TU Delft

3DCityDB Tools for QGIS

Giorgio Agugiaro

27 October 2023

License

This presentation is licensed under the Creative Commons License CC BY-NC-SA 4.0. According to CC BY-NC-SA 4.0 permission is granted to share this document, i.e. copy and redistribute the material in any medium or format, and to adapt it, i.e. remix, transform, and build upon the material under the following conditions:

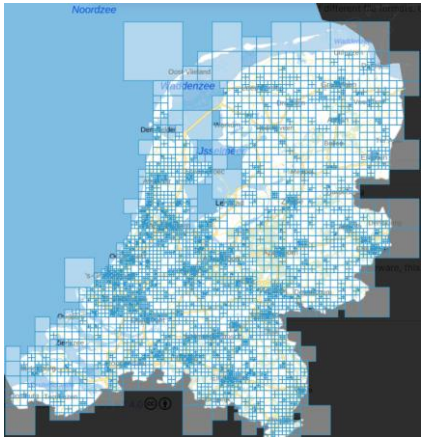
- **Attribution:** You must give appropriate credit, provide a link to the license, and indicate if changes were made. You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.
- **NonCommercial:** You may not use the material for commercial purposes.
- **ShareAlike:** If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original.
- **No additional restrictions:** You may not apply legal terms or technological measures that legally restrict others from doing anything the license permits.

Motivation: 3D city models

Motivation
Plug-in overview
Demo
Tests
Conclusions
Resources

- Semantic 3D city models can become rather **huge datasets**
  - Generally, area is split into file-based "portions" (e.g. tiles)

- For example:
  - Rijssen-Holten (NL) 25 files
  - Den Haag (NL) 48 files
  - Vienna (AT) 1460 files
  - 3D BAG (whole NL) 8138 files



- Next logical step: store and manage everything by means of a **spatial database**!

Motivation

IDEA:

Motivation
Plug-in overview
Demo
Tests
Conclusions
Resources

- **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
  - (At least) basic SQL is well-known also outside the GIS user community

Motivation

Motivation
Plug-in overview
Demo
Tests
Conclusions
Resources

BUT:

- CityGML does not follow the Simple Feature for SQL model (SFS)
  - Nested features
  - One feature can have multiple representations
  - A representation is a combination of:
    - Level of Detail (LoD)
    - Geometry types (polygons, …, implicit geometries)
    - Semantics

CityGML 2.0 module	Representations
Bridge	194
Building	148
CityFurniture	8
Generics	10
LanduUse	5
Relief	30
Transportation	50
Tunnel	138
Vegetation	8
WaterBody	16
Total	**607**

(Excluding CityObjectGroup module)

Plug-in overview

SO:

- Why not using **QGIS**?
  - It can be extended with Python-based plug-in -> **3DCityDB-Tools** plug-in

Main functionalities

- Create **"classic" GIS layers** to hide 3DCityDB complexity
  - Deal with different geometries (multiple LoDs, implicit representations, etc.)
  - Merge all standard attributes of a feature into a single "table"
- **Deal with** the possibly *huge* **size of city models** stored in a database
- **Editing of attributes**: possible (depending on user privileges)
- **Deletion of features**: possible (depending on user privileges)
- Editing of geometries: NOT possible
- Support for **multiple users** with **different privileges** (read-only, read-write)

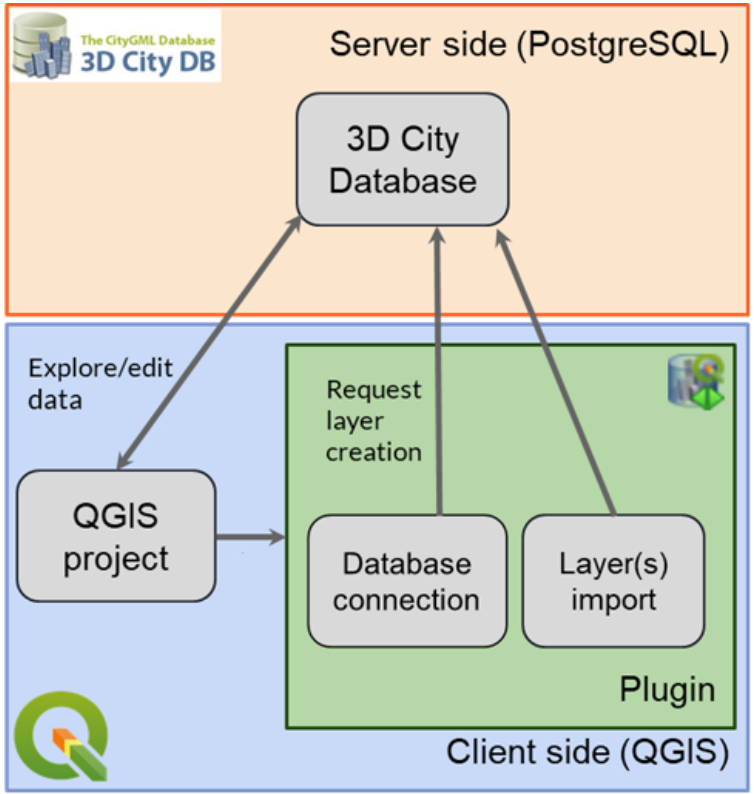
Motivation
Plug-in overview
Demo
Tests
Conclusions
Resources

Plug-in overview

Motivation
Plug-in overview
Demo
Tests
Conclusions
Resources

Server-side
PostgreSQL "QGIS Package"
written in PL/pgSQL

Client-side
QGIS plug-in "3DCityDB-Tools"
written in Python



Plug-in overview

Motivation
Plug-in overview
Demo
Tests
Conclusions
Resources

Currently available tools:

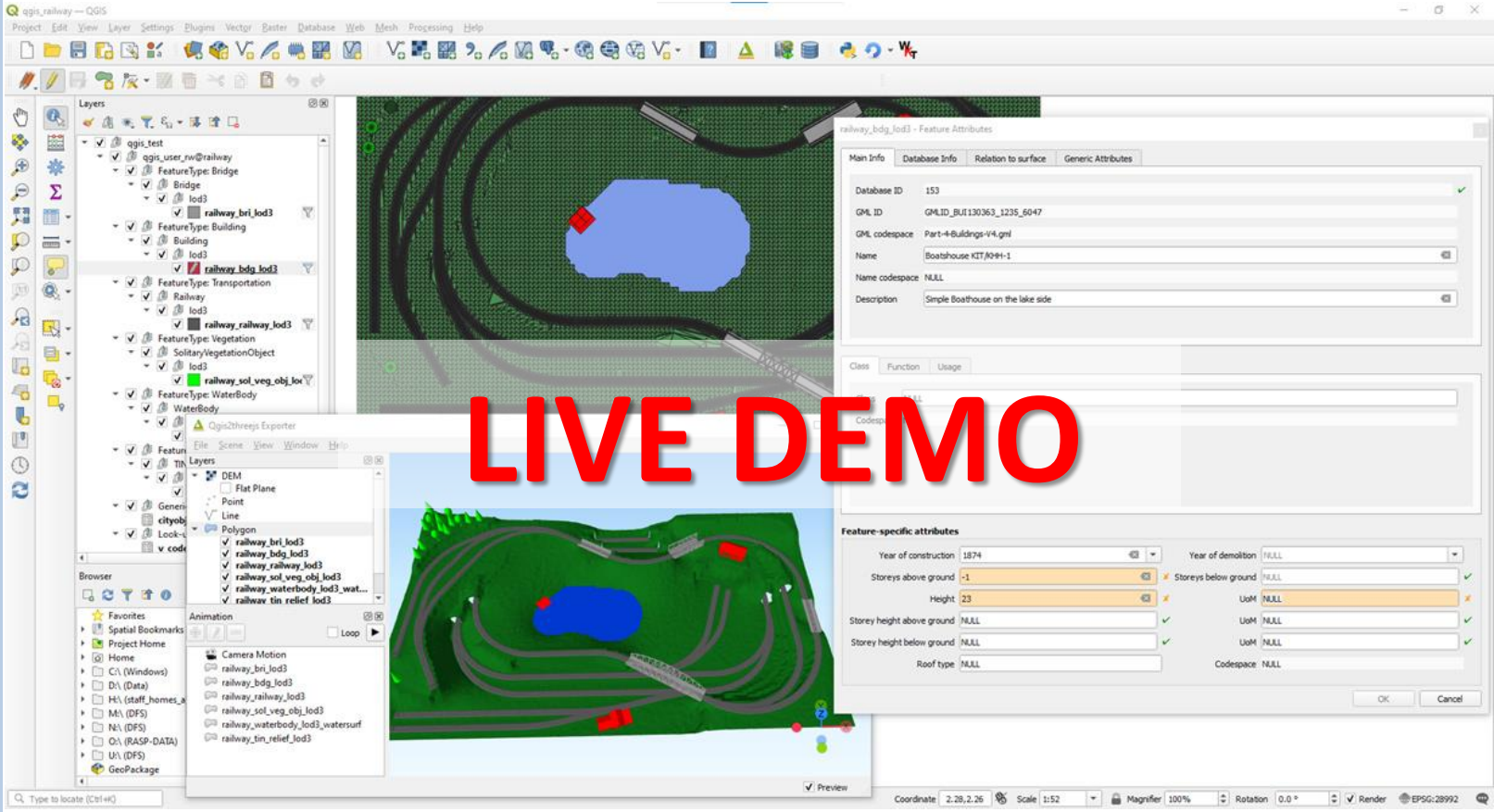
- **Layer Loader**
  - Creates layers and loads them into QGIS

- **Bulk Deleter**
  - Deletes features from the database

- **QGIS Package Administrator**
  - Takes care of installation & users´ settings

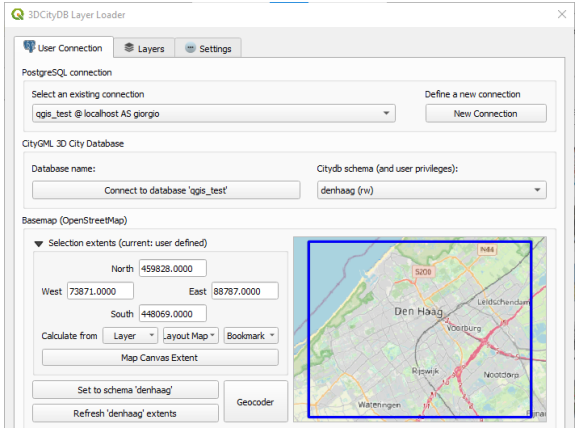
TU Delft 3Dgeoinfo

- Motivation
- Plugin overview
- **Demo**
- Conclusions
- Resources

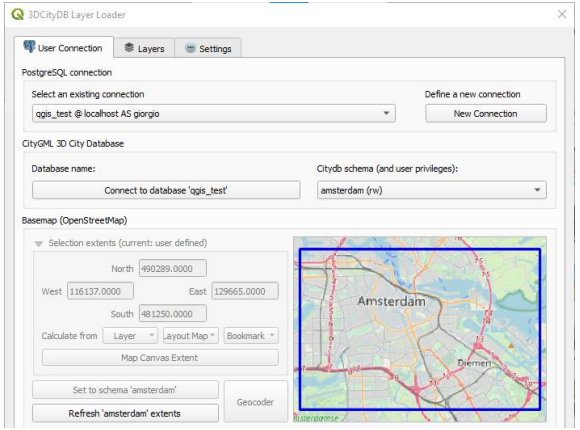


Tests...

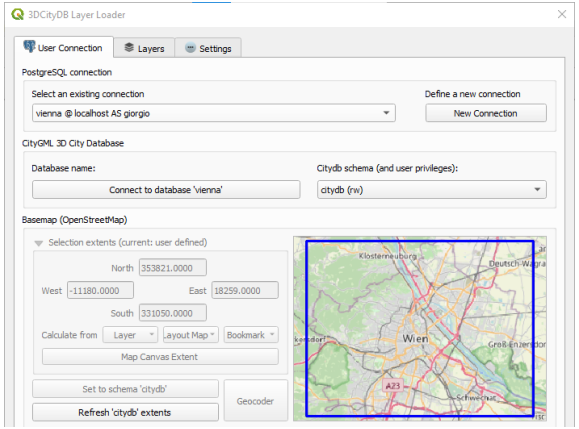
Motivation
Plug-in overview
Demo
Tests
Conclusions
Resources



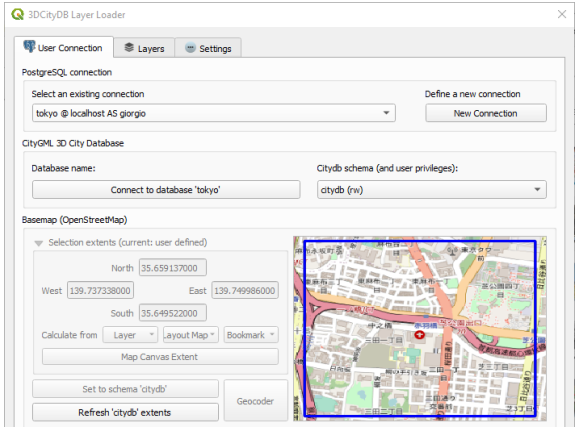
The Hague



Amsterdam



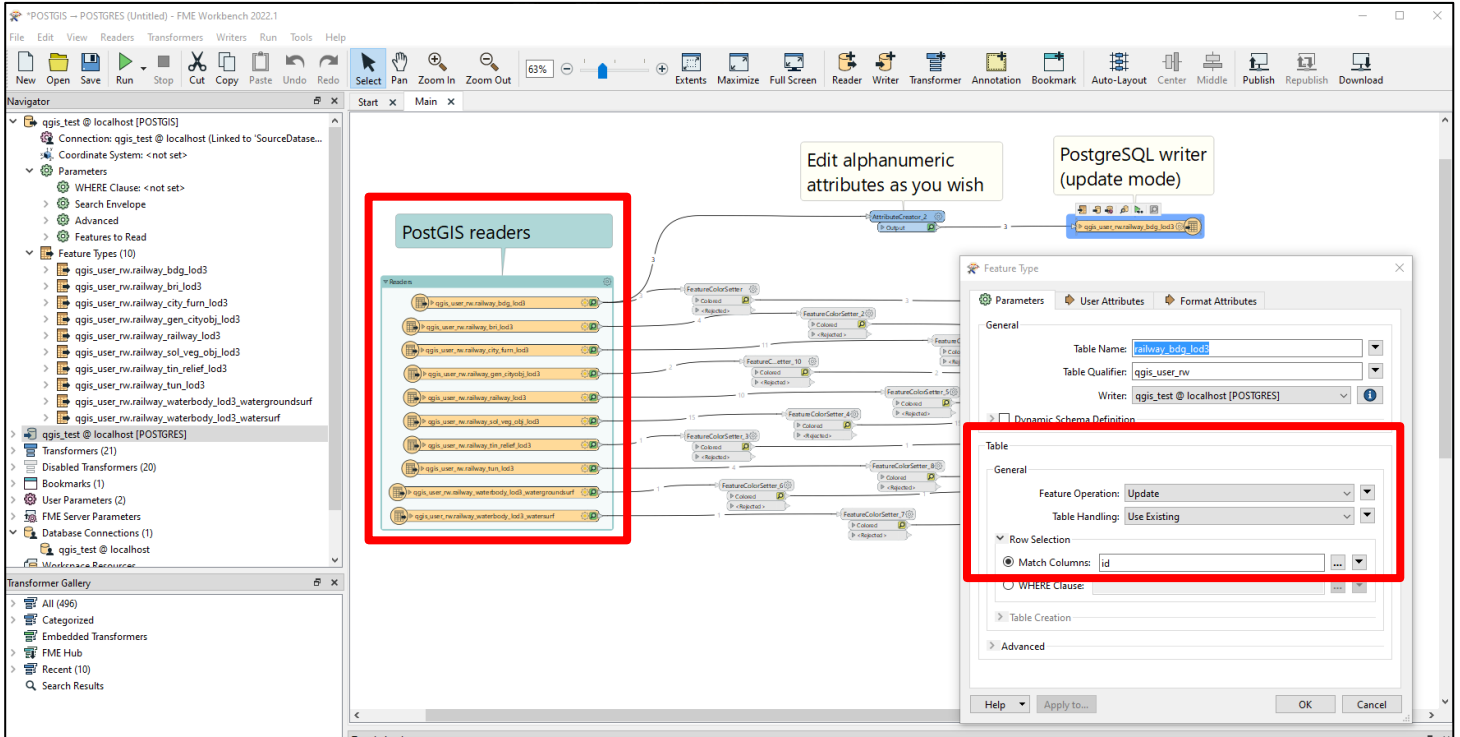
Vienna



Tokyo

QGIS Package (server-side only)

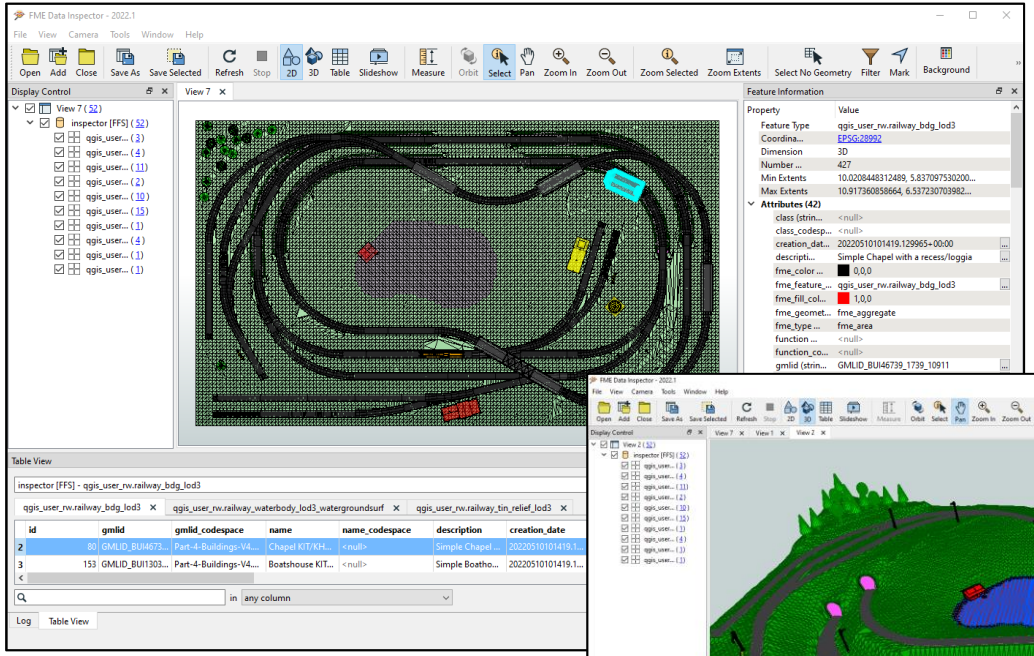
- This is a simple example of how the QGIS Package can be used via FME
  - Simply connect to the 3D City Database and import the views with **PostGIS readers**
  - Updates can be stored using **PostgreSQL writers in *update mode***



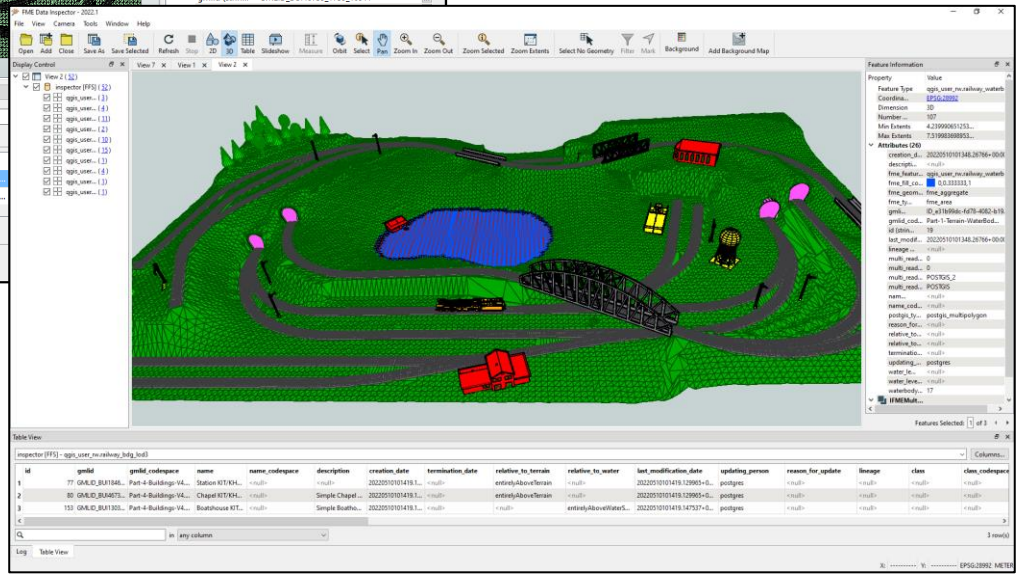
Motivation
Plug-in overview
Demo
Tests
Conclusions
Resources

QGIS Package

Motivation
Plug-in overview
Demo
Tests
Conclusions
Resources



2D visualisation
via FME Data Inspector



3D visualisation
via FME Data Inspector

Conclusions

Motivation
Plug-in overview
Demo
Tests
Conclusions
Resources

- 3DCityDB-Tools plug-in provides
  - Easier interaction with CityGML/CityJSON data stored in the 3DCityDB via QGIS
  - FOSS addition to the CityGML / 3D City Database software "archipelago"

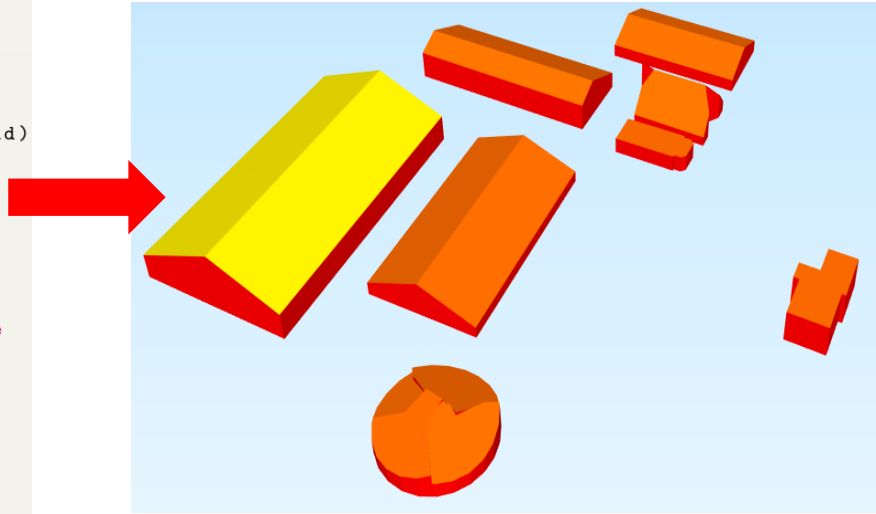
- User can interact via QGIS, or directly with the QGIS Package via **FME**, **python**, etc.

Conclusions

"Plain" 3DCityDB

Example: query of all (building) roofs constructed since 2015

```
SELECT
    ts.id AS roof_id,
    co_ts.gmlid AS roof_gmlid,
    b.id AS building_id,
    co.gmlid AS building_gmlid,
    b.year_of_construction,
    ST_Collect(sg.geometry) AS roof_geom
FROM
    citydb.thematic_surface AS ts
    INNER JOIN citydb.cityobject AS co_ts
        ON (co_ts.id = ts.id)
    INNER JOIN citydb.surface_geometry AS sg
        ON (ts.lod2_multi_surface_id = sg.root_id)
    INNER JOIN citydb.building AS b
        ON (b.id = ts.building_id)
    INNER JOIN citydb.cityobject AS co
        ON (co.id = b.id)
WHERE
    ts.objectclass_id = 33 AND -- roofsurfaces
    b.objectclass_id = 26 AND -- buildings
    b.year_of_construction >= '2015-01-01'::date
GROUP BY
    ts.id,
    co_ts.gmlid,
    b.id,
    co.gmlid,
    b.year_of_construction
ORDER BY
    b.id,
    ts.id;
```



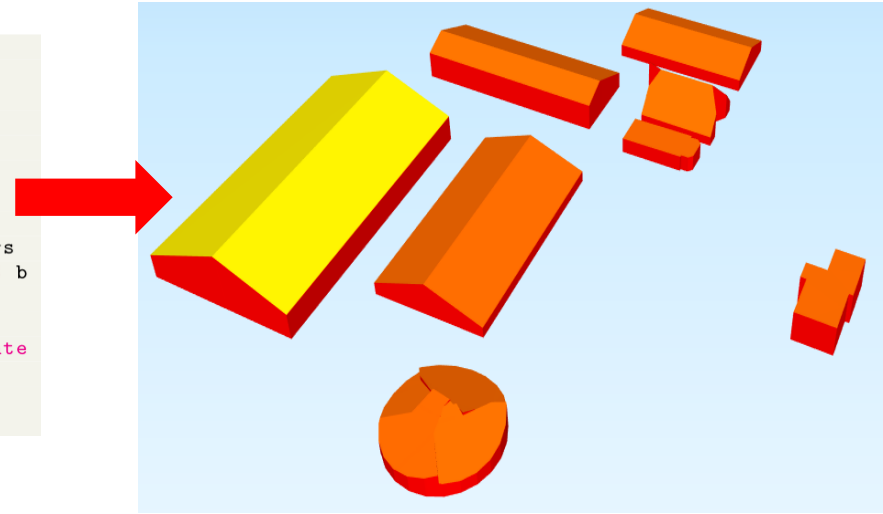
Motivation
Plug-in overview
Demo
Tests
Conclusions
Resources

Conclusions

QGIS Package

Example: query of all (building) roofs constructed since 2015

```sql
SELECT
    rs.id AS roof_id,
    rs.gmlid AS roof_gmlid,
    rs.building_id AS bdg_id,
    b.gmlid AS bdg_gmlid,
    b.year_of_construction,
    rs.geom AS roof_geom
FROM
    qgis_user_ro.citydb_bdg_lod2_roofsurf AS rs
    INNER JOIN qgis_user_ro.citydb_bdg_lod2 AS b
        ON b.id = rs.building_id
WHERE
    b.year_of_construction >= '2015-01-01'::date
ORDER BY
    b.id,
    rs.id;
```



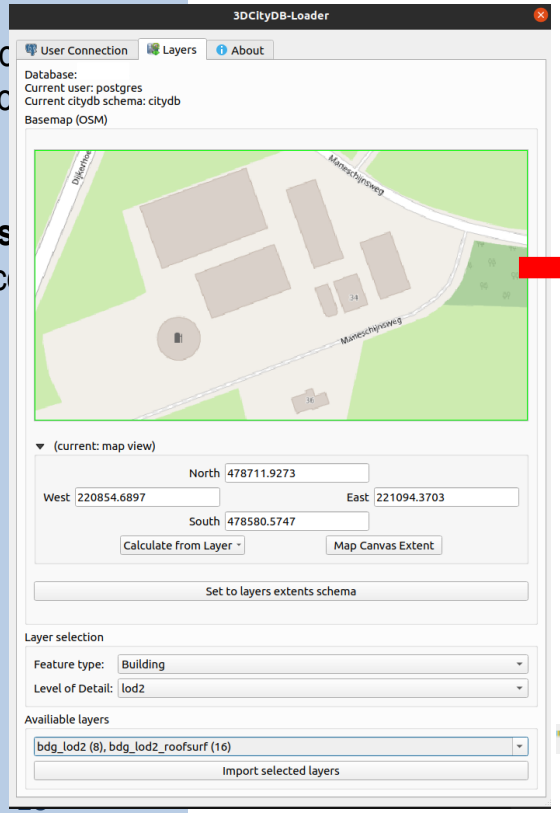
Motivation
Plug-in overview
Demo
Tests
Conclusions
Resources

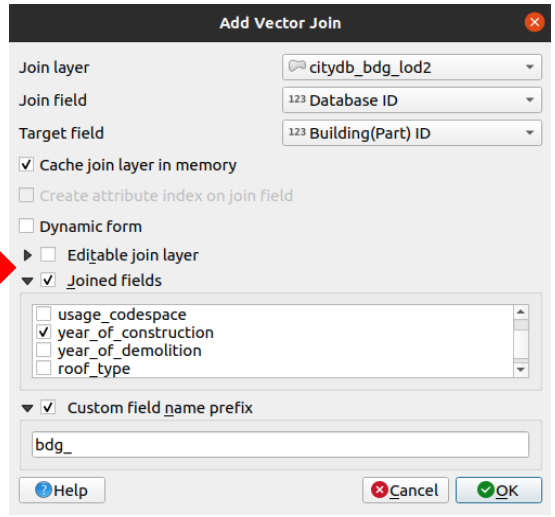
Conclusions

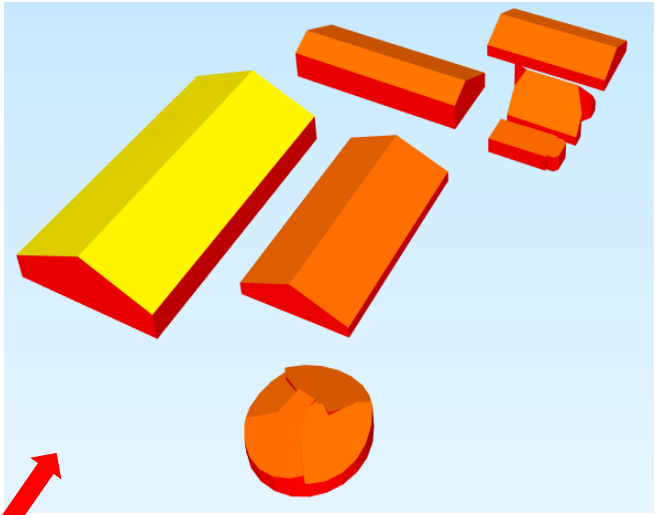
QGIS
3DCityDB-Tools

Example: query of all (building) roofs constructed since 2015

Motivatic
Plug-in c
Demo
Tests
Conclus
Resourc



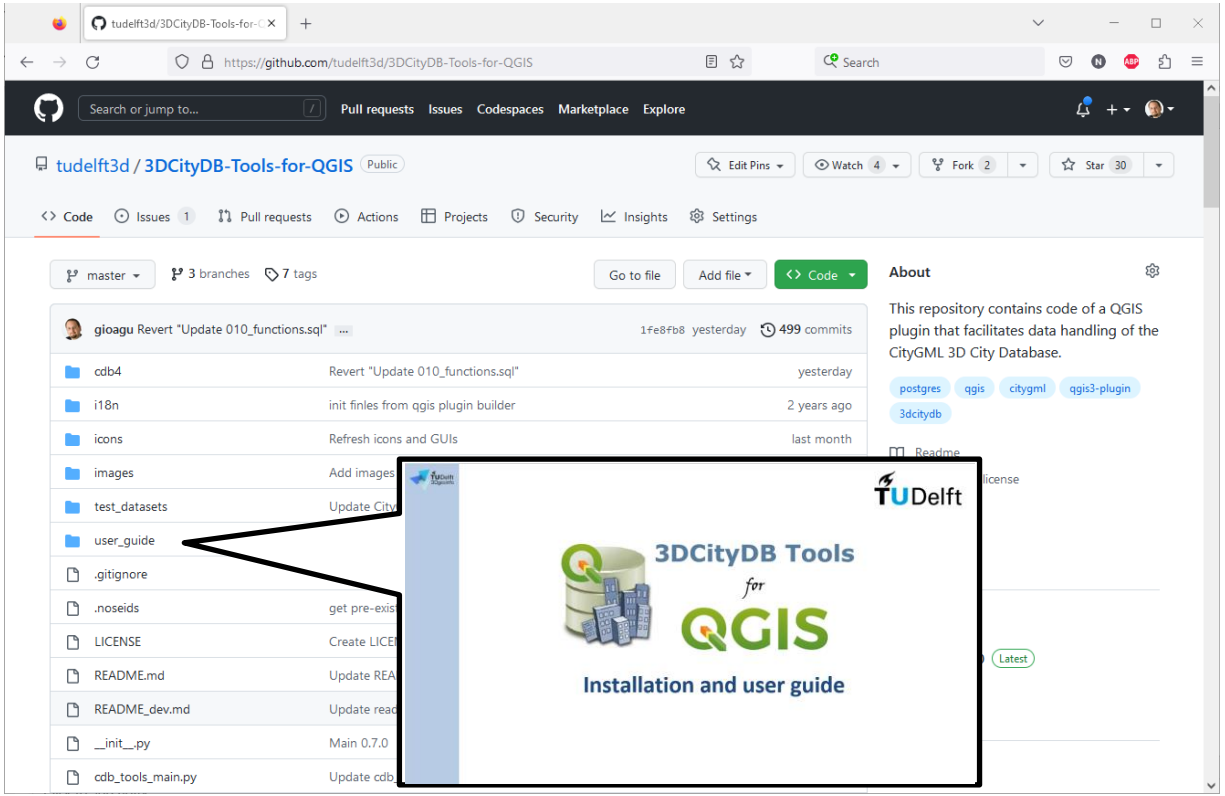




```
"bdg_year_of_construction" >= make_date(2015,1,1)
```

Resources

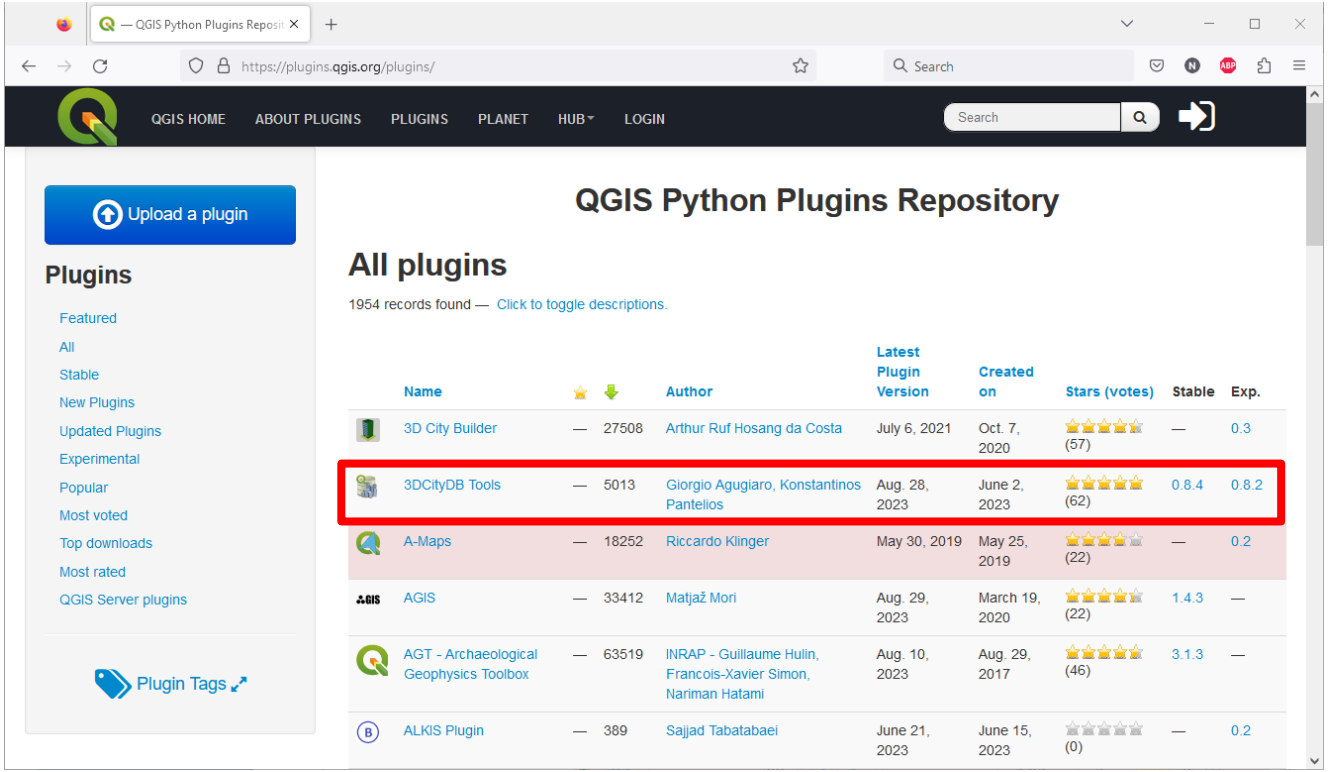
GitHub repository: https://github.com/tudelft3d/3DCityDB-Tools-for-QGIS



Motivation
Plug-in overview
Demo
Tests
Conclusions
Resources

Resources

QGIS Python Plugins Repository: https://plugins.qgis.org/plugins/



Motivation
Plug-in overview
Demo
Tests
Conclusions
Resources

Thank you for your attention!

3DCityDB Tools

for

QGIS