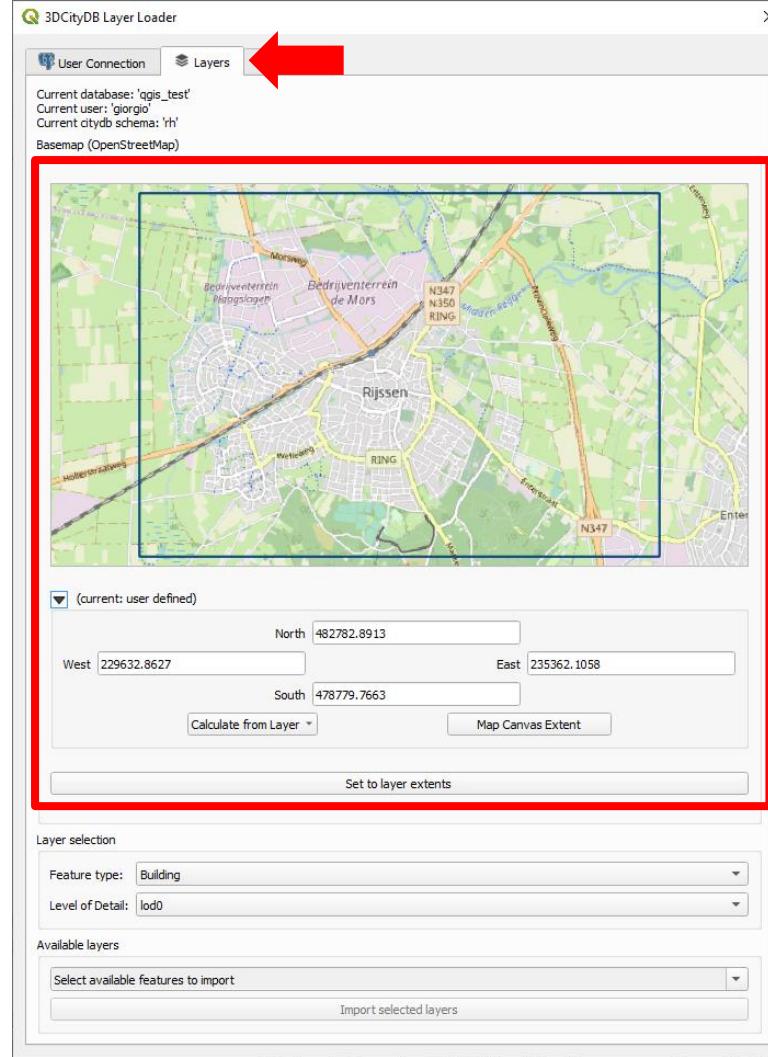


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In the "Layers" tab

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



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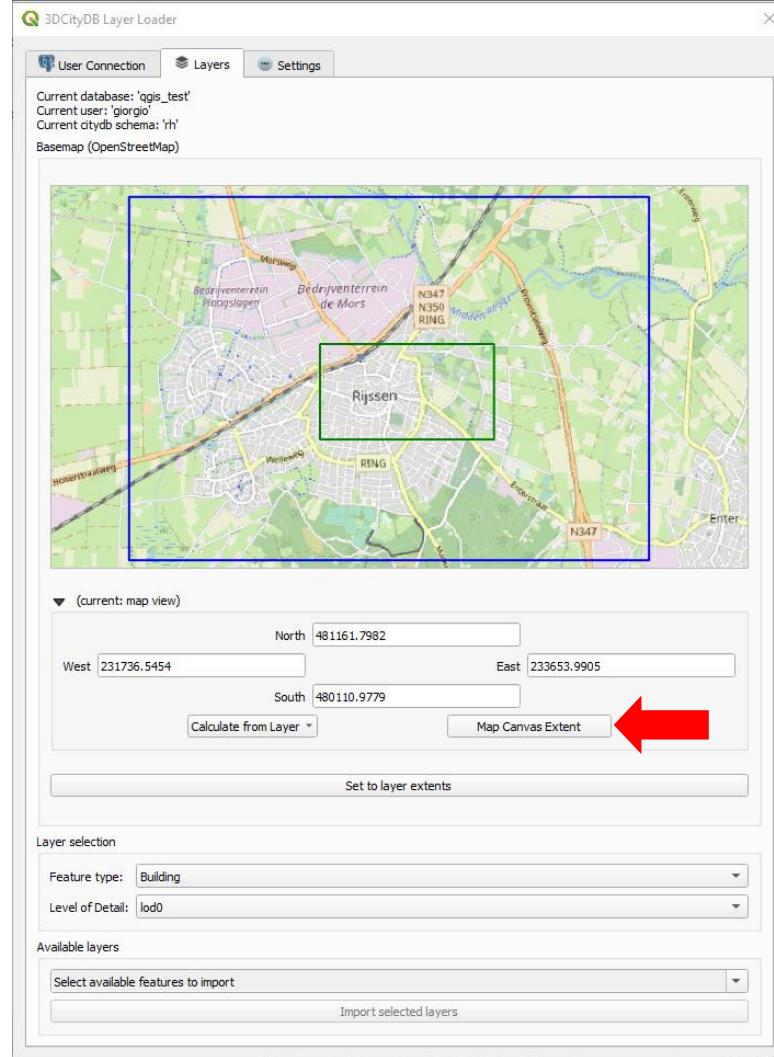
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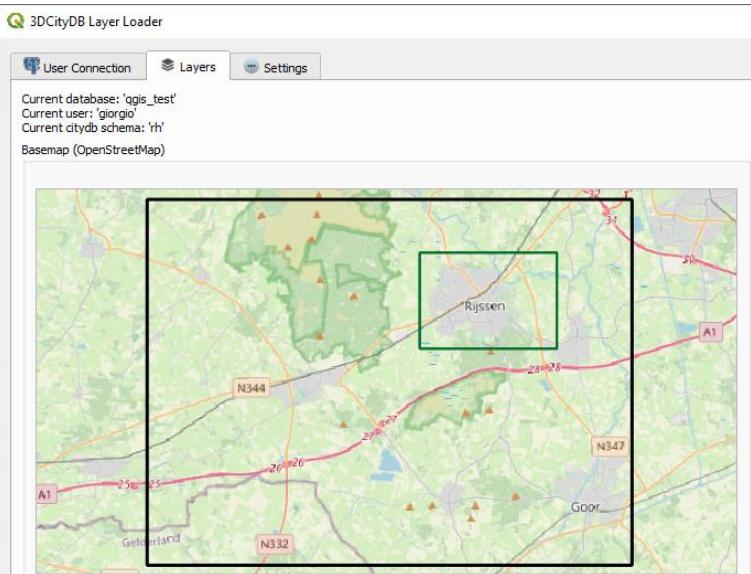
9) Depending on your needs, you can further reduce the extents of the layers to be loaded into QGIS by pressing the **Map Canvas Extent button**. The new extents are represented by the **green bounding box**.

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

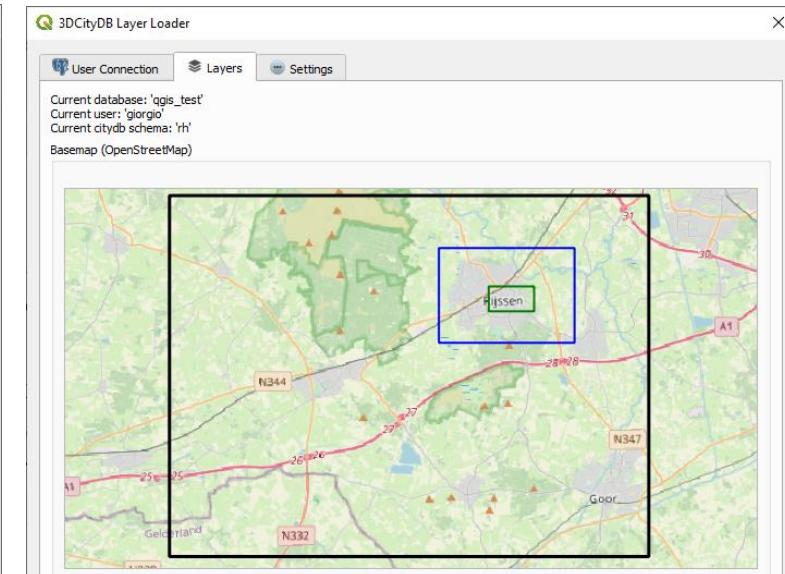


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Database- and QGIS-side extents coincide (default)



User-selected QGIS-layers extents

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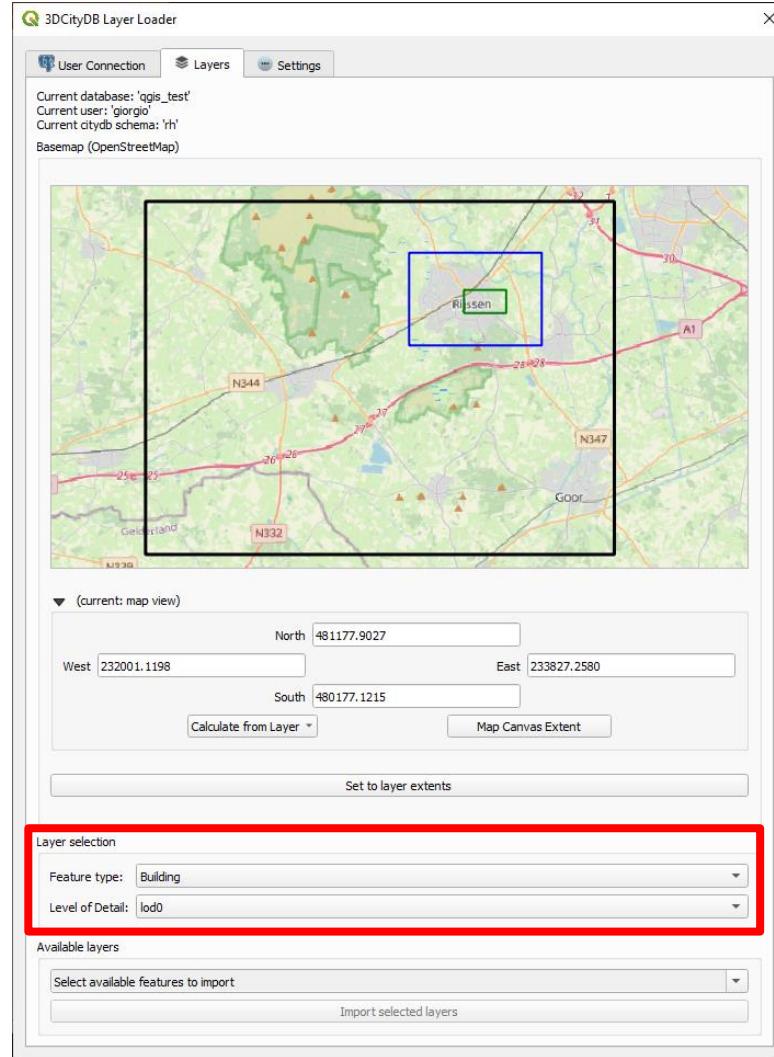
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Layer Loader

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**).

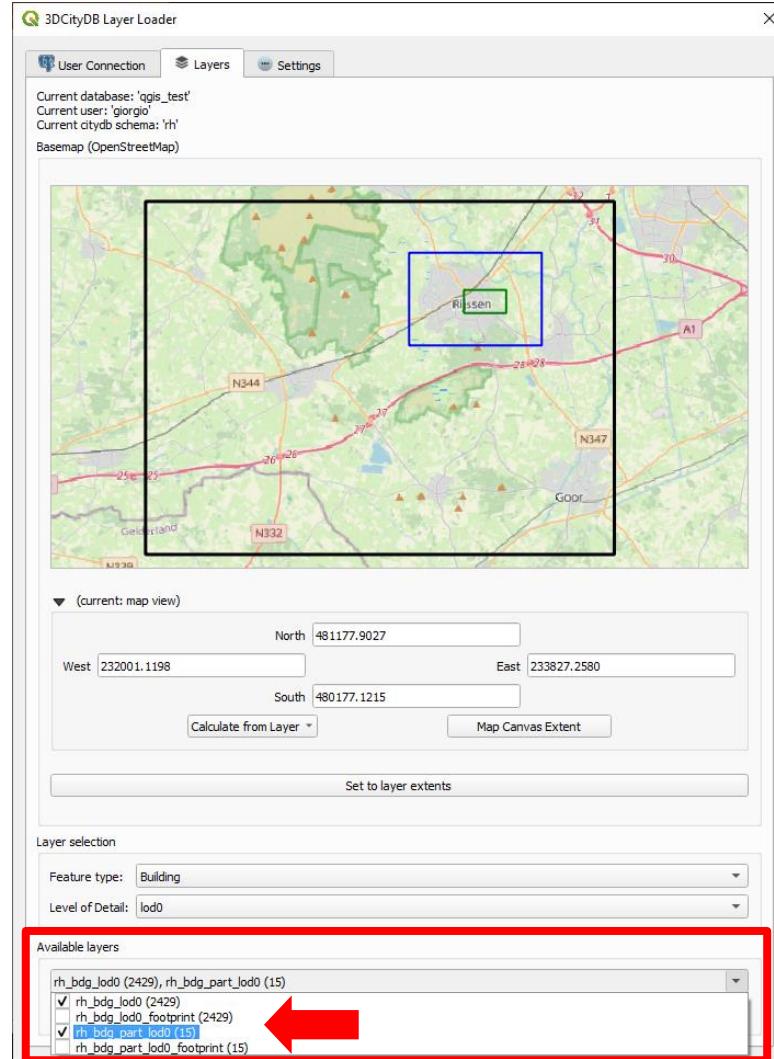


Layer Loader

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

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

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

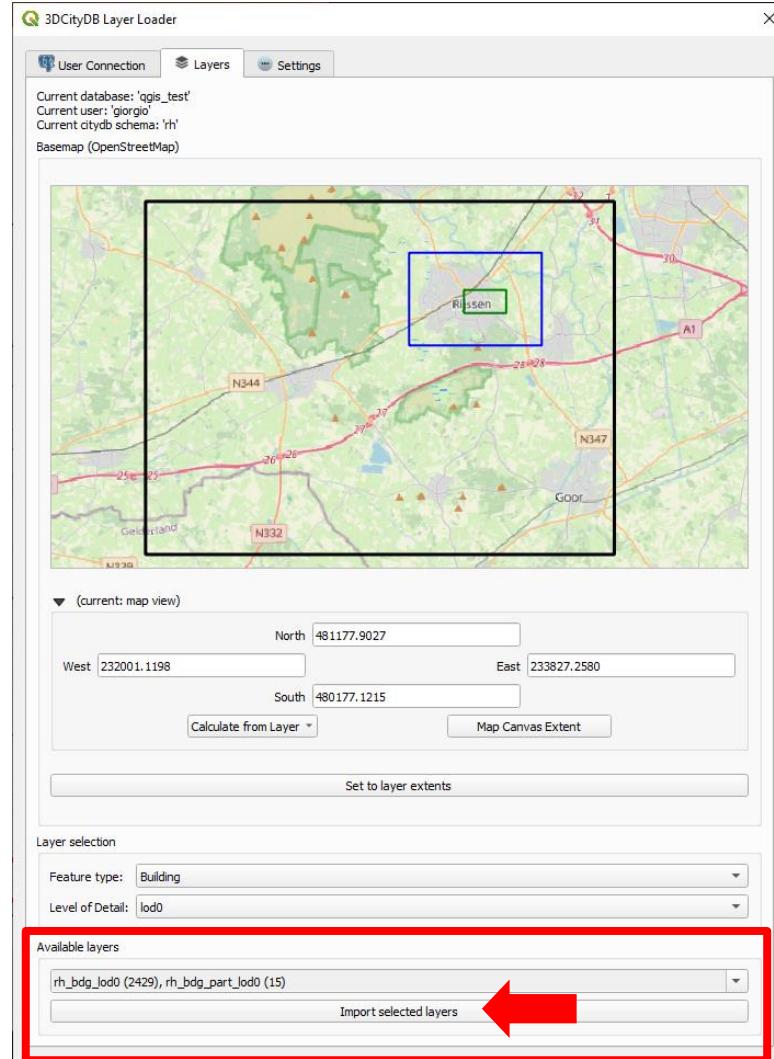


Layer Loader

12) 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)

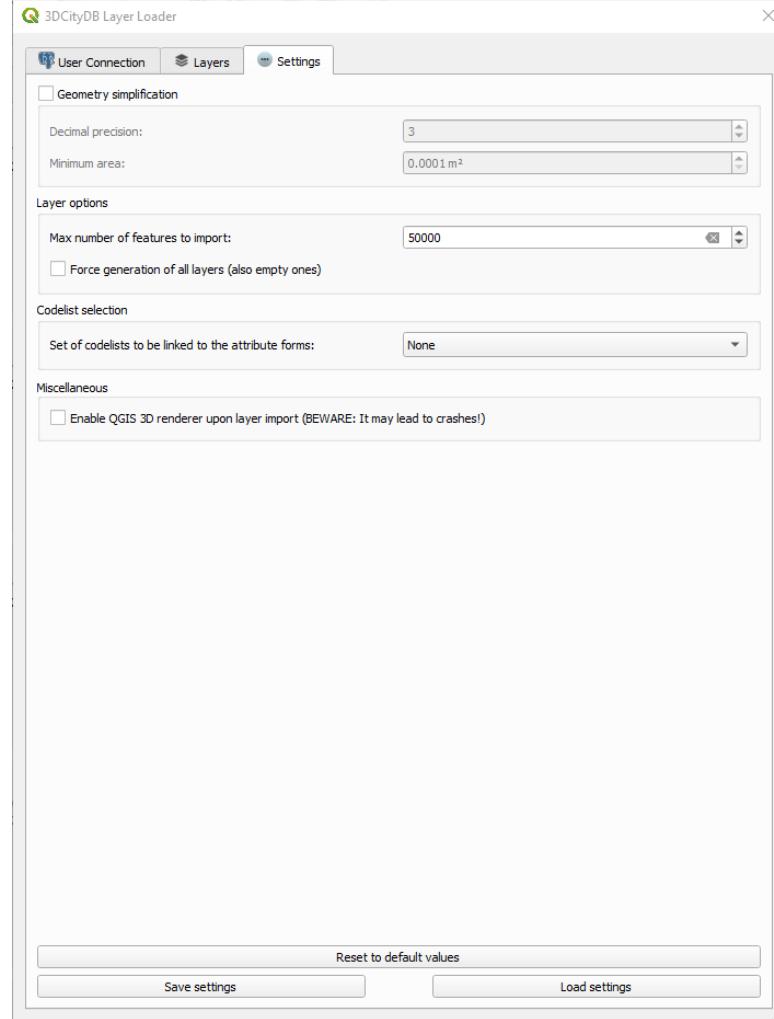
Nota bene: Layers that have already been loaded can be selected, but won't be loaded again



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 (see next slide)
- 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
- The **Codelist selection** allows to load codelists and set up the attribute forms accordingly (see next slides)
- In the **Miscellaneous box**, the user can force the 3D rendered to be enabled upon import of the selected layers, although this might lead to instabilities (see next slides)
- Settings can be saved, (re)loaded and reset to the default values.



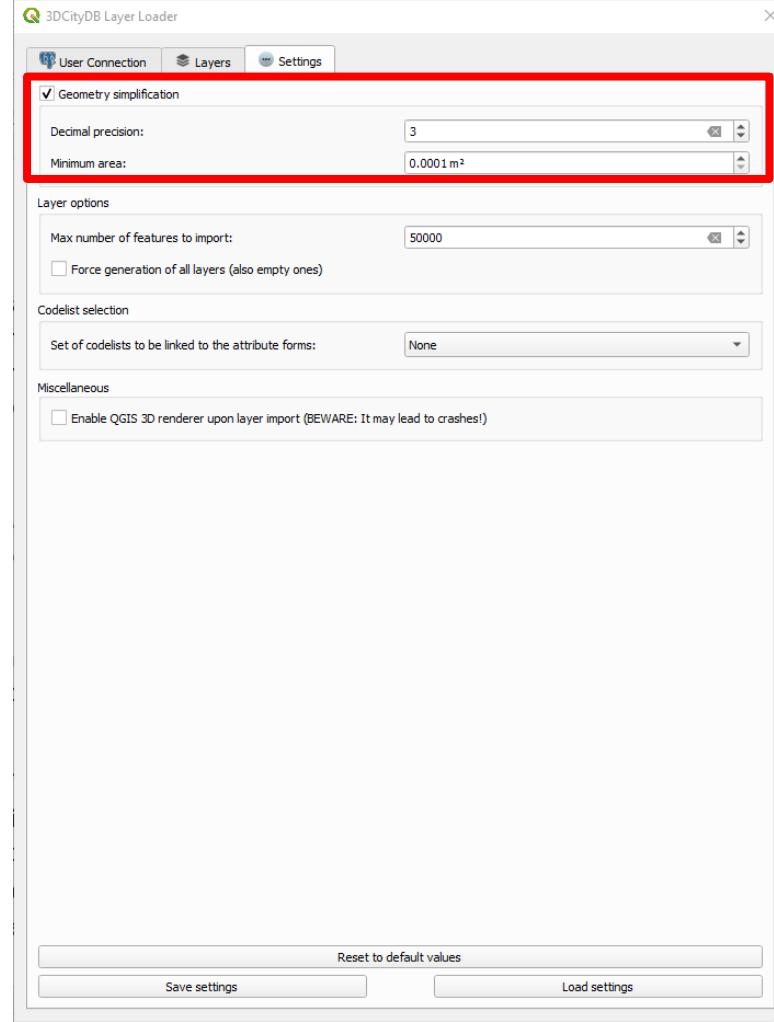
Geometry simplification

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

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

Beware! This operation:

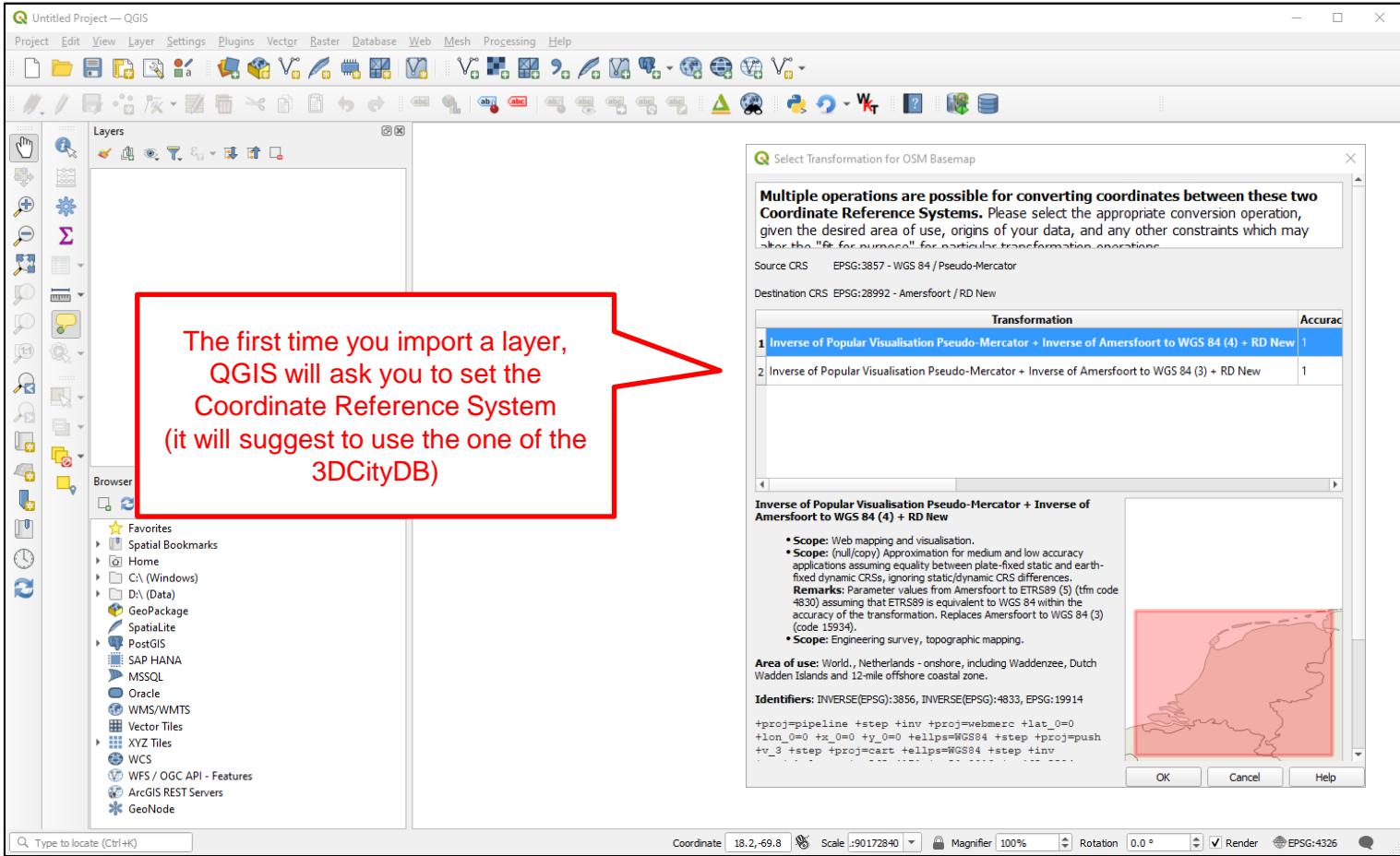
- can significantly increase the time needed to refresh the layers
- does NOT change the original data in the database!



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



The screenshot shows the QGIS interface with the 'Layers' panel open. A red box highlights a message in the center of the screen: "The first time you import a layer, QGIS will ask you to set the Coordinate Reference System (it will suggest to use the one of the 3DCityDB)". An arrow points from this message to the 'Select Transformation' dialog window.

Select Transformation for OSM Basemap

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

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
```

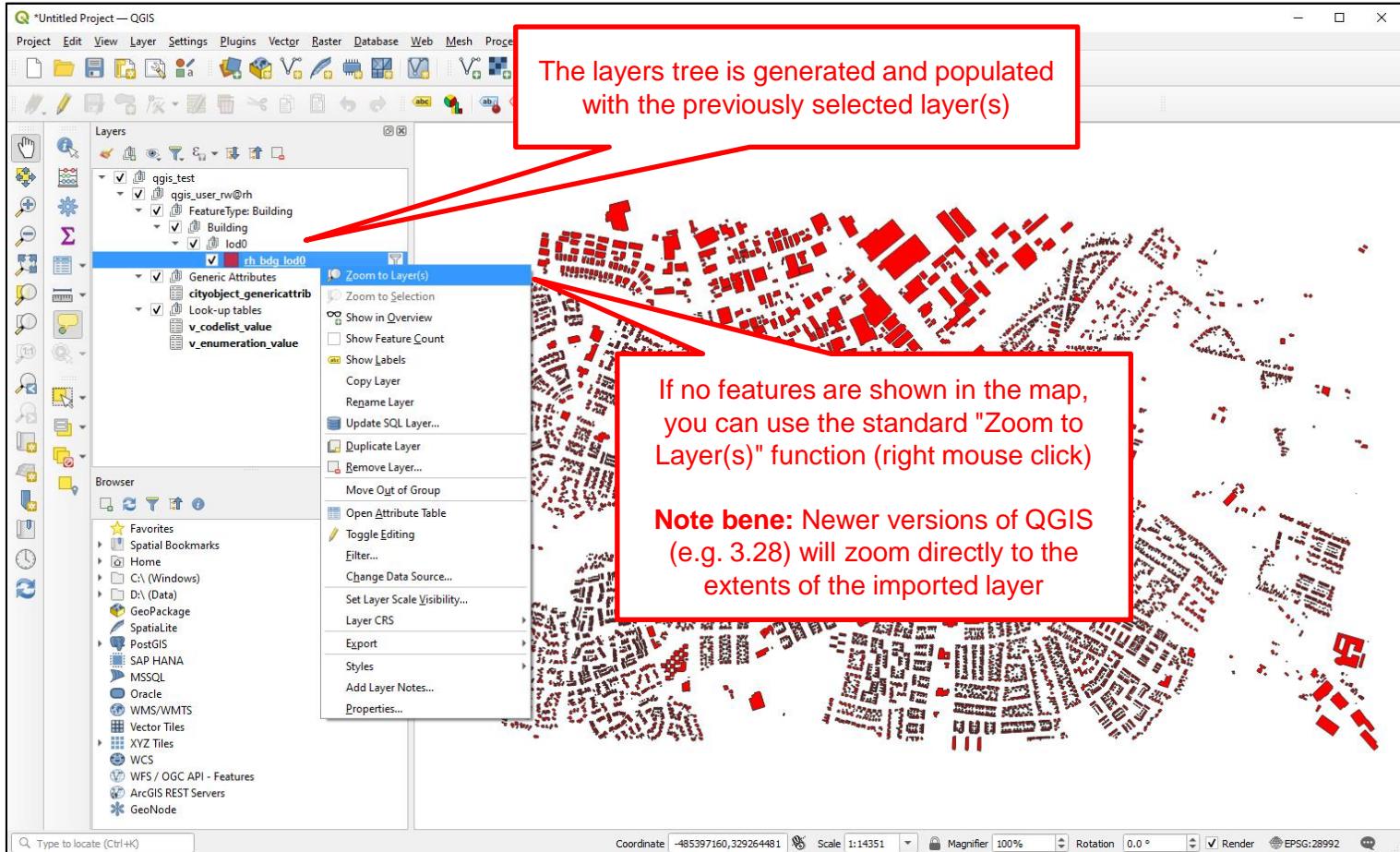
OK Cancel Help

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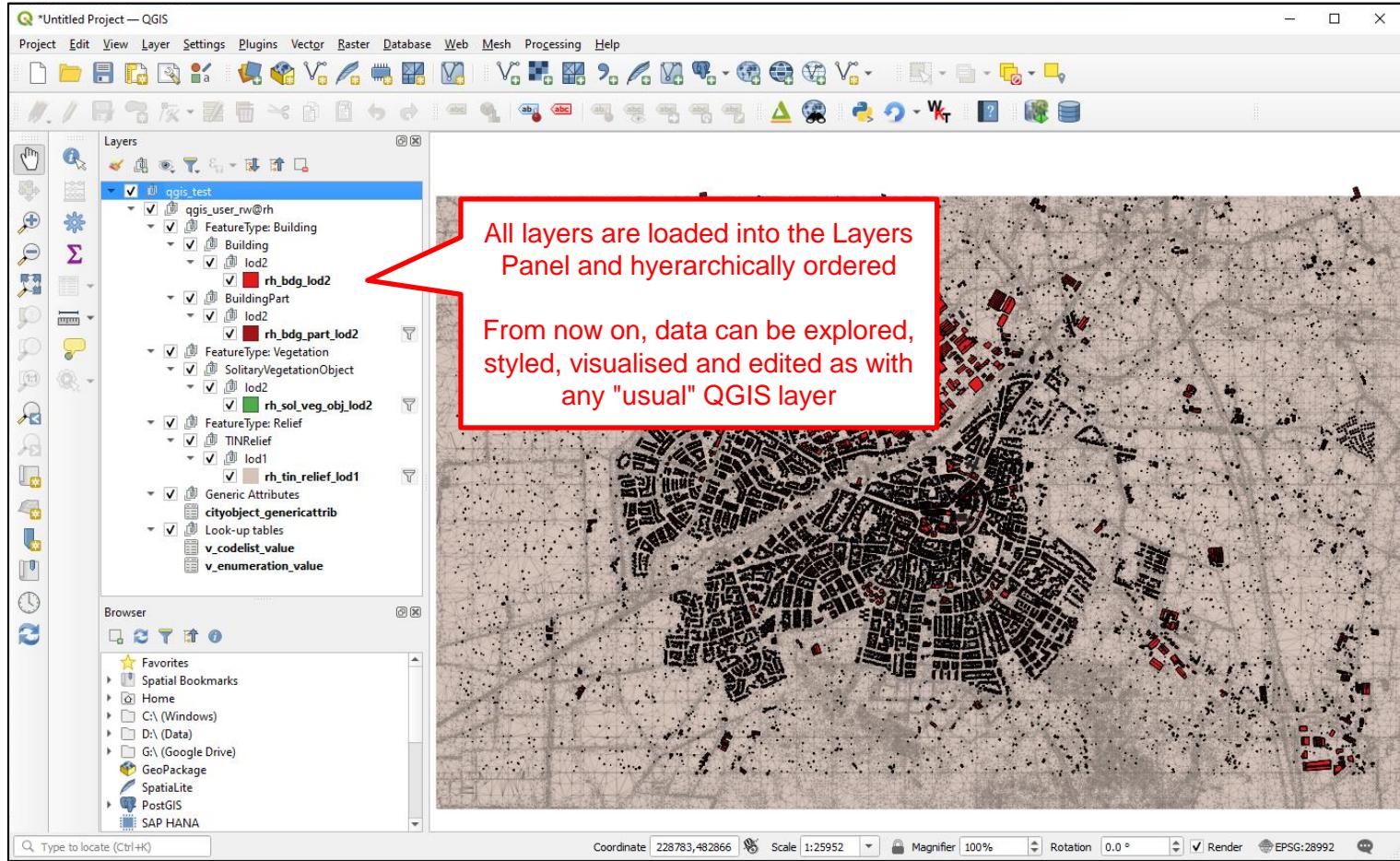


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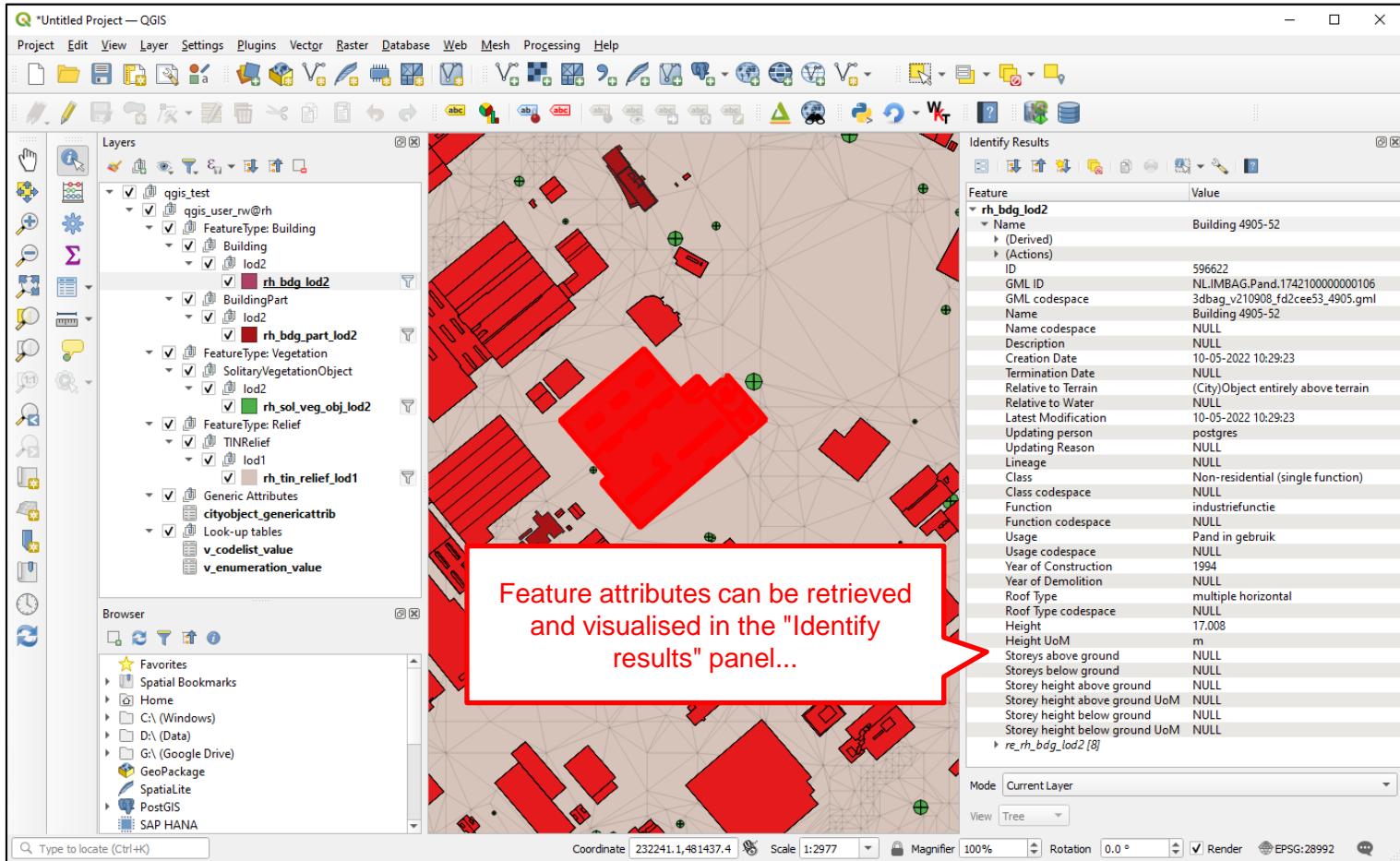
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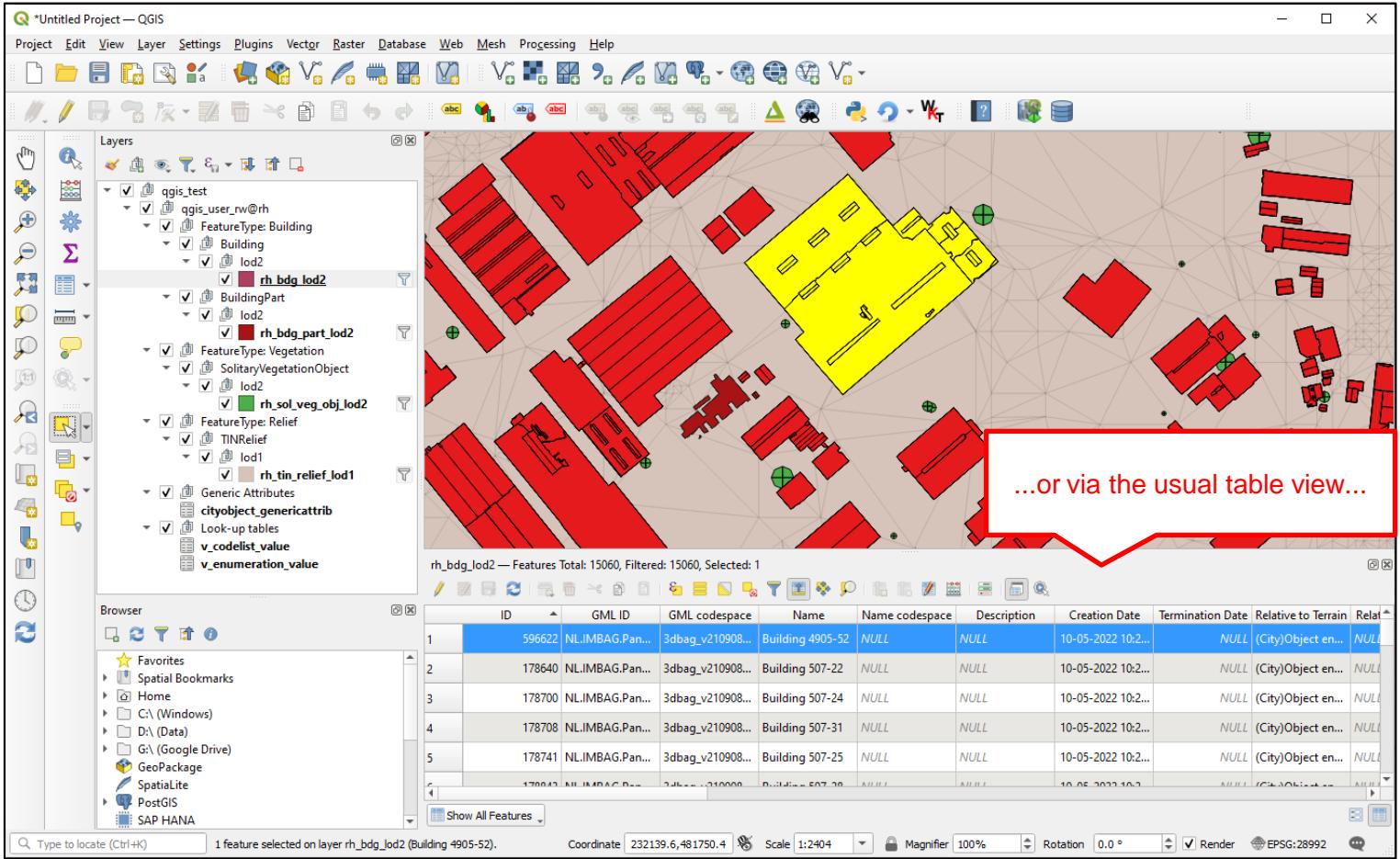
The screenshot shows the QGIS interface with a map view containing red polygonal buildings on a grey terrain background. The 'Identify Results' panel on the right displays detailed attributes for a selected feature. A red callout box points to this panel with the text: "Feature attributes can be retrieved 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, 481437.4
 Scale: 1:2977
 Magnifier
 100%
 Rotation: 0.0°
 Render
 EPSG:28992

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The screenshot shows a QGIS interface with the following elements:

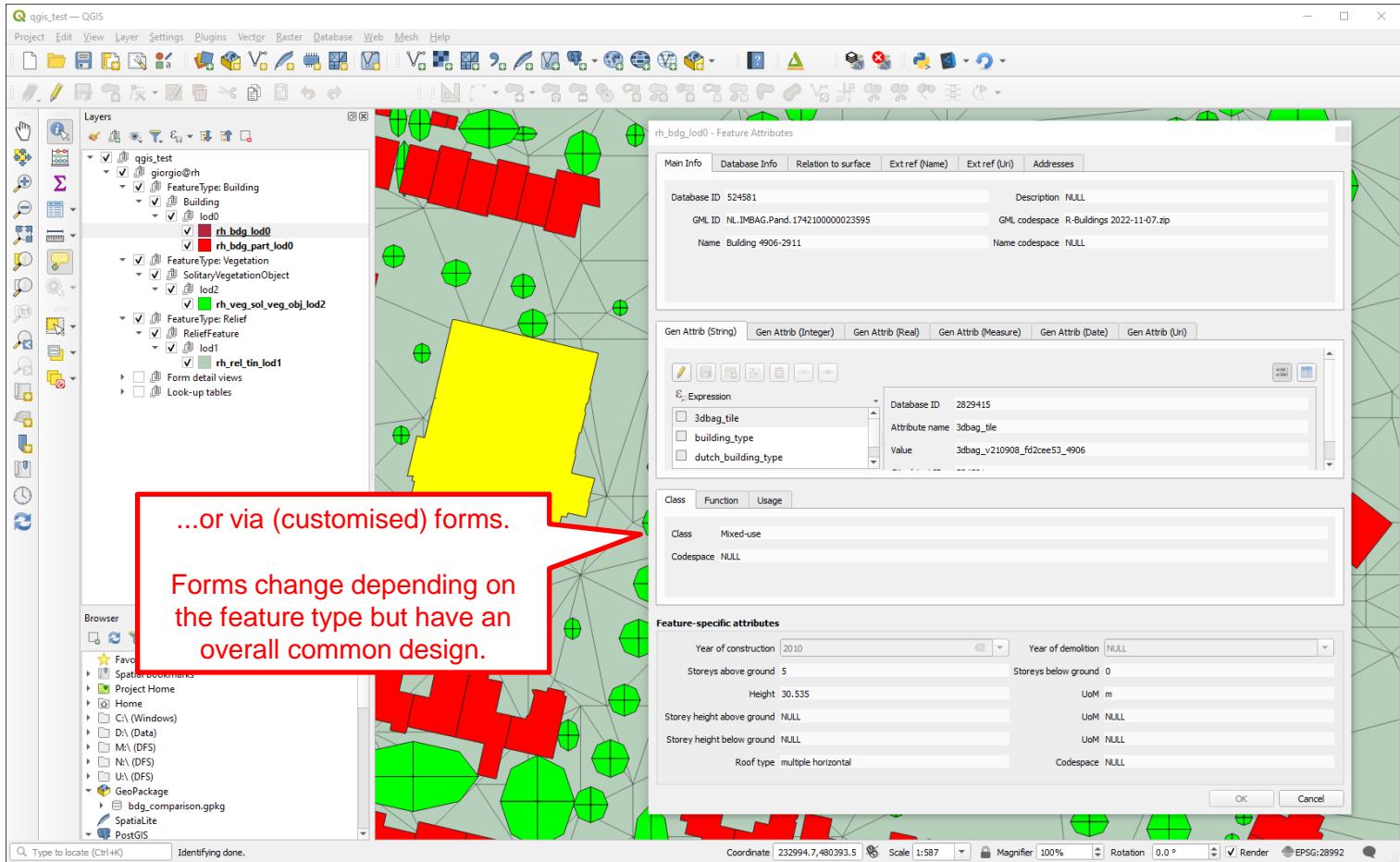
- Layers Panel:** Displays a tree structure of layers. The 'qgis_test' project contains several sub-layers under 'qgis_user_rw@rh', including 'Building', 'Vegetation', and 'Relief'. There are also 'lod2' and 'lod1' layers, as well as 'Generic Attributes' and 'Look-up tables'.
- Map View:** Shows a map of a residential area with buildings represented by red polygons and vegetation by yellow polygons. A specific building is highlighted in yellow.
- Table View:** A red box highlights a table at the bottom right showing the attributes of the selected feature. The table has columns: ID, GML ID, GML codespace, Name, Name codespace, Description, Creation Date, Termination Date, Relative to Terrain, and Relative to Map.
- Table Data:**

ID	GML ID	GML codespace	Name	Name codespace	Description	Creation Date	Termination Date	Relative to Terrain	Relative to Map
1	596622	NL.1MBAG.Pan...	3dbag_v210908..	Building 4905-52	NULL	NULL	10-05-2022 10:2...	NULL	(City)Object en...
2	178640	NL.1MBAG.Pan...	3dbag_v210908..	Building 507-22	NULL	NULL	10-05-2022 10:2...	NULL	(City)Object en...
3	178700	NL.1MBAG.Pan...	3dbag_v210908..	Building 507-24	NULL	NULL	10-05-2022 10:2...	NULL	(City)Object en...
4	178708	NL.1MBAG.Pan...	3dbag_v210908..	Building 507-31	NULL	NULL	10-05-2022 10:2...	NULL	(City)Object en...
5	178741	NL.1MBAG.Pan...	3dbag_v210908..	Building 507-25	NULL	NULL	10-05-2022 10:2...	NULL	(City)Object en...
- Bottom Bar:** Includes a search bar ('Type to locate (Ctrl+K)'), coordinate information ('Coordinate 232139.6,481750.4'), scale ('Scale 1:2404'), magnifier ('Magnifier 100%'), rotation ('Rotation 0.0°'), and projection ('EPSG:28992').

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

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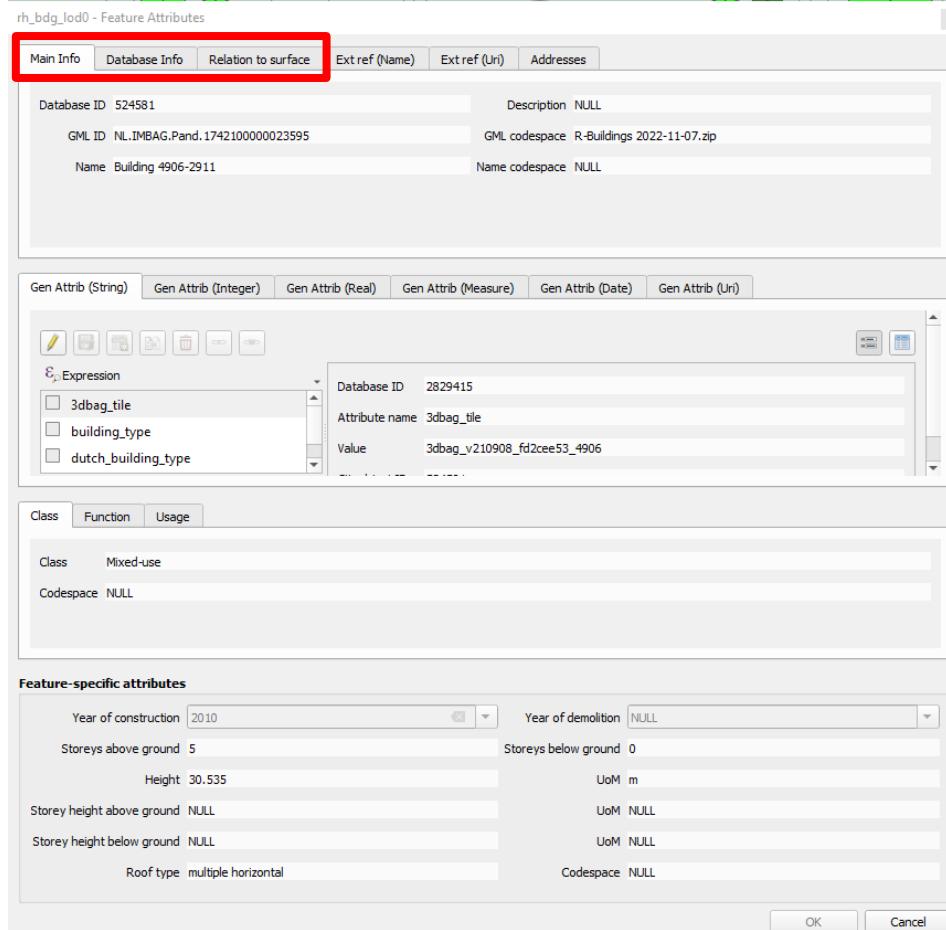
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Attributes are grouped into tabs.

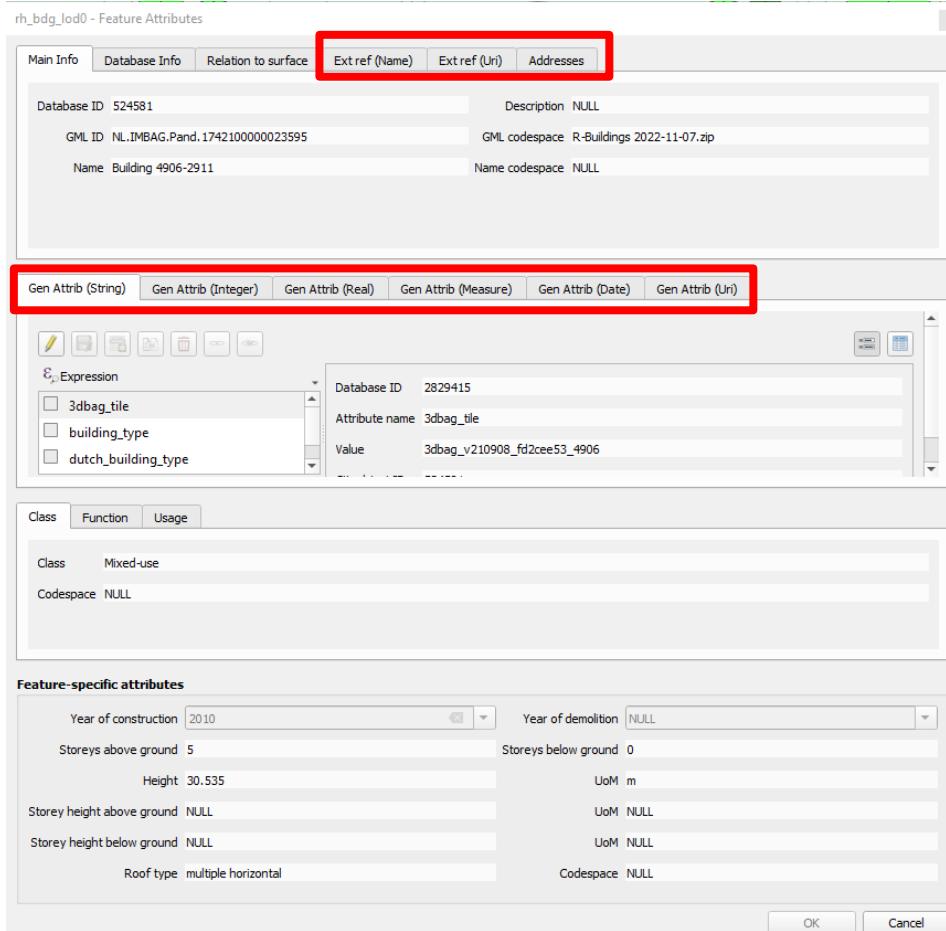


The screenshot shows the QGIS Attribute Editor for a feature named "Building 4906-2911". The top tab bar includes "Main Info", "Database Info", "Relation to surface", "Ext ref (Name)", "Ext ref (Uri)", and "Addresses". The "Main Info" tab is selected, displaying basic information like Database ID (524581), GML ID (NL.IMBAG.Pand.1742100000023595), 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 "Class" 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), Storeys above ground (5), Height (30.535), Storey height above ground (NULL), Storey height below ground (NULL), Roof type (multiple horizontal), Year of demolition (NULL), Storeys below ground (0), Height (NULL), and Roof type (NULL).

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



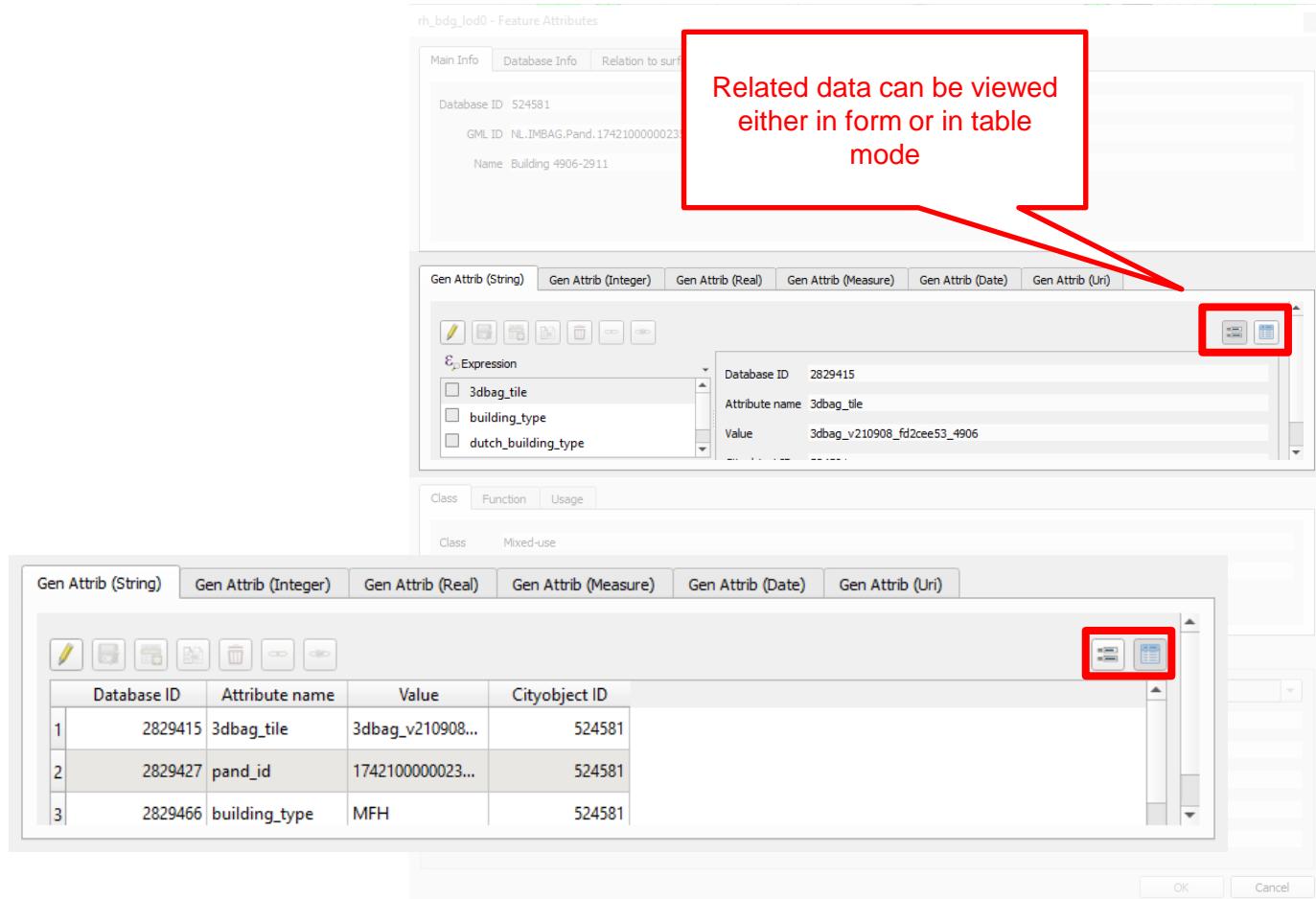
The screenshot shows the 'Feature Attributes' dialog box in QGIS. The top navigation bar includes tabs for 'Main Info', 'Database Info', 'Relation to surface', 'Ext ref (Name)', 'Ext ref (Uri)', and 'Addresses'. The 'Ext ref (Name)' tab is currently selected and highlighted with a red border. Below this, there are sections for 'Gen Attrib (String)', 'Gen Attrib (Integer)', 'Gen Attrib (Real)', 'Gen Attrib (Measure)', 'Gen Attrib (Date)', and 'Gen Attrib (Uri)'. The 'Expression' section displays three entries: '3dbag_tile', 'building_type', and 'dutch_building_type', each with a checkbox and a value field. The 'Class' section shows 'Class' as 'Mixed-use' and 'Codespace' as 'NULL'. The bottom section, 'Feature-specific attributes', contains fields for 'Year of construction' (2010), 'Storeys above ground' (5), 'Height' (30.535), 'Storey height above ground' (NULL), 'Storey height below ground' (NULL), 'Roof type' (multiple horizontal), 'Year of demolition' (NULL), 'Storeys below ground' (0), 'Height m' (NULL), 'Storey height above ground m' (NULL), 'Storey height below ground m' (NULL), and 'Codespace' (NULL). Buttons for 'OK' and 'Cancel' are at the bottom right.

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Use in QGIS: Attributes



The screenshot shows the QGIS Attribute Editor for a feature named "Building 4906-2911". The top part displays "Feature Attributes" with tabs for Main Info, Database Info, and Relation to surface. The Main Info tab shows Database ID 524581, GML ID NL.IMBAG.Pand.1742100000023, and Name Building 4906-2911. A red box highlights the "Form" button in the bottom right corner of the editor window.

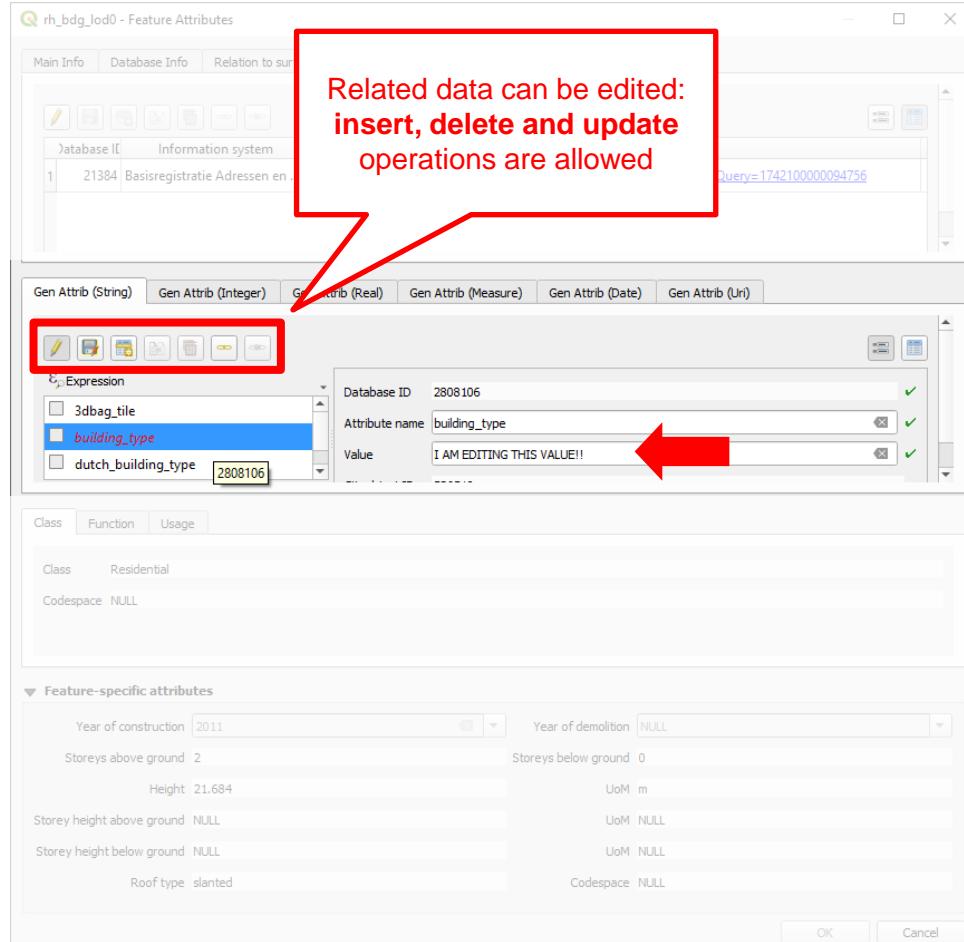
The bottom part shows the attribute table with three rows:

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

A red box highlights the "Table" button in the bottom right corner of the attribute table interface. A red callout box points from the "Table" button to the text: "Related data can be viewed either in form or in table mode".

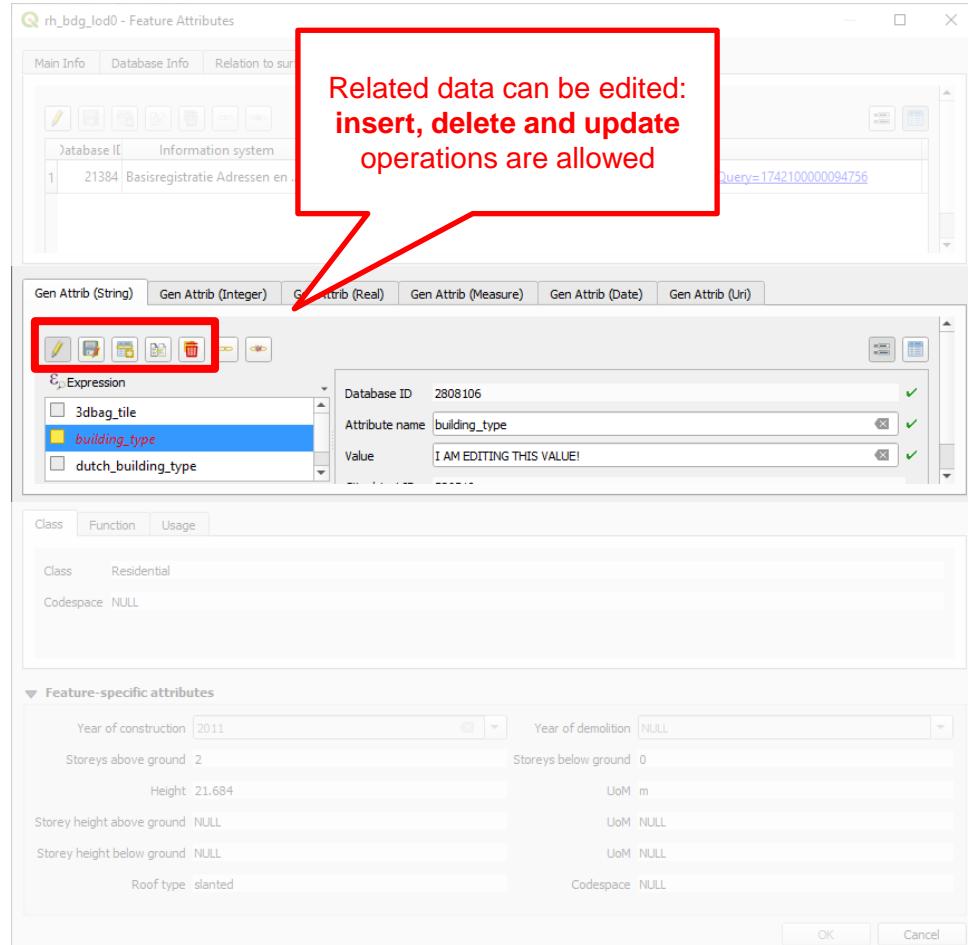
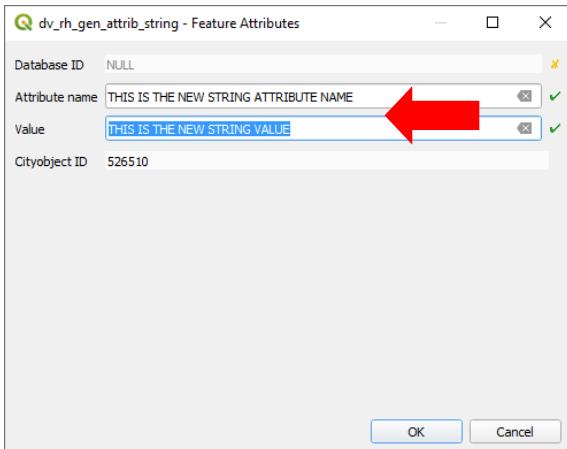
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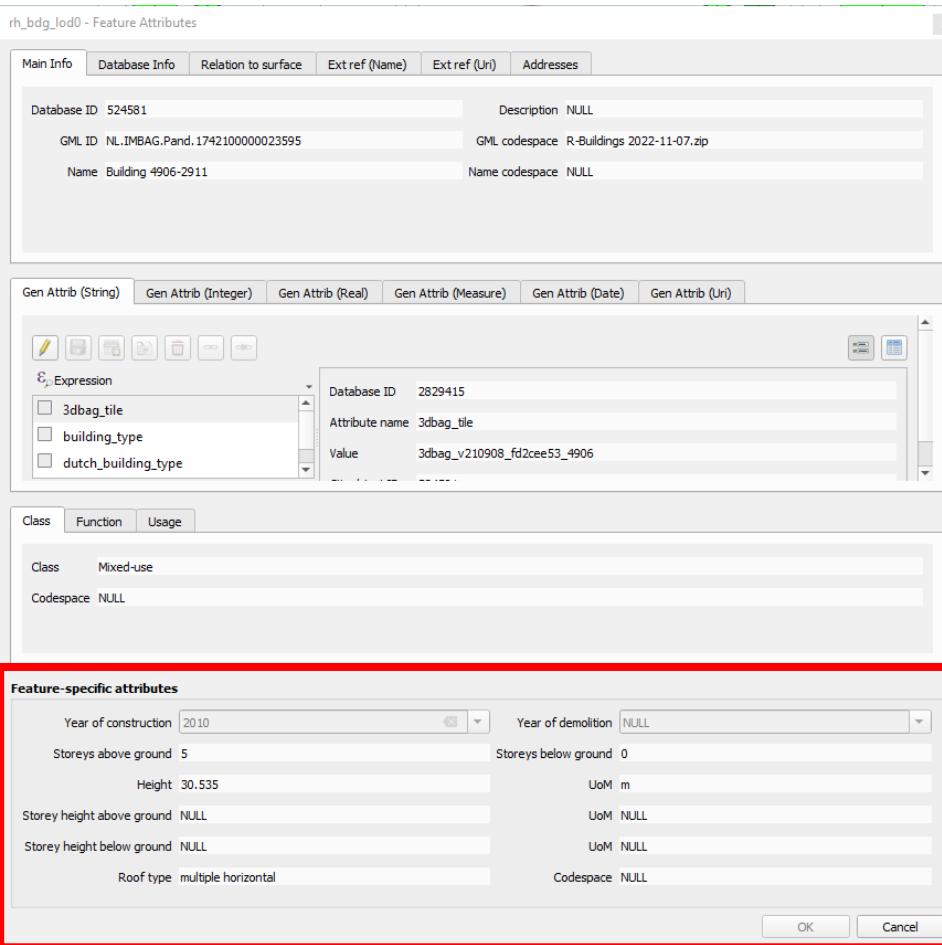


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Use in QGIS: Attributes



The screenshot shows the QGIS Attribute Editor interface. At the top, there's a header bar with tabs: Main Info, Database Info, Relation to surface, Ext ref (Name), Ext ref (Uri), and Addresses. Below this, the Main Info tab is active, displaying database details like Database ID (524581), GML ID (NL.IMGAG.Pand.1742100000023595), Name (Building 4906-2911), Description (NULL), and codespace information (GML codespace: R-Buildings 2022-11-07.zip, Name codespace: NULL).

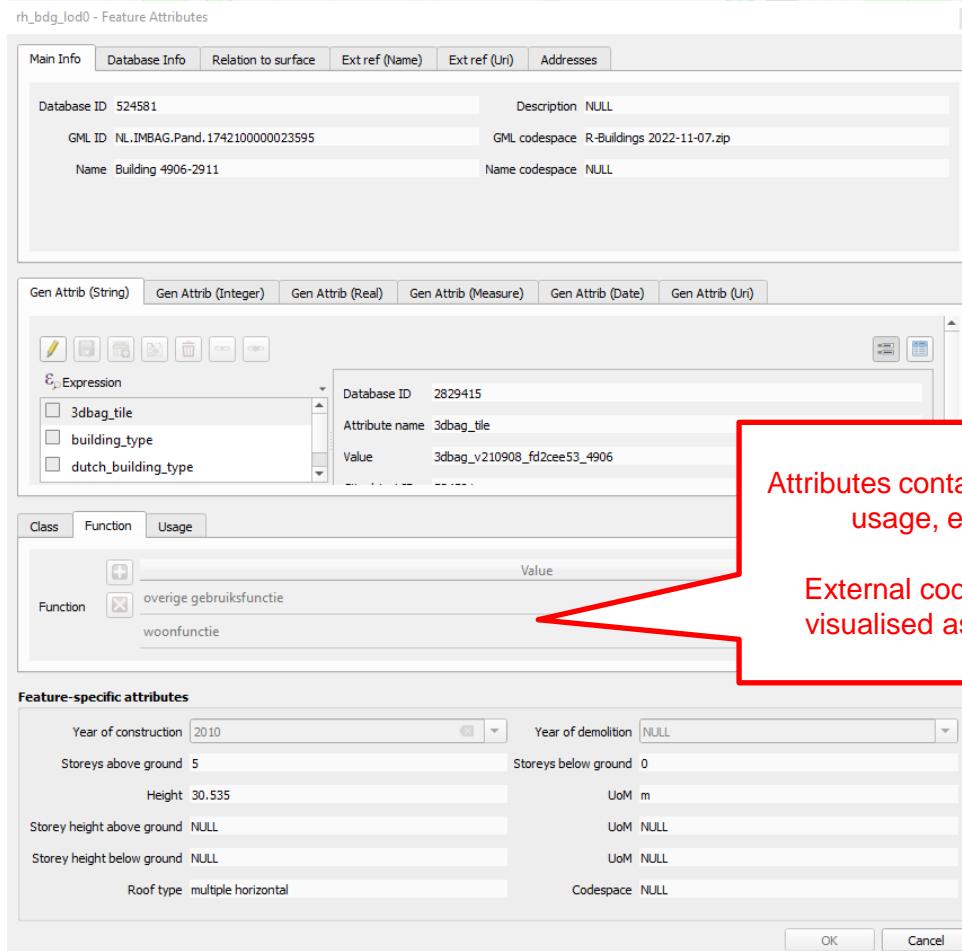
A red box highlights the lower section of the interface, which contains a table for "Feature-specific attributes". This table includes fields such as Year of construction (2010), Storeys above ground (5), Height (30.535), Storey height above ground (NULL), Storey height below ground (NULL), Roof type (multiple horizontal), Year of demolition (NULL), Storeys below ground (0), and Codespace (NULL). Buttons for OK and Cancel are at the bottom right of this dialog.

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

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
Codespace	NULL

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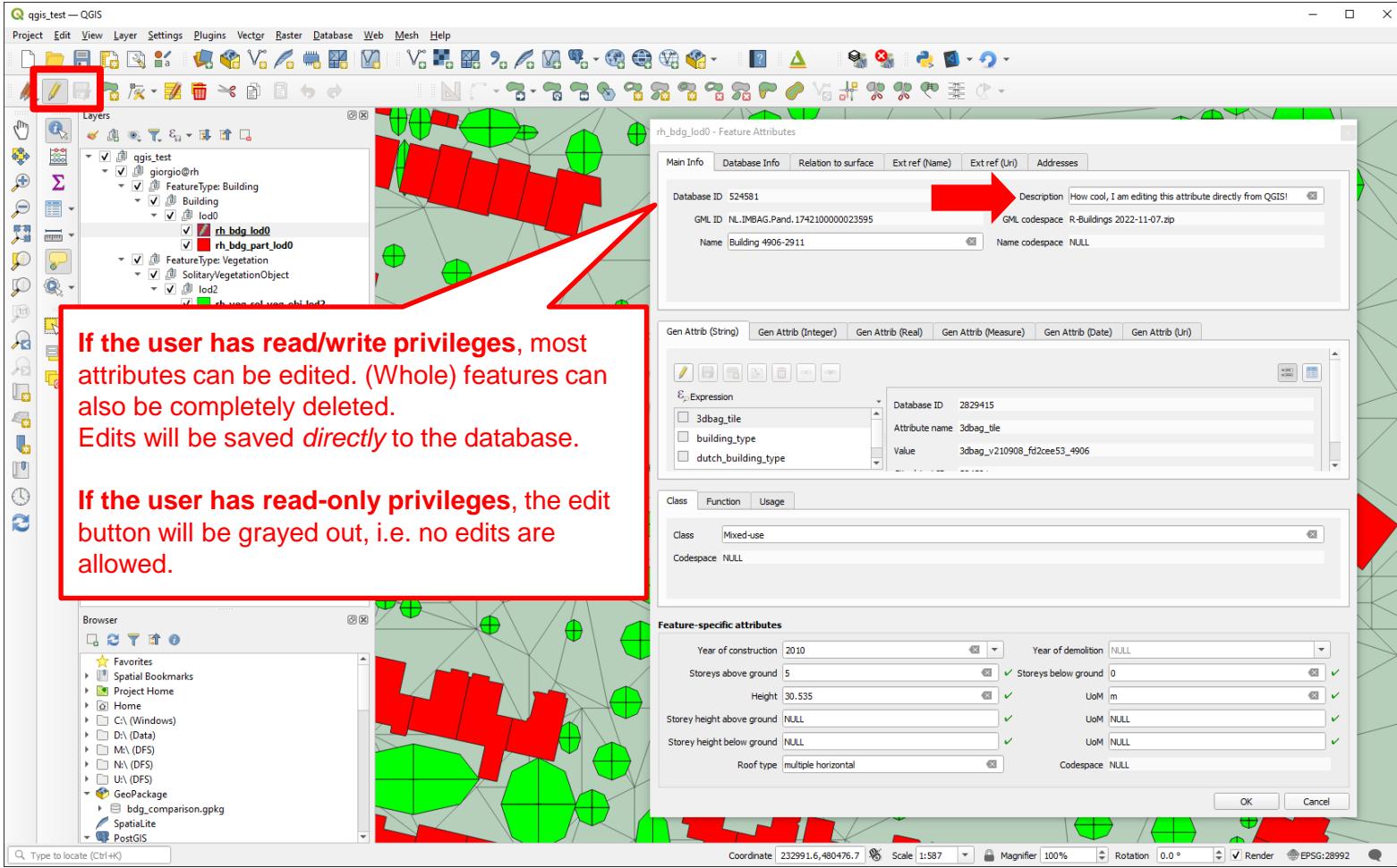


Attributes containing [0..*] entries (e.g. function, usage, etc.) are presented as lists.

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

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The screenshot shows the QGIS interface with a building layer selected. A red box highlights the edit icon in the toolbar. A red arrow points from the edit icon to the 'Edit ref (Name)' tab in the 'Feature Attributes' dialog, which is open for a building feature named 'Building 4906-2911'. The dialog shows the database ID (524581), GML ID (NL_IMBAG.Pand.1742100000023595), and name. The 'Edit ref (Name)' tab is active, and a red arrow points to the 'Description' field containing the text 'How cool, I am editing this attribute directly from QGIS!'. Below the main info, there are tabs for 'Gen Attrib (String)', 'Gen Attrib (Integer)', etc., and a table showing attribute values like '3dbag_tile' and 'building_type'. Another red box highlights the 'Edit ref (Name)' tab in the dialog. A red arrow points from the 'Edit ref (Name)' tab to the 'Edit ref (Name)' tab in the 'Feature-specific attributes' dialog at the bottom, which lists various building attributes with their current values.

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.

Feature Attributes

Main Info	Database Info	Relation to surface	Ext ref (Name)	Ext ref (Un)	Addresses
Database ID: 524581	Description: How cool, I am editing this attribute directly from QGIS!				
GML ID: NL_IMBAG.Pand.1742100000023595	GML codespace: R-Buildings 2022-11-07.zip				
Name: Building 4906-2911	Name codespace: NULL				

Gen Attrib (String) Gen Attrib (Integer) Gen Attrib (Real) Gen Attrib (Measure) Gen Attrib (Date) Gen Attrib (Un)

Attribute	Value
3dbag_tile	2829415
building_type	
dutch_building_type	3dbag_v210908_fd2cee53_4906

Class Function Usage

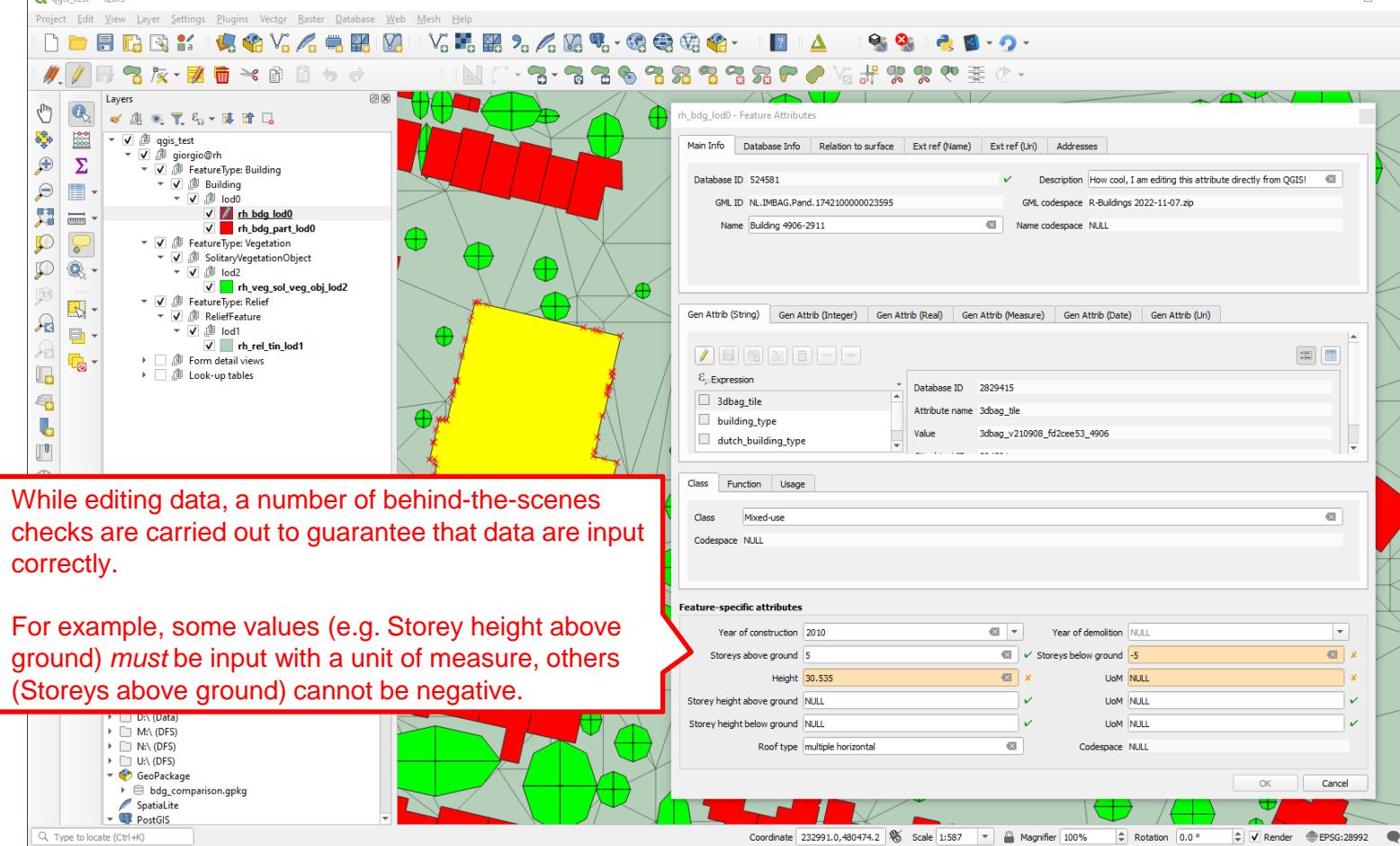
Class	Mixed-use
Codespace	NULL

Feature-specific attributes

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

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The screenshot shows the QGIS interface with a map view displaying buildings and vegetation. A context menu is open over a red building, showing options like 'Edit feature' and 'Attribute table'. The 'Attribute table' option is highlighted.

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

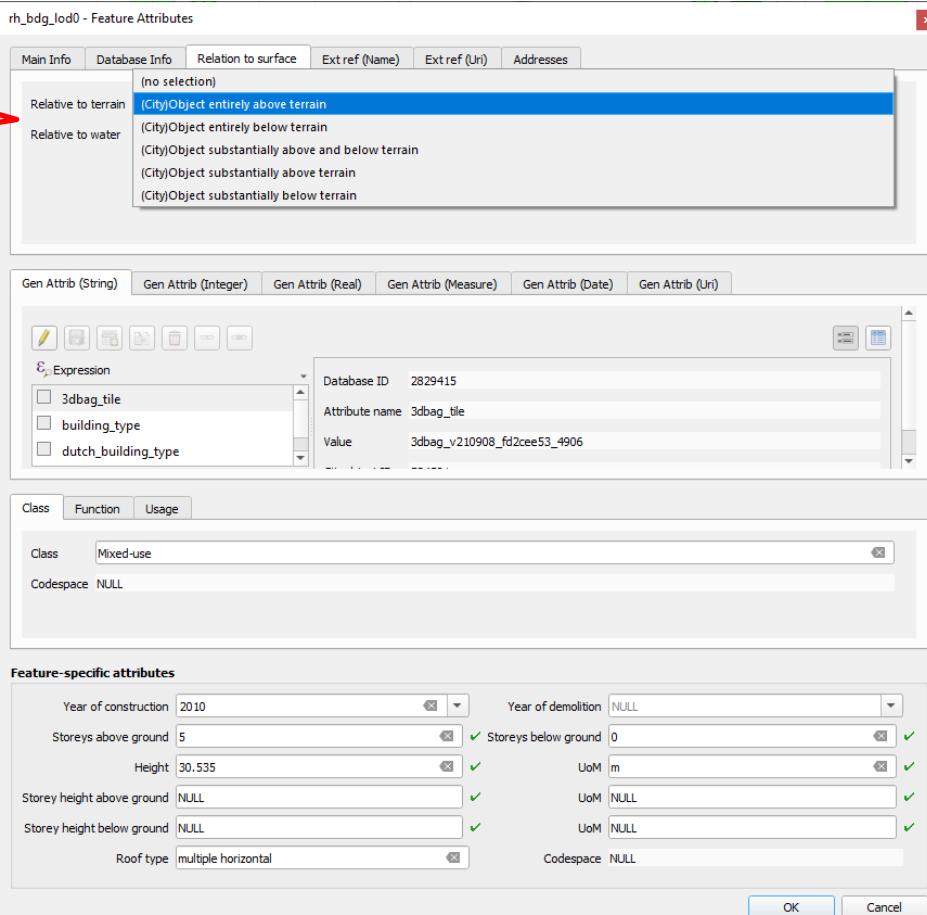
For example, some values (e.g. Storey height above ground) *must* be input with a unit of measure, others (Storeys above ground) cannot be negative.

The 'Feature Attributes' dialog is open, showing the 'Main Info' tab. The 'Name' field contains 'Building 4906-2911'. The 'Gen Attrib (String)' tab shows an expression for '3dbag_tile' with value '3dbag_v210908_fd2ceef53_4906'. The 'Feature-specific attributes' tab includes fields for 'Year of construction' (2010), 'Storeys above ground' (5), 'Height' (30.535), and 'Roof type' (multiple horizontal). A note at the bottom right of the dialog says 'How cool, I am editing this attribute directly from QGIS!'.

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



Use in QGIS: Codelist support

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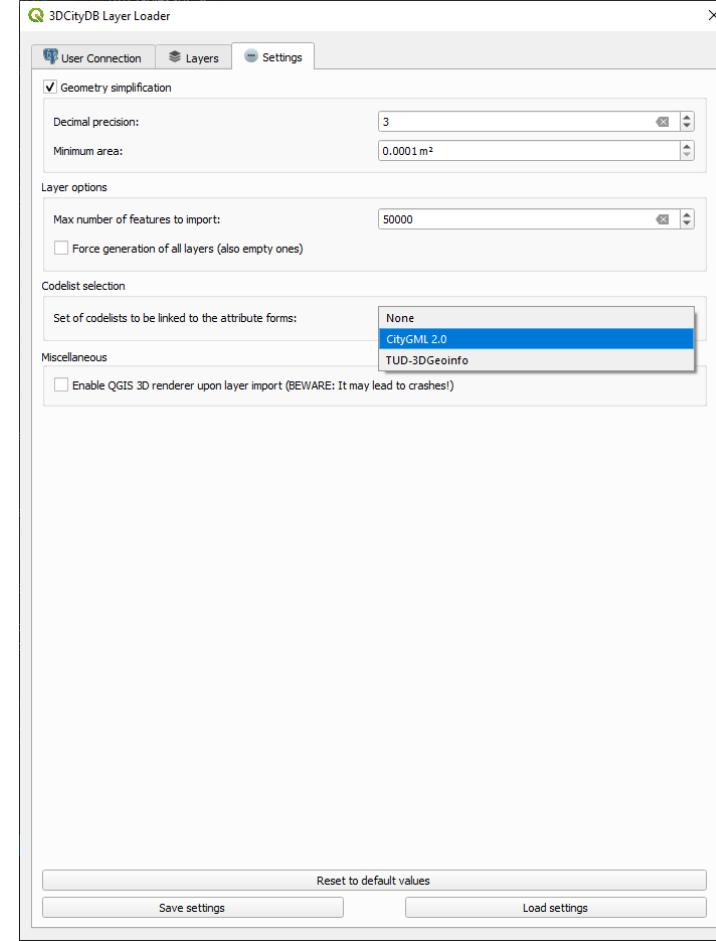
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Codelists can be selected upon layer import

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

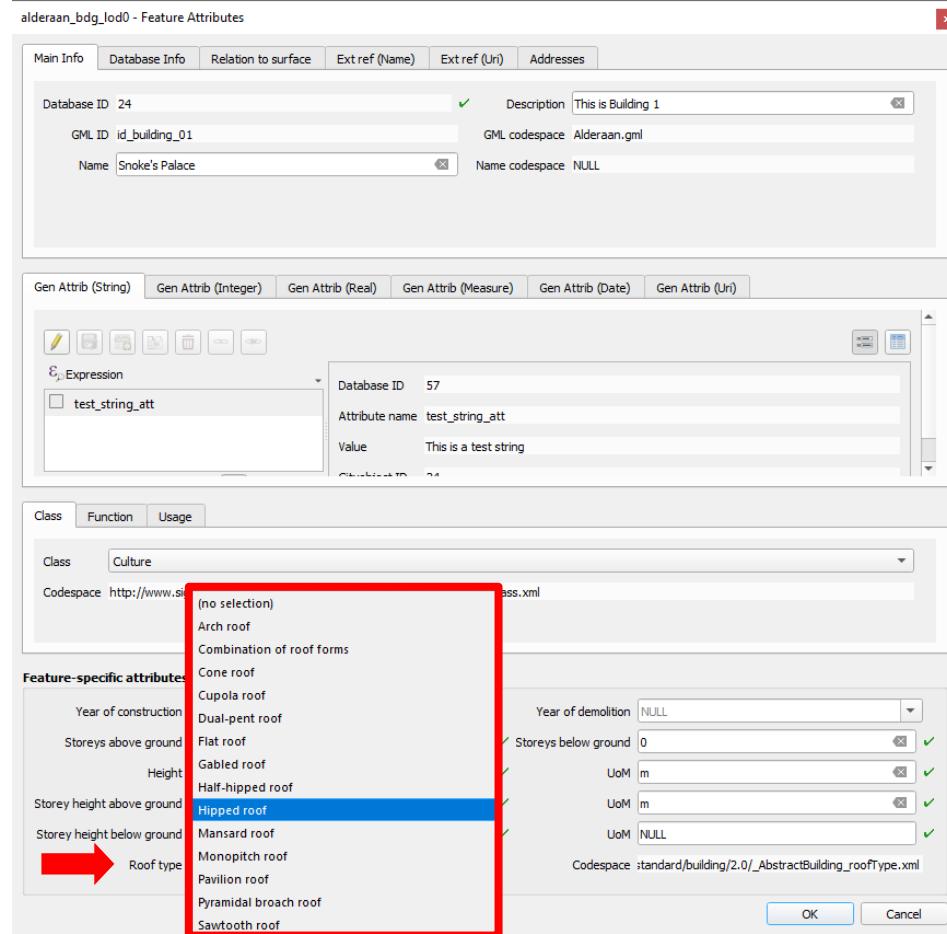
Codelists can be added and customised either by the database administrator or by the user (see **Advanced options**)



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 feature with Database ID 24, named 'Snake's Palace'. The 'Gen Attrib (String)' tab is active, displaying an attribute named 'test_string_att' with value 'This is a test string'. In the 'Feature-specific attributes' section, there is a dropdown menu labeled 'Roof type' with a red arrow pointing to it. A red box highlights the list of available roof types, which includes:

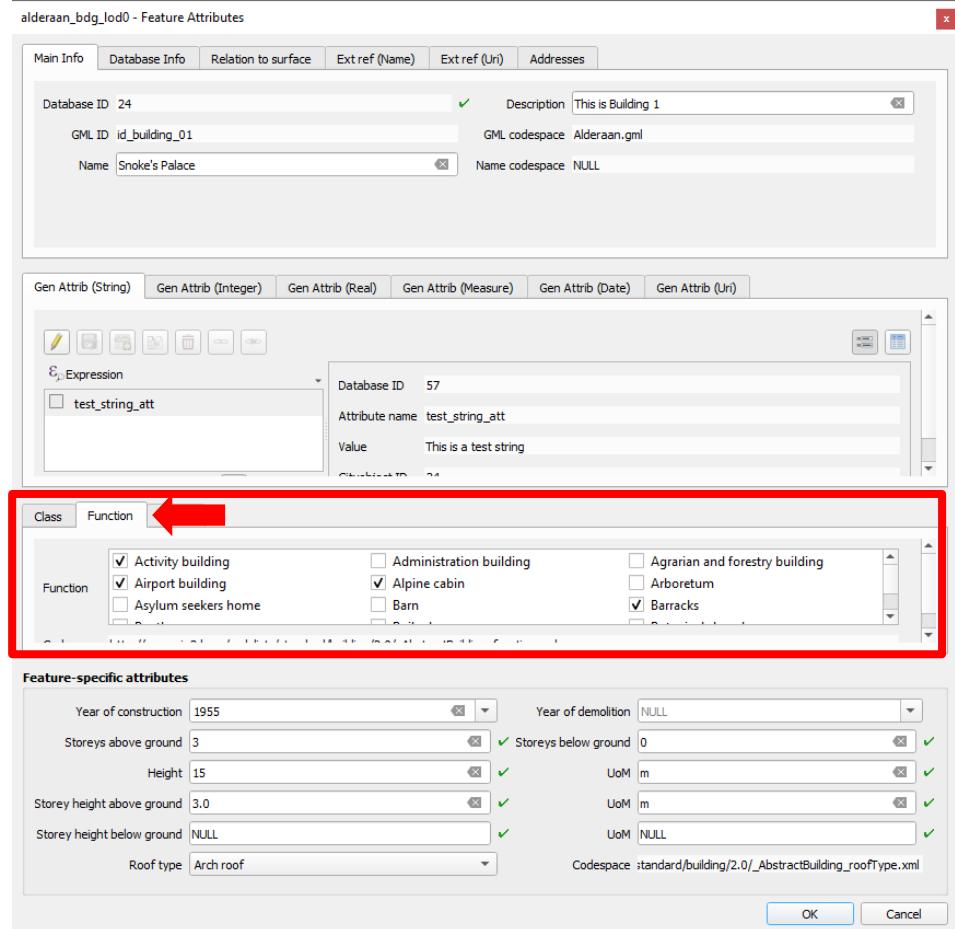
- (no selection)
- Arch roof
- Combination of roof forms
- Cone roof
- Cupola roof
- Dual-pent roof
- Flat roof
- Gabled roof
- Half-hipped roof
- Hipped roof** (highlighted in blue)
- Mansard roof
- Monopitch roof
- Pavilion roof
- Pyramidal broach roof
- Sawtooth roof

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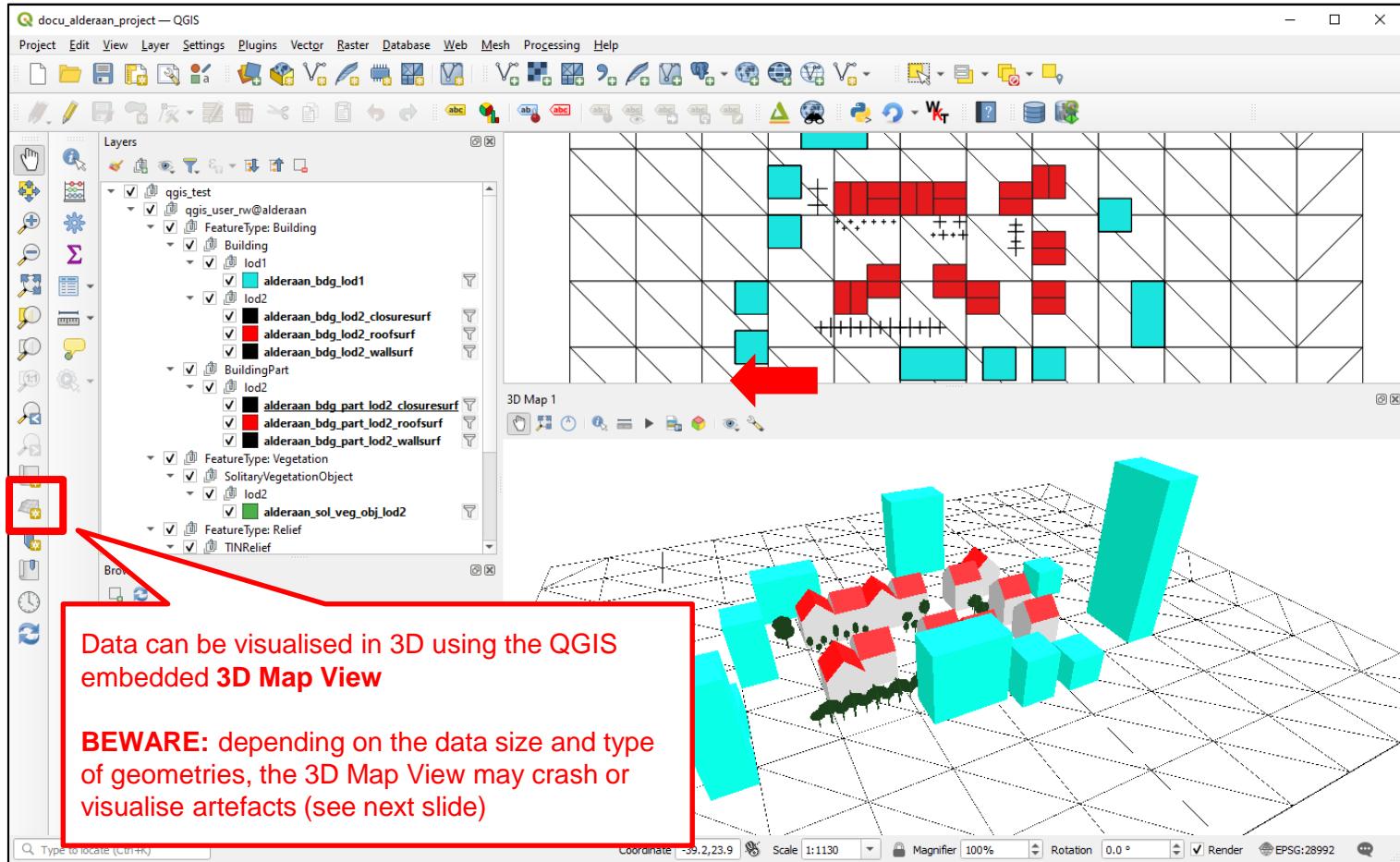
In the case of a CityGML property with cardinality [0..*], the associated codelist values are presented as a **multiple-selection list**

Example: property (Building) function



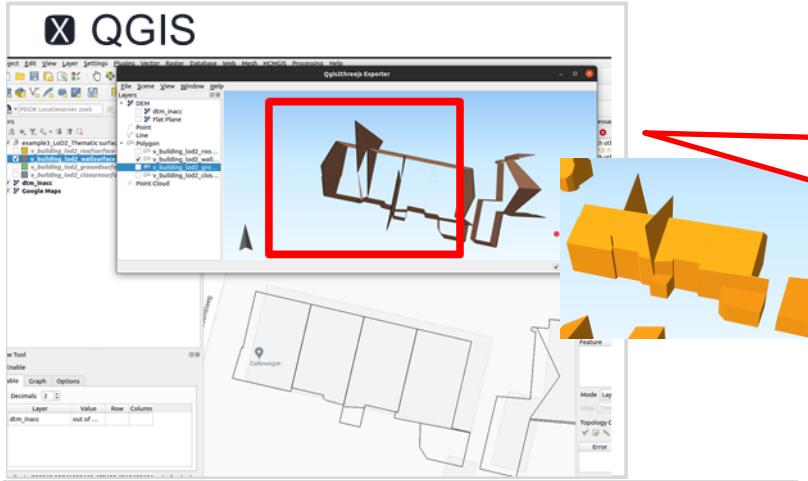
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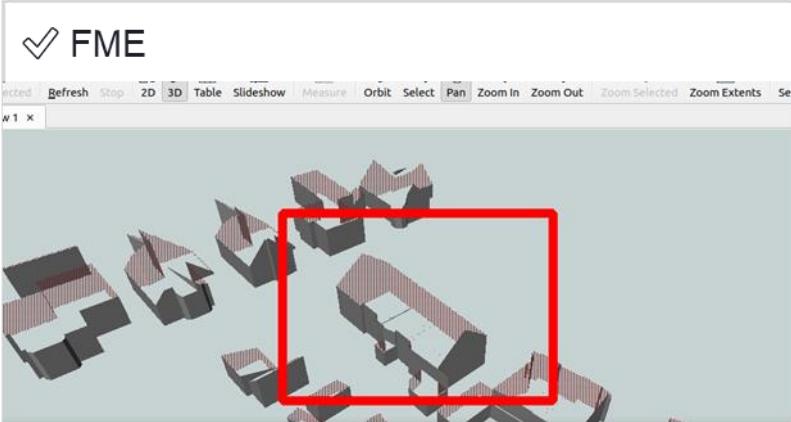


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In our tests, such artefacts are however a 3D visualisation issue (QGIS 3D renderer?) and *not* related to the actual data. 3D visualisation in FME and in Google Earth show indeed correct results.

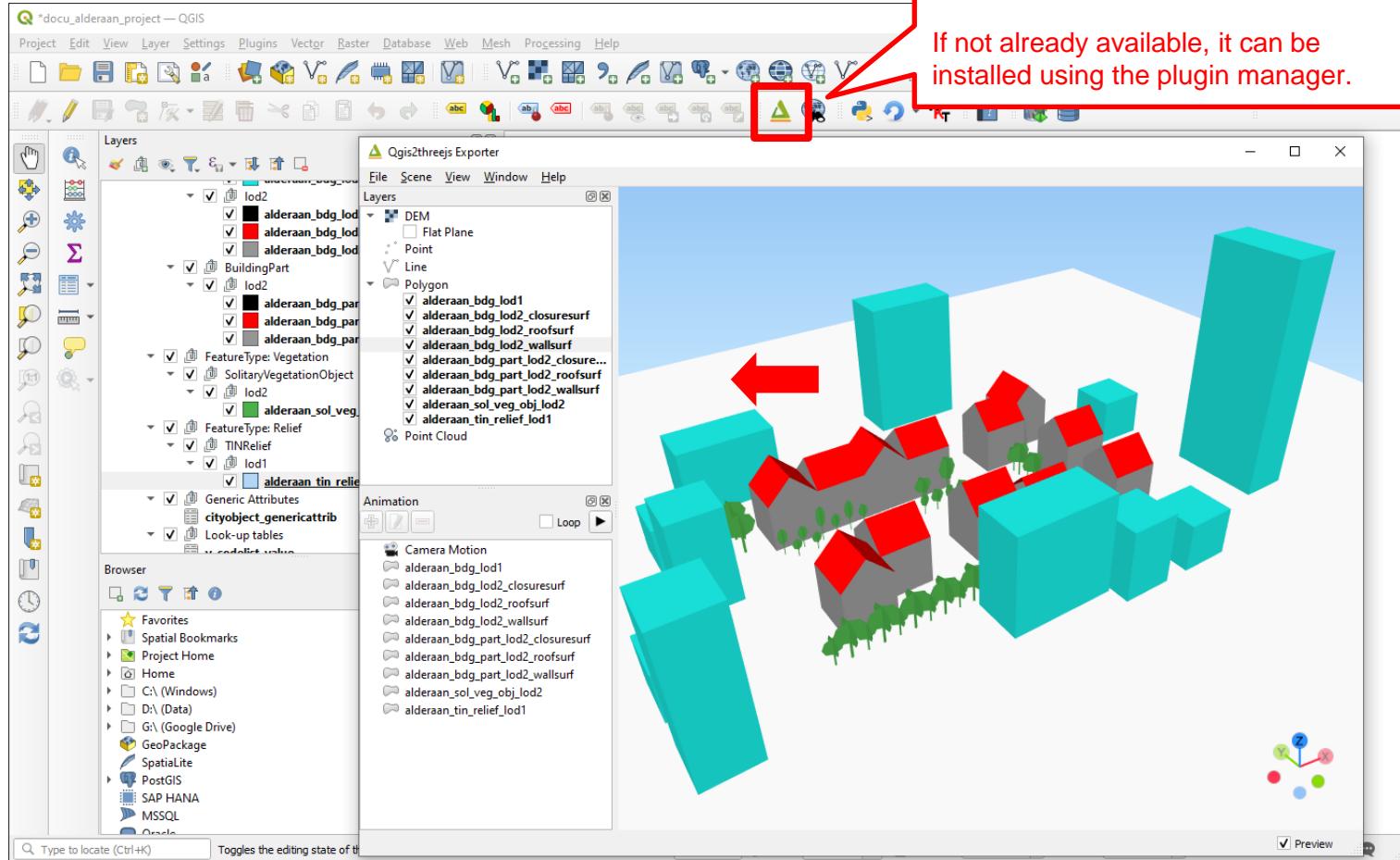


✓
Google
earth
(as KML)

Use in QGIS: 3D visualisation

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

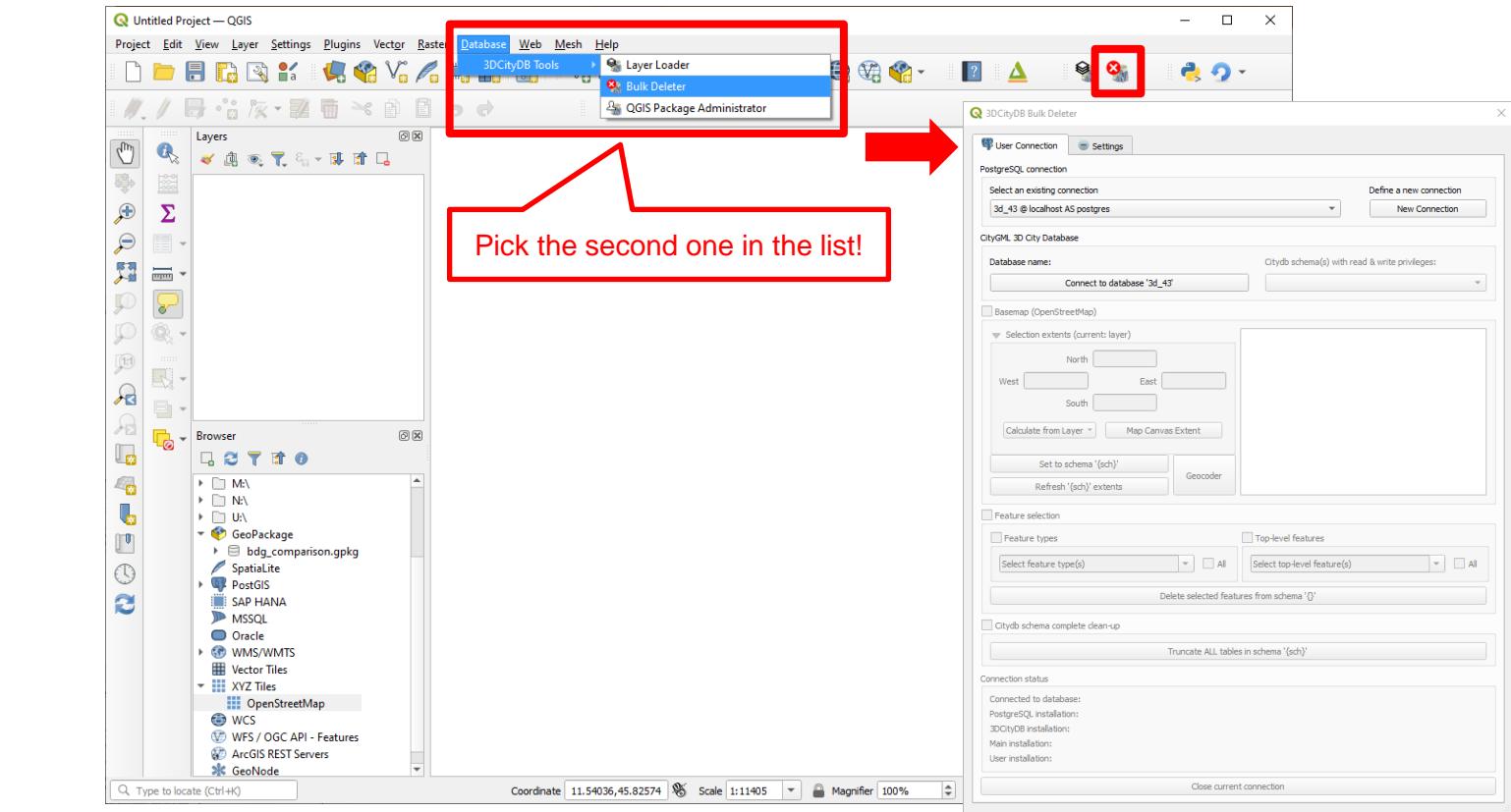
If not already available, it can be installed using the plugin manager.



Bulk Deleter



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



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, and a red arrow points from it to the 'Bulk Deleter' option, which is also highlighted with a red box. Below the menu, a red box contains the text 'Pick the second one in the list!'. To the right, the '3DCityDB Bulk Deleter' dialog box is open, showing connection settings and selection options for a PostgreSQL database.

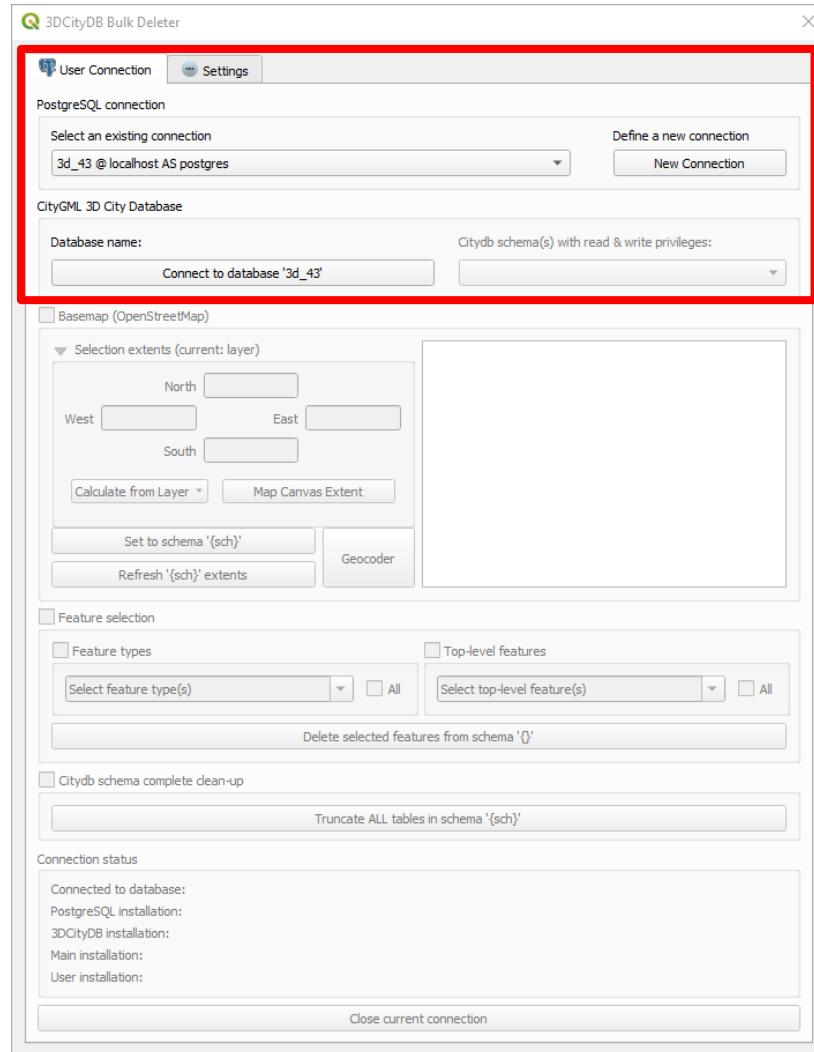
Pick the second one in the list!

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")

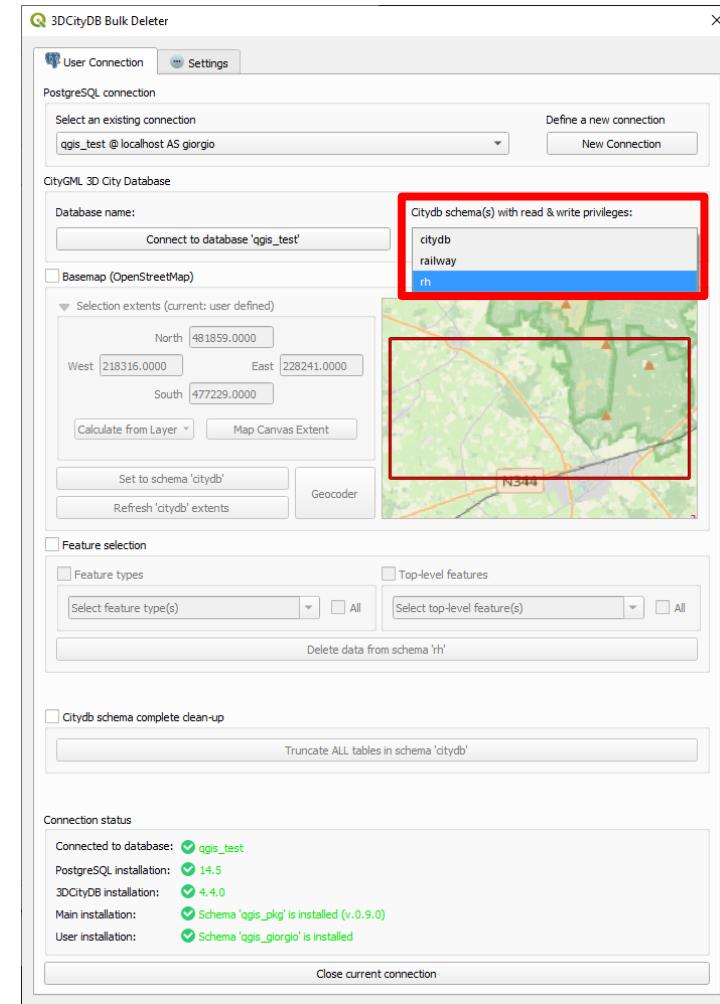
2) Connect to the chosen database



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

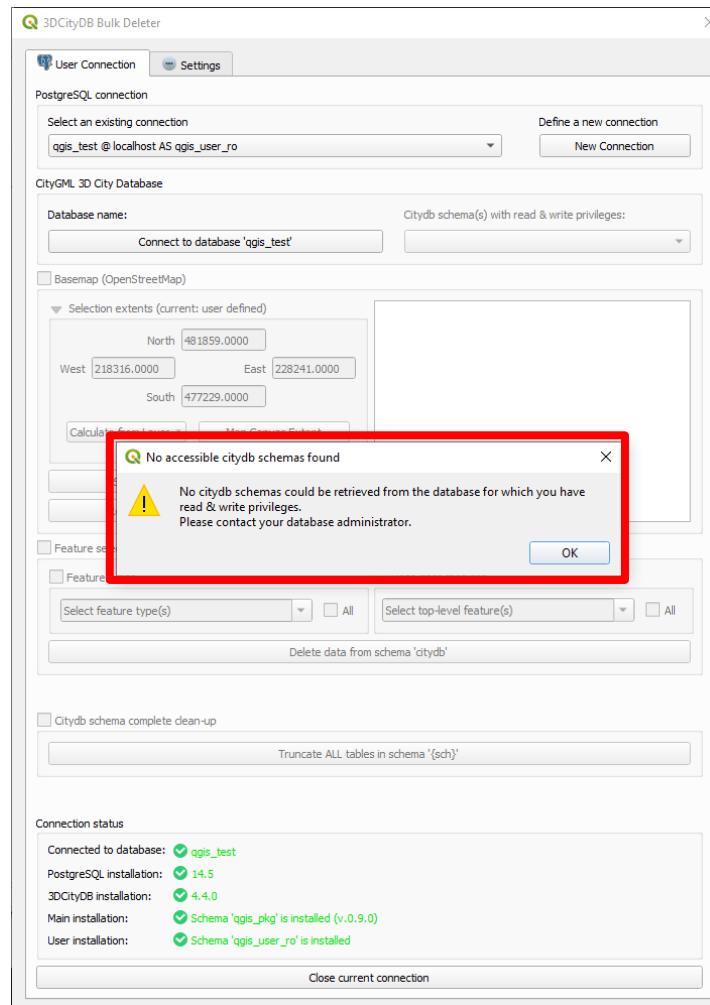


Bulk Deleter

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.

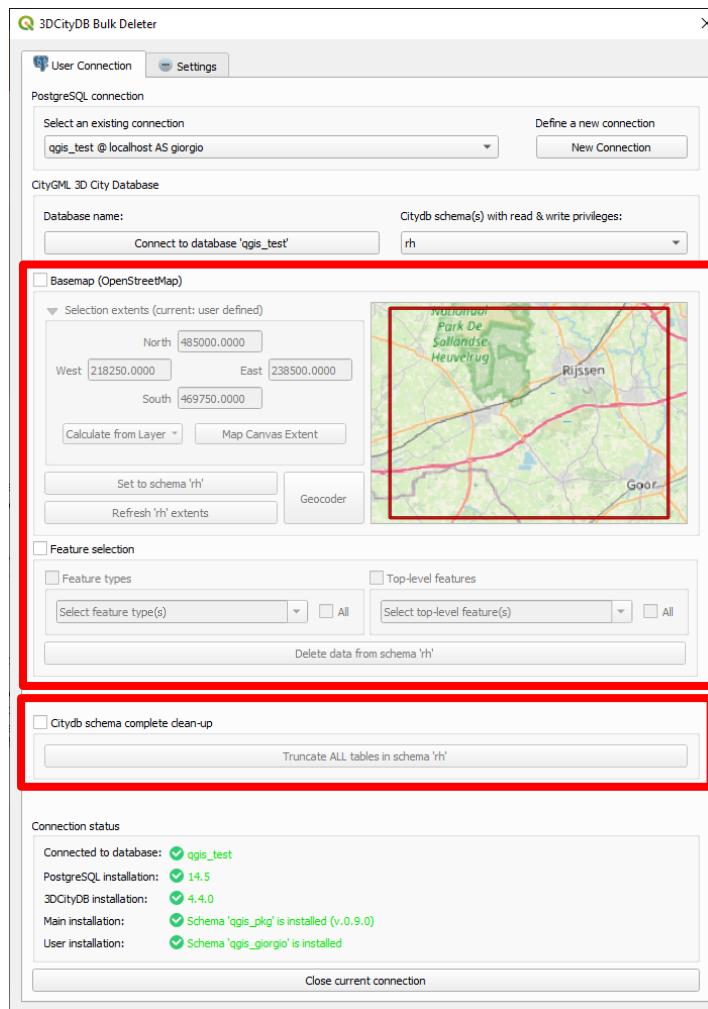


Bulk Deleter

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

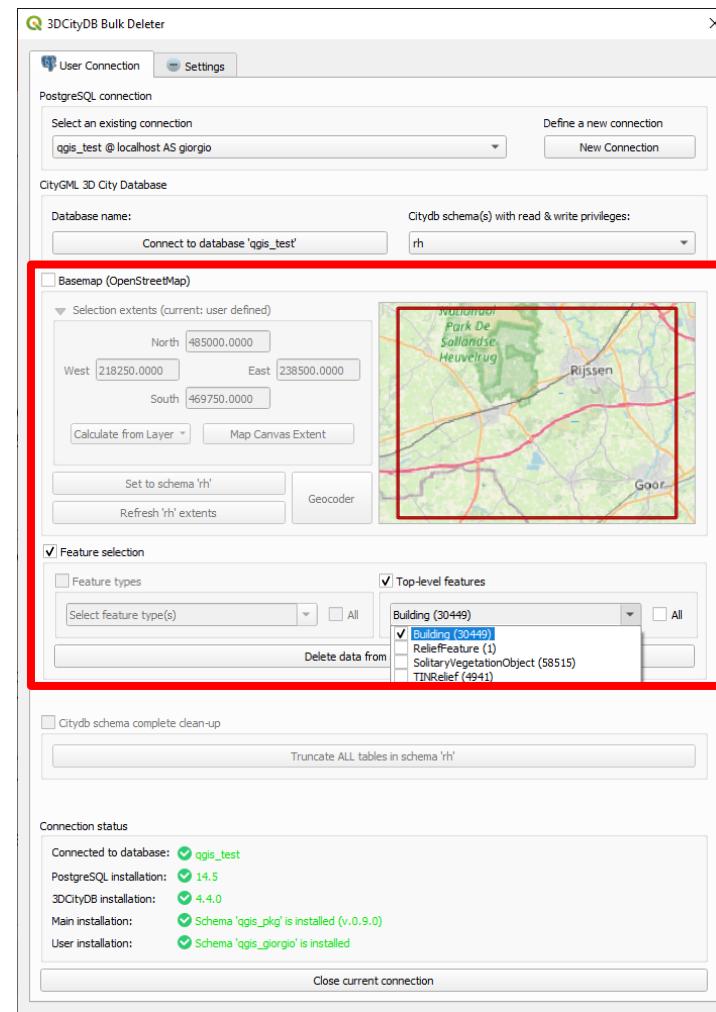
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5a) Select the features to delete. Activate the **Feature selection box**. You can now select:

- 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 classes
- Feature Type "Relief" includes "TINRelief", "BreakLineRelief" and "MassPointRelief" top-level classes



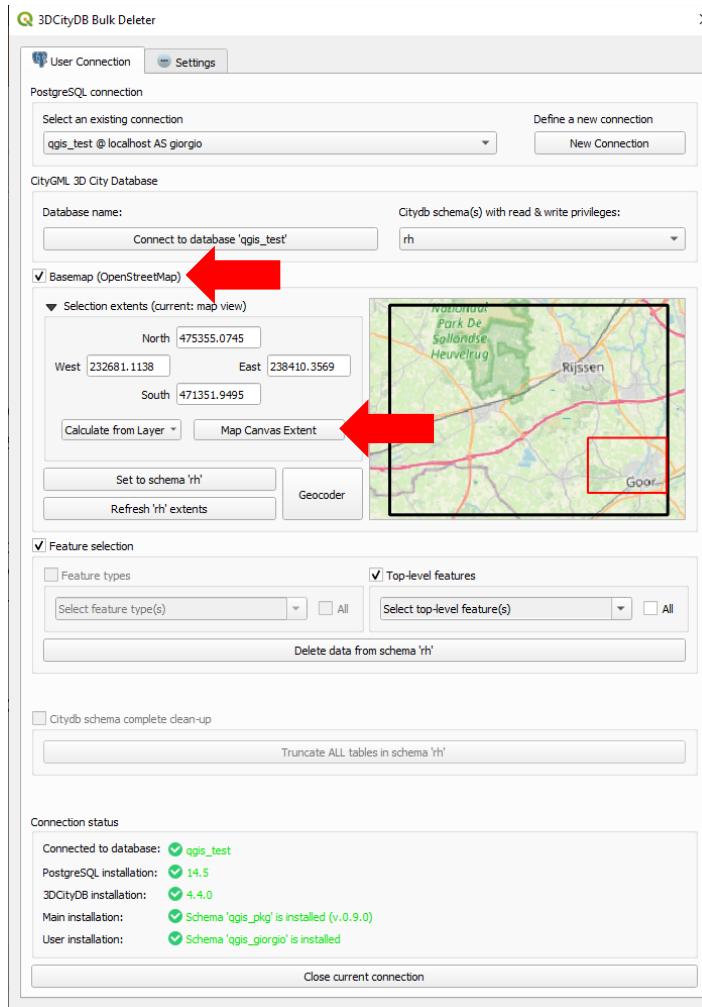
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- 5a) Select the features to delete. Activate the **Feature selection box**. You can now select:
- either CityGML Features types
 - or top-level features
 - and, optionally, define the extents of the area where to delete the selected feature. You must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

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

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



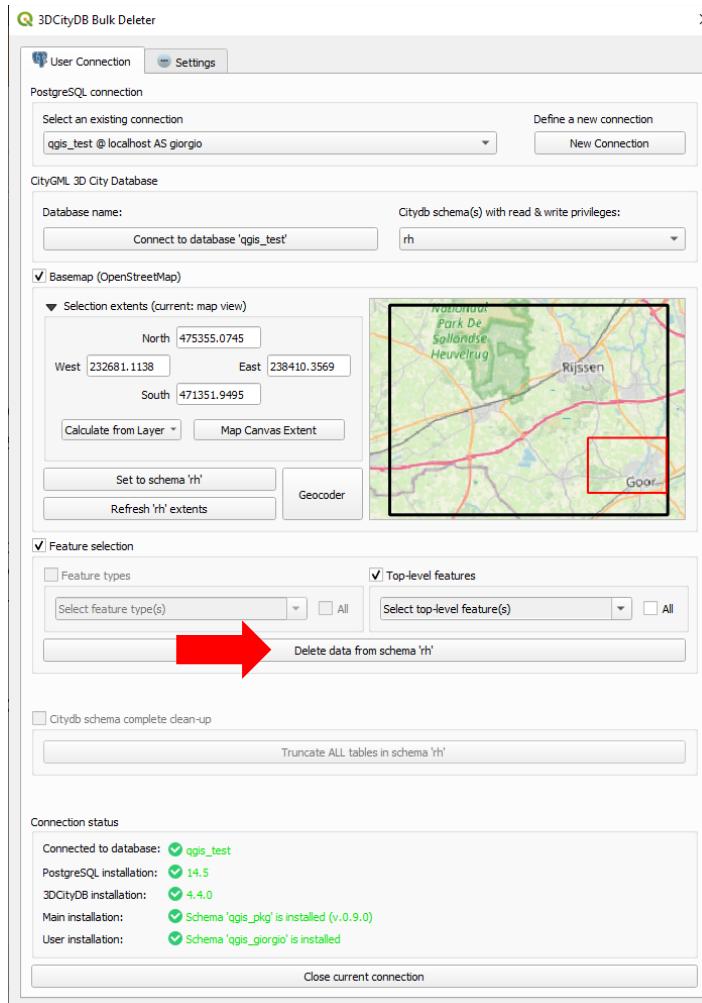
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6a) Press the **Delete data from schema {cdb_schema}** button

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

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

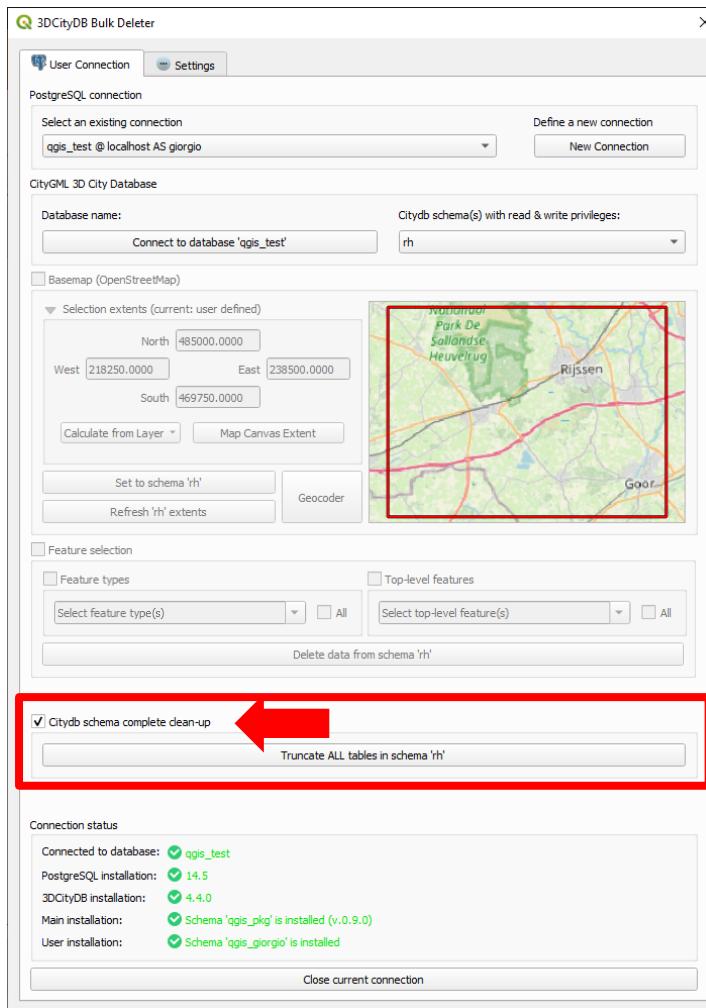


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5b) Enable the **Citydb schema complete clean-up box** and press the **Truncate ALL tables in schema {cdb_schema}** button.

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



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Customised codelists

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

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

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

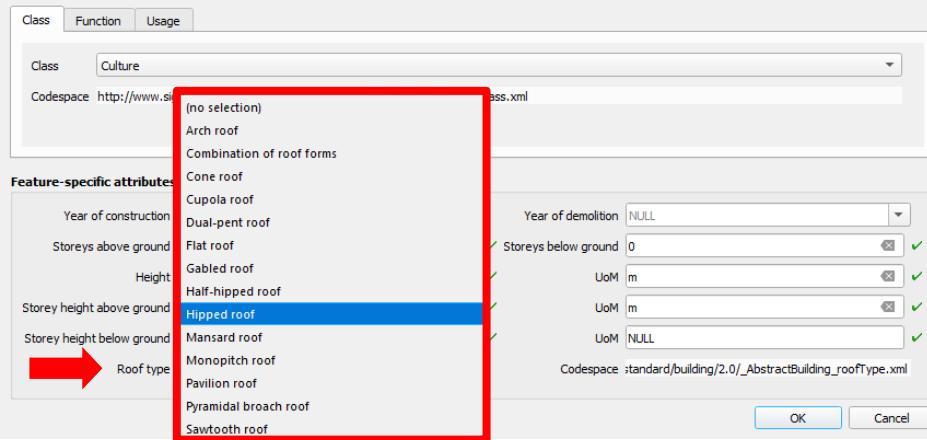
In this way the user does not have to "remember" specific codes when typing, thus reducing the chances of wrong data input

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

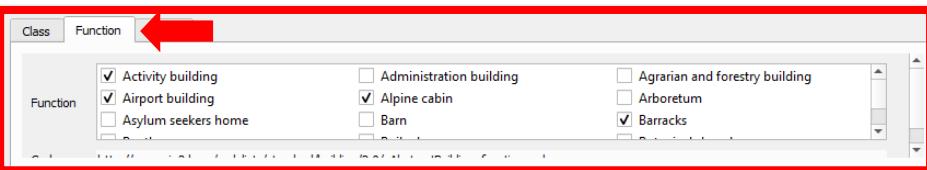
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Property with cardinality [0..1]:
 drop-down list



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



Customised codelists

Adding customised codelists requires **two steps**:

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

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

1) Administrator:

- The predefined tables are in schema **qgis_pkg**
- All codelists and rules are made available to each newly created `qgis_{usr}` schema

2) User:

- The predefined tables are in schema **qgis_{usr_name}**
- All codelists and rules are available only to user

Customised codelists

Adding customised codelists requires **two steps**:

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

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

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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

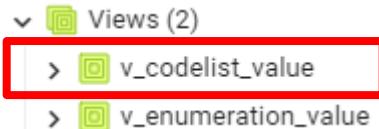
Table CODELIST (excerpt)

[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

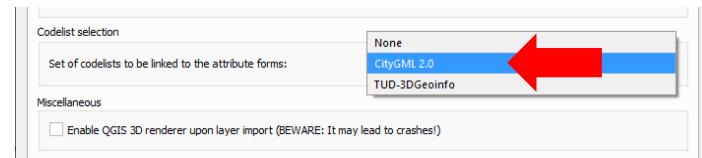
Tables (8)	
>	codelist
>	codelist_lookup_config
>	codelist_value
>	enumeration
>	enumeration_value
>	extents
>	layer_metadata
>	settings

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

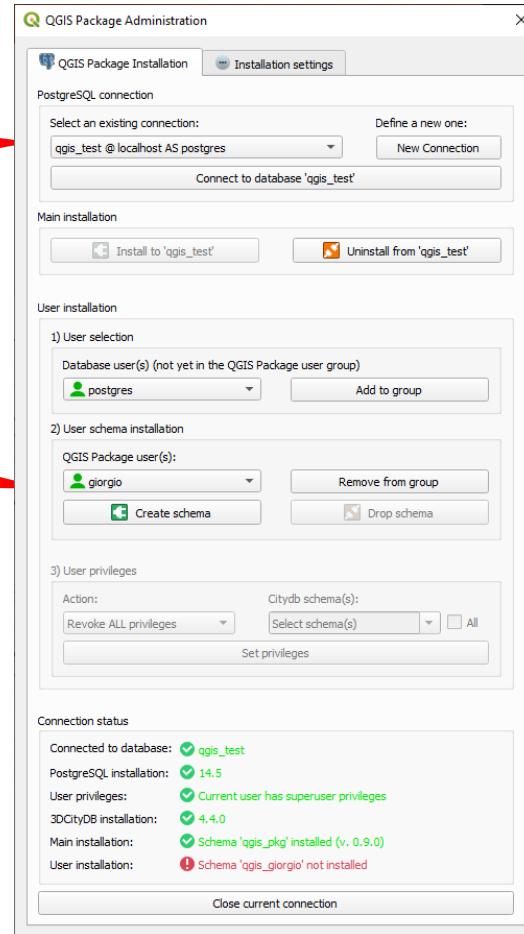
2) **Removal of the 3DCityDB-Tools plugin** from QGIS

- 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

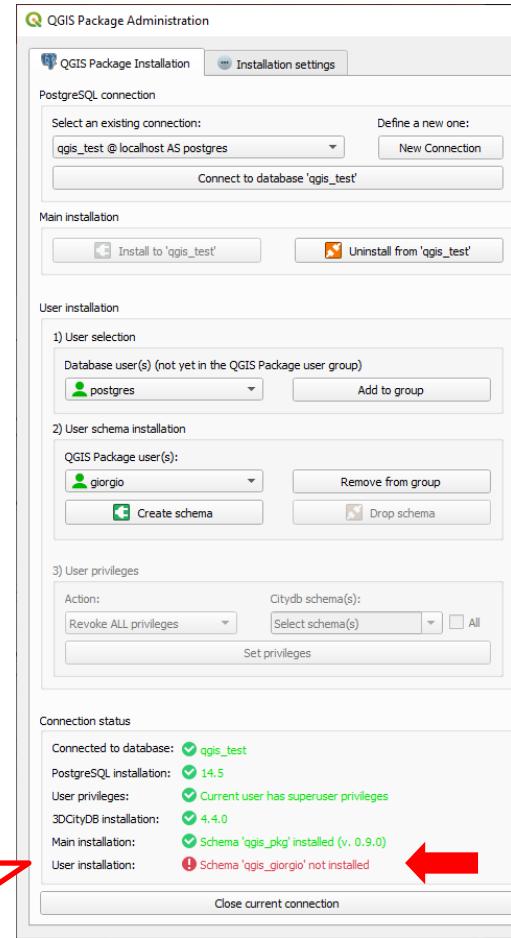


3) Select the user

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

Drop user schema

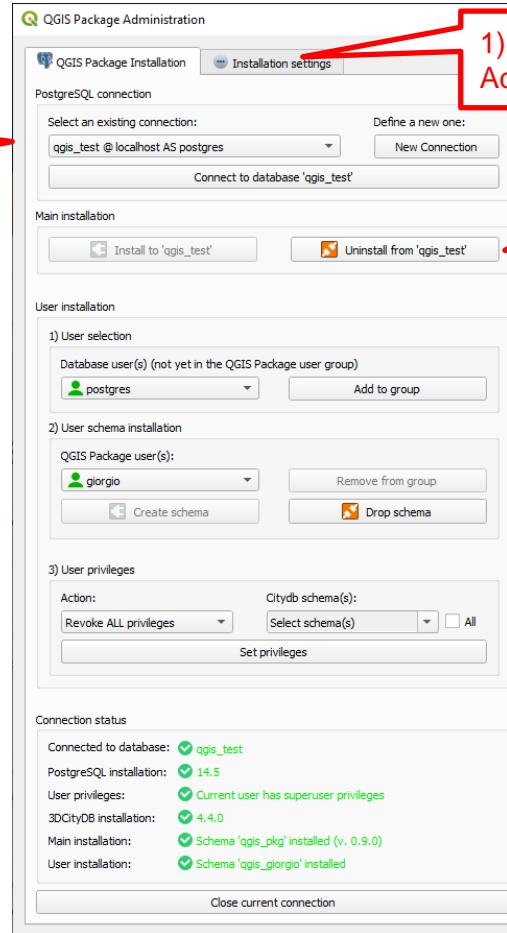
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Software uninstall: Uninstall QGIS Package

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2) Connect as administrator

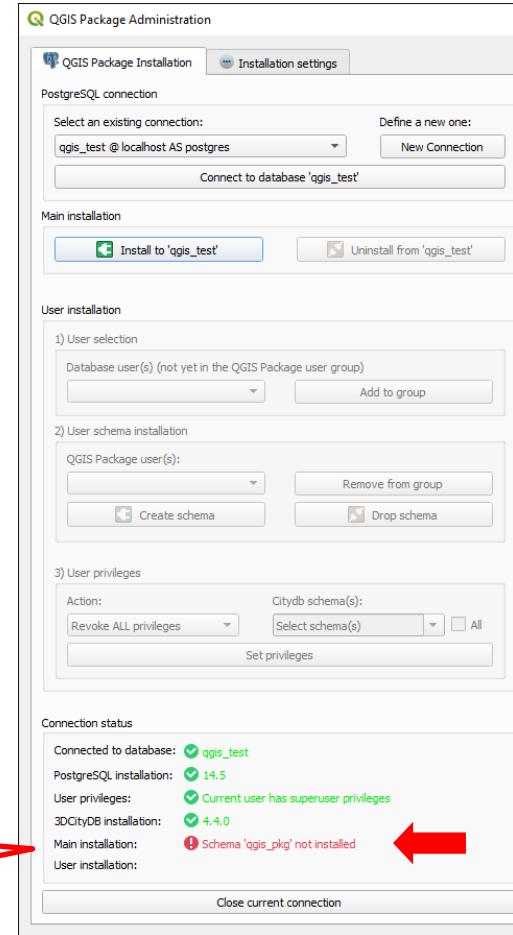


1) Load the "QGIS Package Administration" GUI

3) Uninstall the QGIS Package from the current database

Uninstall QGIS Package

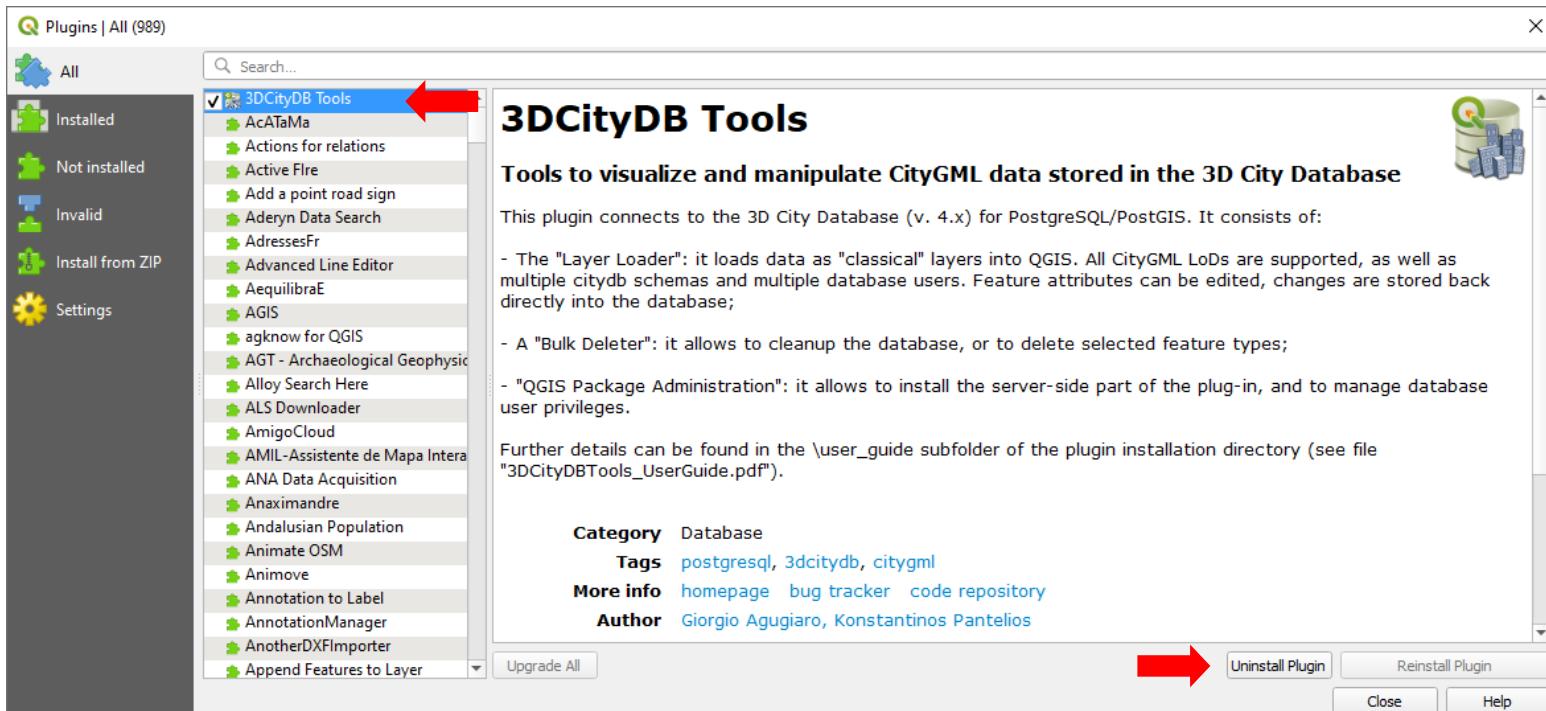
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Uninstall 3DCityDB-Tools

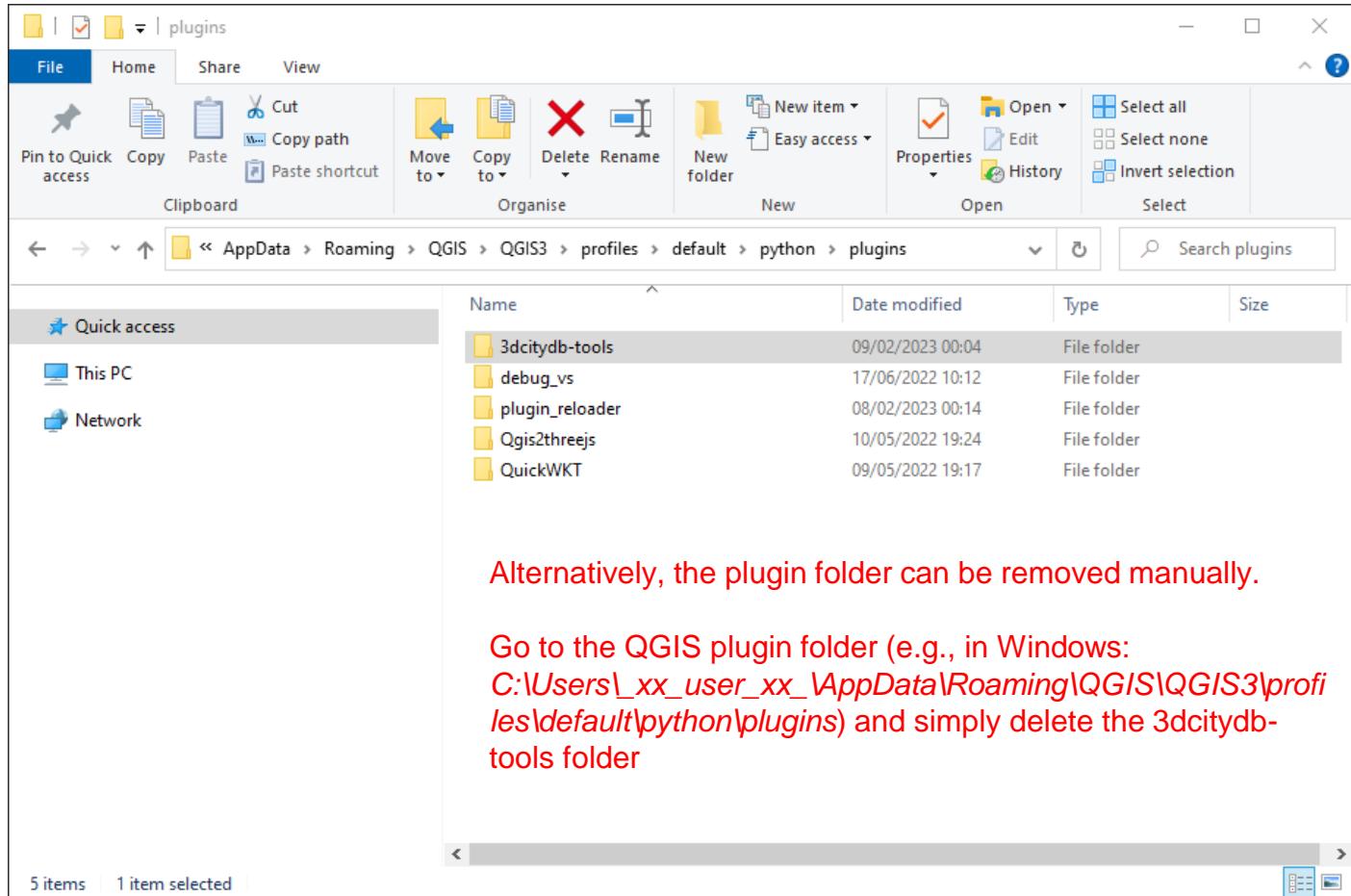
The plugin can be uninstalled from the \Plugins\Manage and Install Plugins... Menu in QGIS

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Uninstall 3DCityDB-Tools



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Current limitations

As of plugin version 0.8

In general:

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

The QGIS Package does not support:

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

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QGIS Package in a nutshell

- It represents the **server-side part** of the QGIS plugin
 - Most of the actions carried out from the QGIS GUI can be actually performed also by interacting directly with the database (e.g. using **PgAdmin**)
- It can be installed and used independently from the QGIS client-side part
 - E.g. with FME, or programmatically via Python, SQLAlchemy, etc.
- It requires
 - PostgreSQL **v. 10 or higher**
 - An existing installation of the 3DCityDB **v. 4.x**
- All relevant entities are installed in the "**qgis_pkg**" database schema
 - Database types
 - Triggers and trigger functions
 - Functions
 - Tables, mostly used as templates for the user schemas

QGIS Package in a nutshell

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The database administrator can:

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

The required SQL functions are all available in schema **qgis_pkg**.

QGIS Package: Create user schemas

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

For example:

- User "giorgio" -> schema "qgis_giorgio"
- User "konstantinos" -> schema "qgis_konstantinos"
- User "postgres" -> schema "qgis_postgres"

Each user schema will be used only by the corresponding user

Each user schema is accessible only by the corresponding user (and the database superusers)

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

SQL example

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

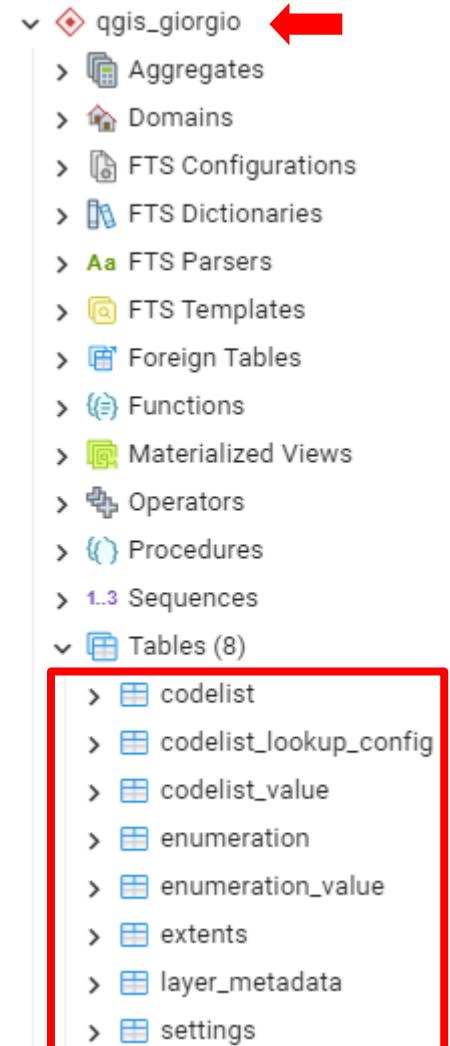
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User schema overview

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)



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QGIS Package: User management

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The database administrator can grant user privileges

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('giorgio', 'ro','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('konstantinos', 'rw','citydb_2');
```

-- Database user "camilo" 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('camilo ', 'rw');
```

QGIS Package: User management

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The database administrator can revoke user privileges

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 has to remove them manually (or use the QGIS plugin 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.

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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

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

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SQL examples

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

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

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

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

QGIS Package: Layer management

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The database administrator can refresh the materialized views with function **qgis_pkg.refresh_mvviews(...)**.

- All materialized views created before will be refreshed. This is necessary every time the layers are generated (or re-generated using a different bounding box).
- The user can refresh the materialized views only for selected CityGML modules using the similar functions:
 - **qgis_pkg.refresh_mvviews_bridge(...)**
 - **qgis_pkg.refresh_mvviews_building(...)**
 - ...
 - **qgis_pkg.refresh_mvviews_waterbody(...)**
- All functions are in schema qgis_pkg and have the same signature (see next slide)

QGIS Package: Layer management

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Function

qgis_pkg.refresh_mvviews(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_mvviews('qgis_giorgio', 'citydb');
```

-- In user schema "qgis_konstantinos", refresh all waterbody module materialized views in citydb schema "alderaan"

```
SELECT qgis_pkg.refresh_mvviews_waterbody('qgis_konstantinos', 'alderaan');
```

QGIS Package: Layer management

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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: 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');

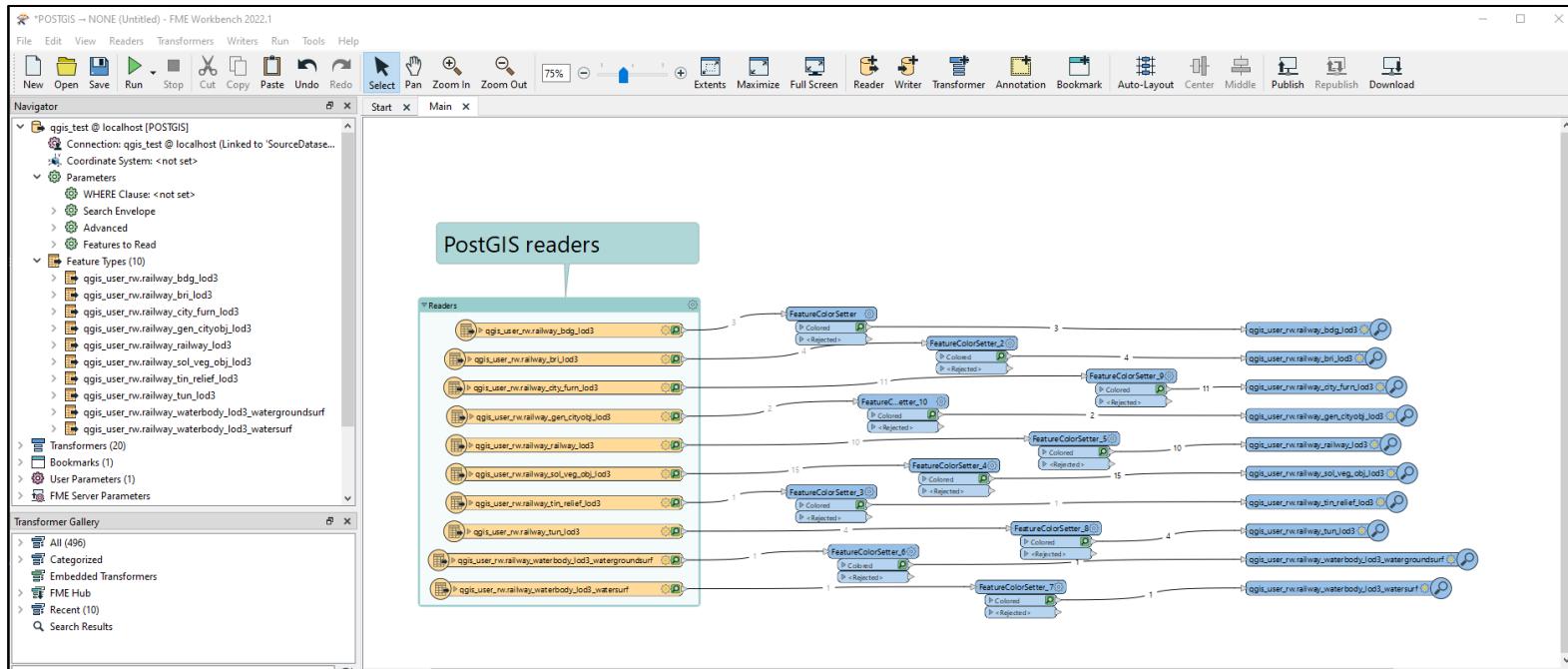
...
-- Then drop the user schema
DROP SCHEMA qgis_giorgio CASCADE;
-- Optionally (if necessary) remove user "giorgio" from the "qgis_pkg_usrgrp_qgis_test" associated to database
-- "qgis_test"
REVOKE qgis_pkg_usrgrp_qgis_test FROM giorgio;
```

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**

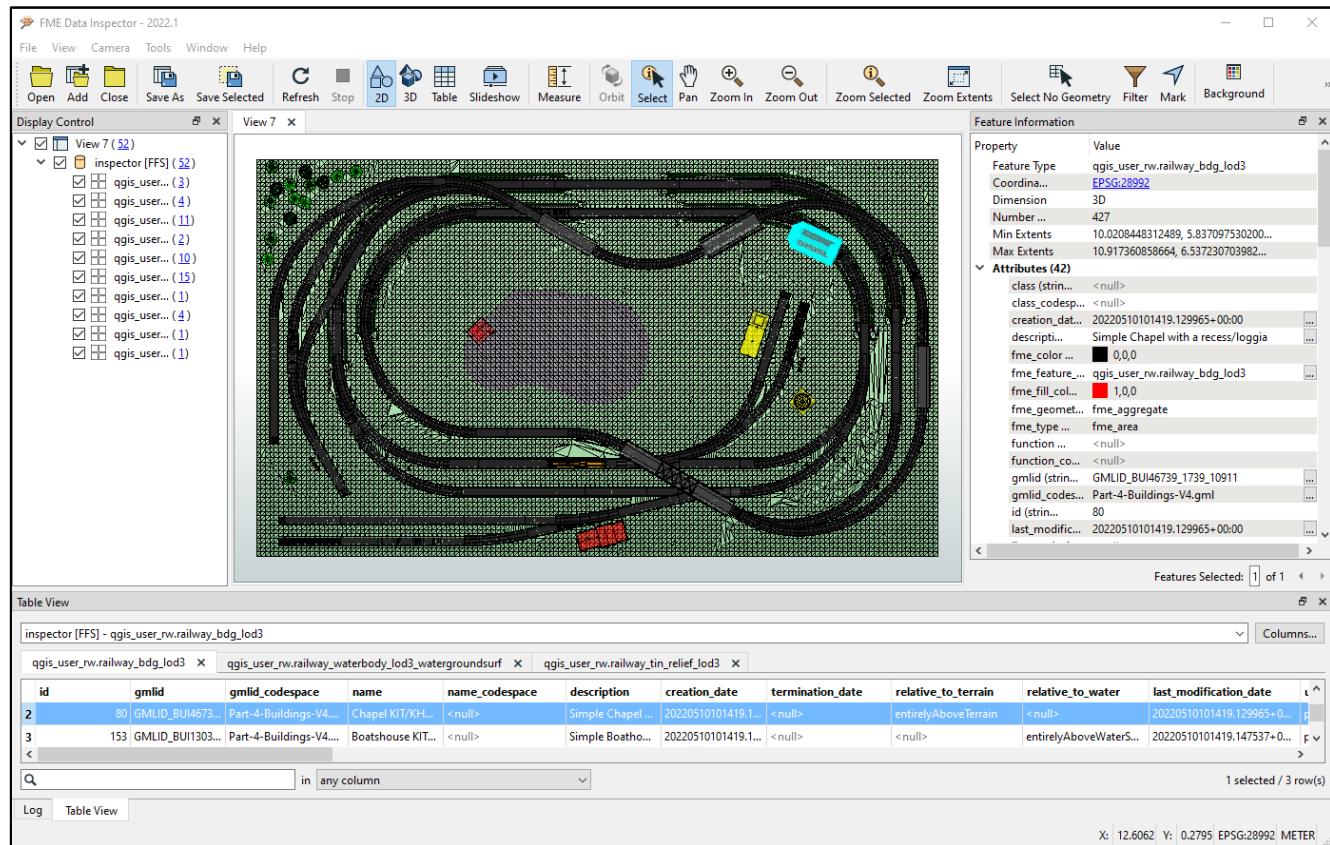
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QGIS Package via FME

- 2D visualisation via FME Data Inspector

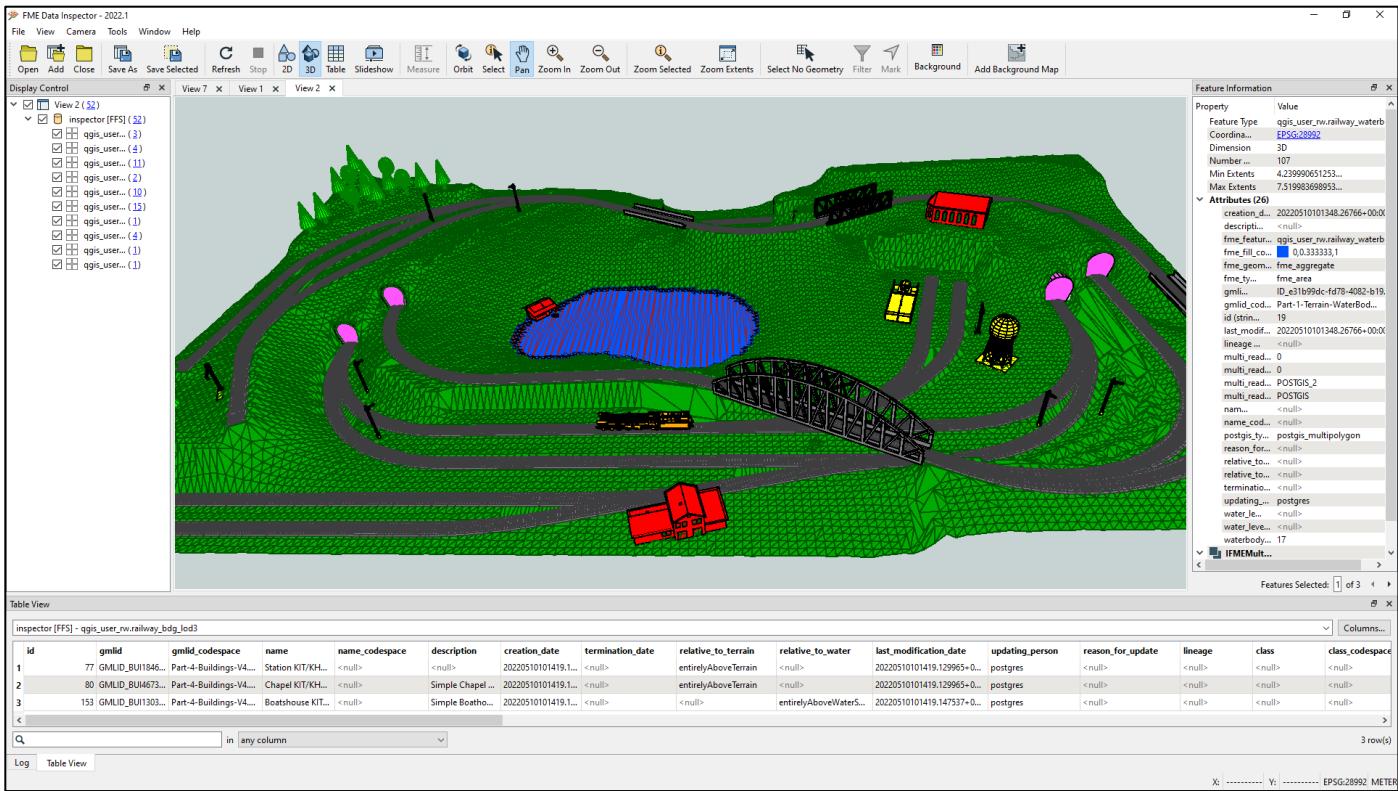
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QGIS Package via FME

- 3D visualisation via FME Data Inspector

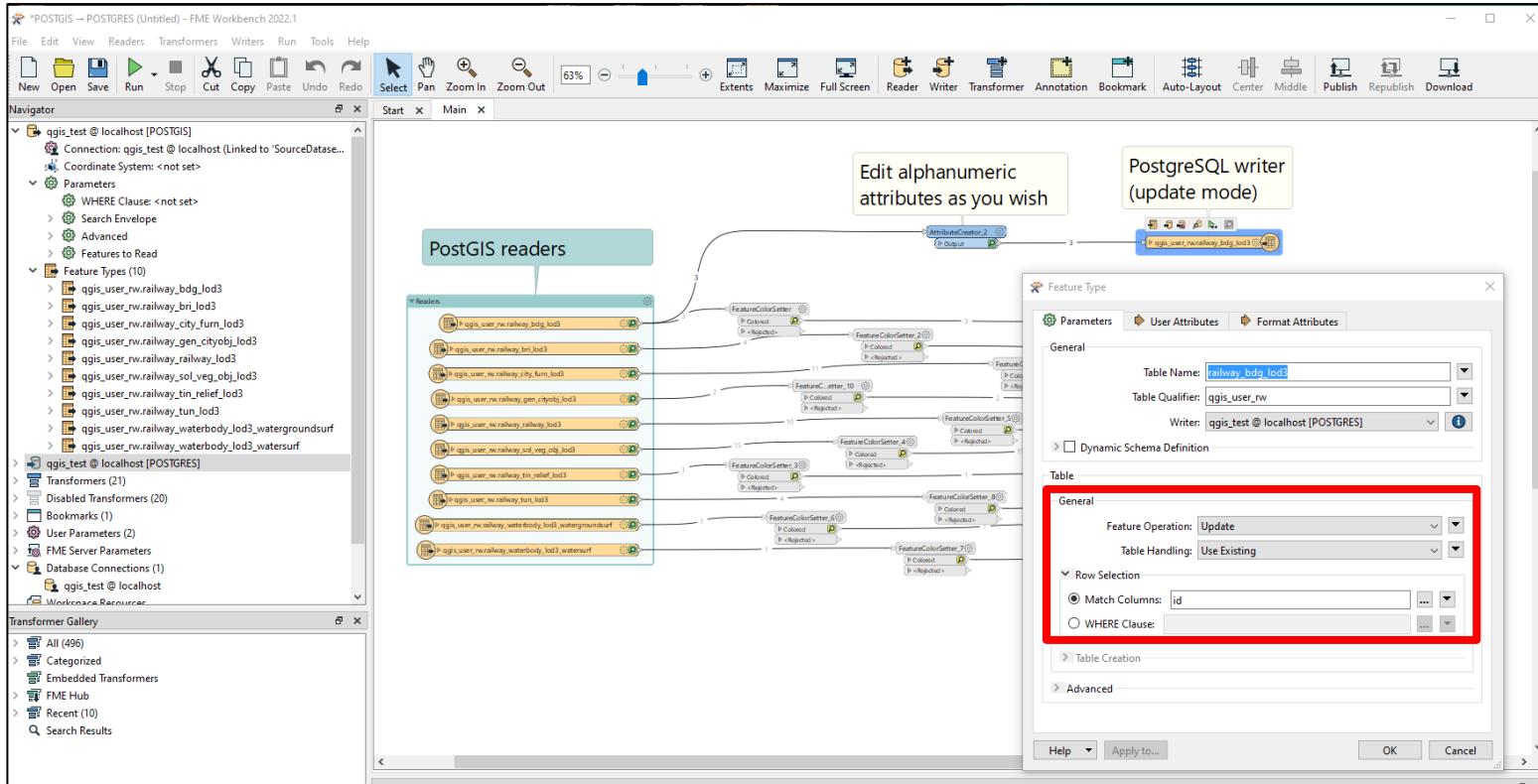
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QGIS Package via FME

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

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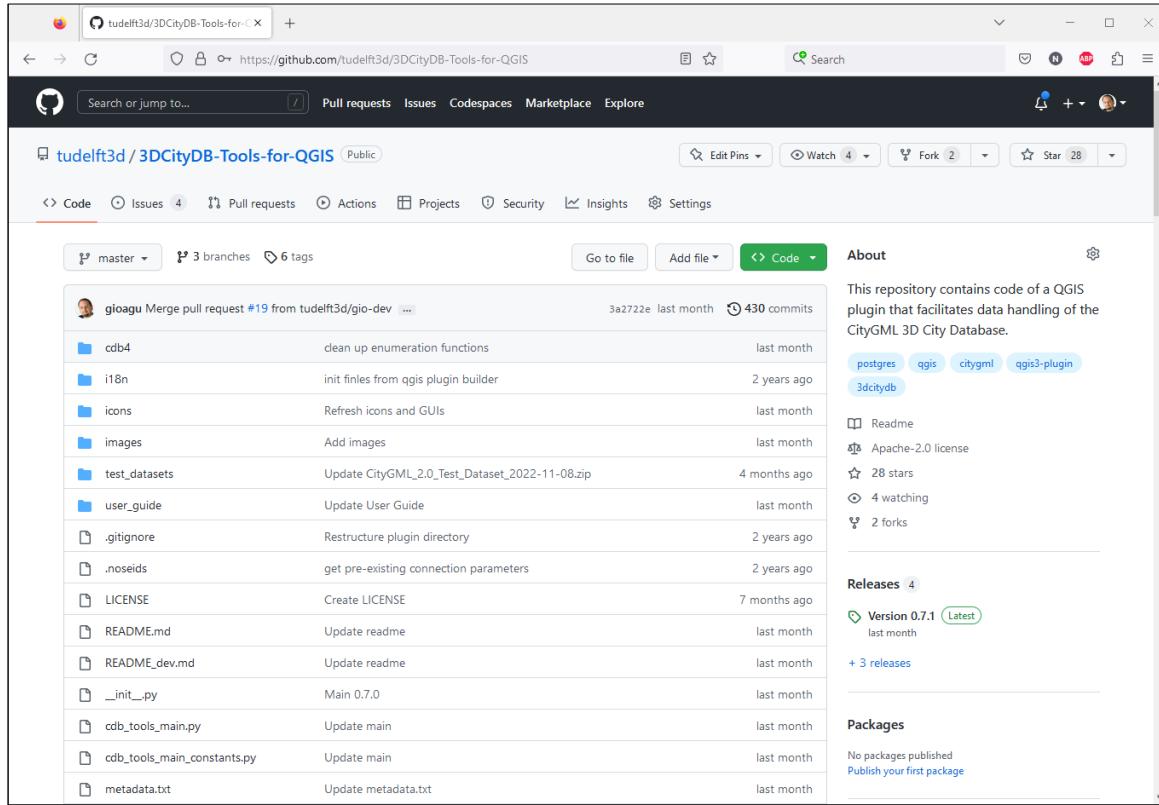
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Source code and GitHub repository

- 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 430 commits. It contains several branches, including master, 3 branches, and 6 tags. The repository description states: 'This repository contains code of a QGIS plugin that facilitates data handling of the CityGML 3D City Database.' The repository has 28 stars, 4 forks, and 4 releases. The latest release is Version 0.7.1 (Latest). There are no packages published.

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

Code

master 3 branches 6 tags

gioagu Merge pull request #19 from tudelft3d/gio-dev ... 3a2722e last month 430 commits

- cdb4 clean up enumeration functions last month
- i18n init files 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 User Guide last month
- .gitignore Restructure plugin directory 2 years ago
- .noseids get pre-existing connection parameters 2 years ago
- LICENSE Create LICENSE 7 months ago
- README.md Update readme last month
- README_dev.md Update readme last month
- __init__.py Main 0.7.0 last month
- cdb_tools_main.py Update main last month
- cdb_tools_main_constants.py Update main last month
- metadata.txt Update metadata.txt last month

Readme

Apache-2.0 license

28 stars

4 watching

2 forks

Releases 4

Version 0.7.1 (Latest) last month

+ 3 releases

Packages

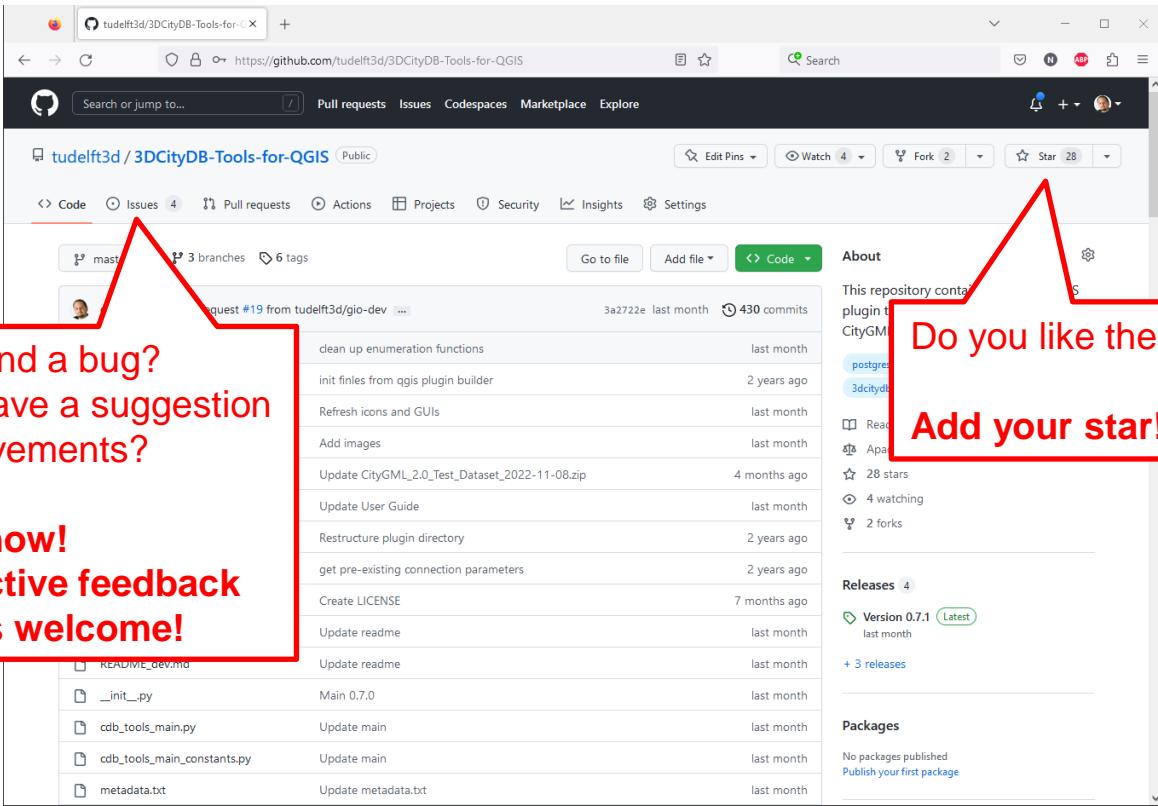
No packages published Publish your first package

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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 has 4 pull requests, 2 forks, 28 stars, and 4 releases. The main page displays a list of commits and pull requests. A red box highlights the repository's purpose: "This repository contains the QGIS plugin to work with CityGML files". Another red box encourages users to contribute by asking: "Did you find a bug? Do you have a suggestion for improvements? Let us know! Constructive feedback is always welcome!" A third red box at the bottom right encourages users to star the repository: "Do you like the plugin? Add your star! ☺".

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! ☺

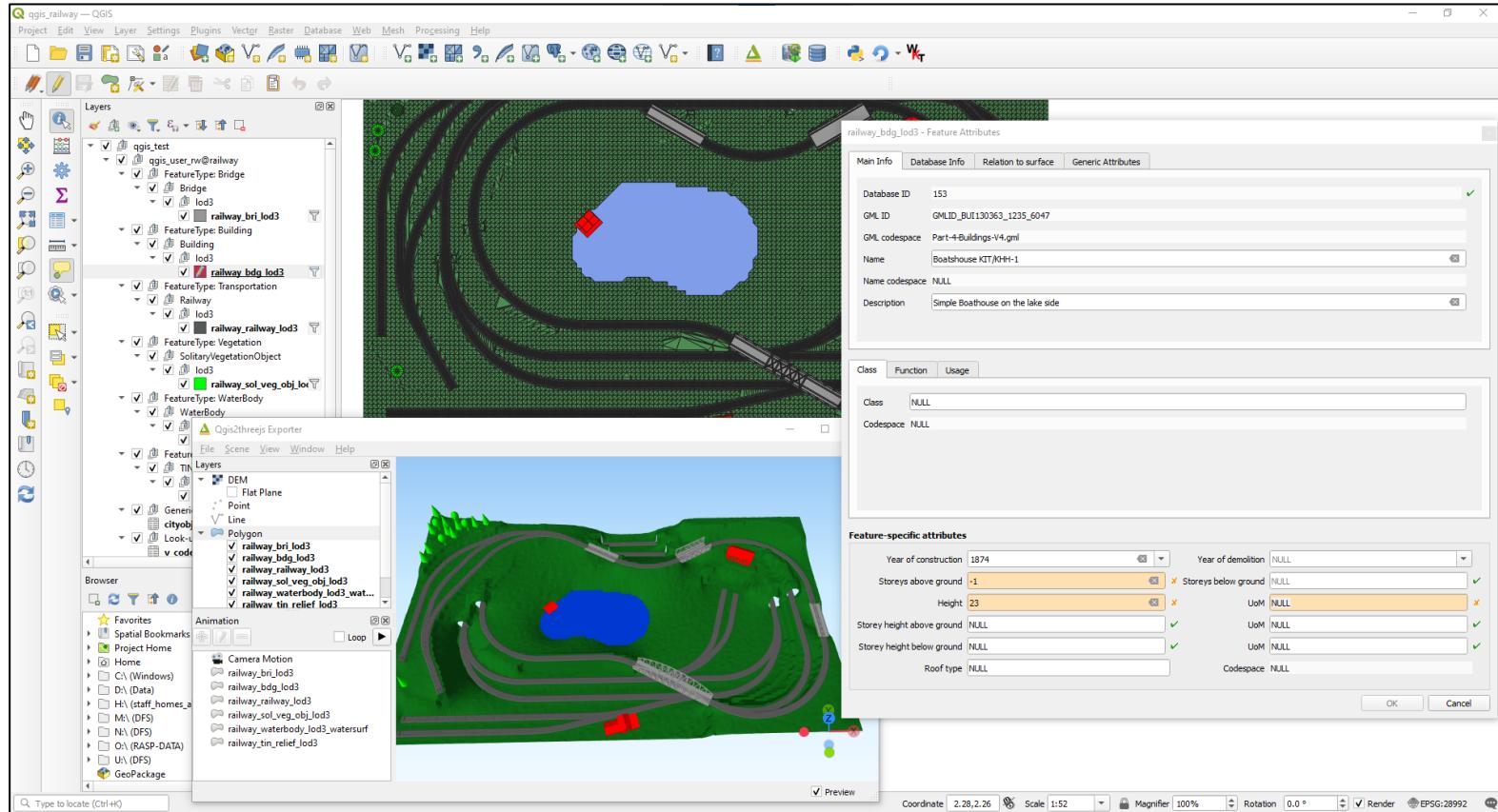
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Test datasets

- 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