

Le 3DBAG : tous les bâtiments des Pays-Bas représentés avec CityJSON

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Webinaire “Autour de la 3D”
(en pyjama à la maison)

2025-02-06

Not only my work... but that of my research group

The screenshot shows the homepage of the 3D geoinformation at TU Delft website. The header features the TU Delft logo and navigation links for about, research, education, download, and etc. A large blue banner on the left contains three blue arrows pointing upwards and to the right. The main title "3D geoinformation" is displayed prominently in white. Below it is the URL "3d.bk.tudelft.nl". Two blue callout boxes are present: one for a "Fully-funded PhD position: 3D Reconstruction and modelling of roofs in European cities" and another for "We're hiring a postdoctoral researcher! Revealing Urban Waste Dynamics from Images with AI". On the right side, there's a section titled "Latest news" with a feed of recent posts. At the bottom, there are logos for CityJSON (with a tree, bar chart, and house icon) and CHEK (Digital Building Permit).

The screenshot shows the "About" page of the 3D geoinformation at TU Delft website. The header includes the TU Delft logo and navigation links for about, research, education, download, and etc. The main content area is titled "Our Staff" and displays a grid of 24 circular profile pictures, each with a name and title. The staff members listed include:

Name	Title
Giorgio Agugiaro	Assistant prof.
Ken Arroyo Ohori	Postdoctoral researcher
Lukas Beuster	PhD candidate
Daniele Cannatella	Assistant prof.
Sheng'an Du	PhD candidate
Siham El Yamari	Postdoctoral researcher
Weixiao Gao	Postdoc
Clara García-Sánchez	assistant prof.
Amir Hakim	Scientific Software Developer and Researcher
Margo van der Helm	Secretary
Nadine Hobelka	PhD candidate
Jin Huang	PhD candidate
Nail Ibrahimli	PhD candidate
Martine de Jong-Lansbergen	Secretary
Aana Iabetski	Postdoc
Hugo Ledoux	associate prof.
Camille Leon-Sánchez	PhD candidate
Miguel Martin	Research fellow
Liangliang Nan	Associate prof.
Akhay Patil	Postdoc
Ivan Paden	PhD candidate
Maarten Prenk	PhD candidate interim
Gina Stavropoulou	Data Engineer
Amy Sterrenberg	PhD candidate
Jantien Stoter	Professor
Daan van der Heide	PhD candidate
Jasper van der Vaart	Scientific Software Developer and Researcher
Stelios Vitalis	PhD candidate

Below the staff list, sections for "Academic visitors" and "Former staff" are shown, each with a grid of three circular profile pictures.

What is 3DBAG?

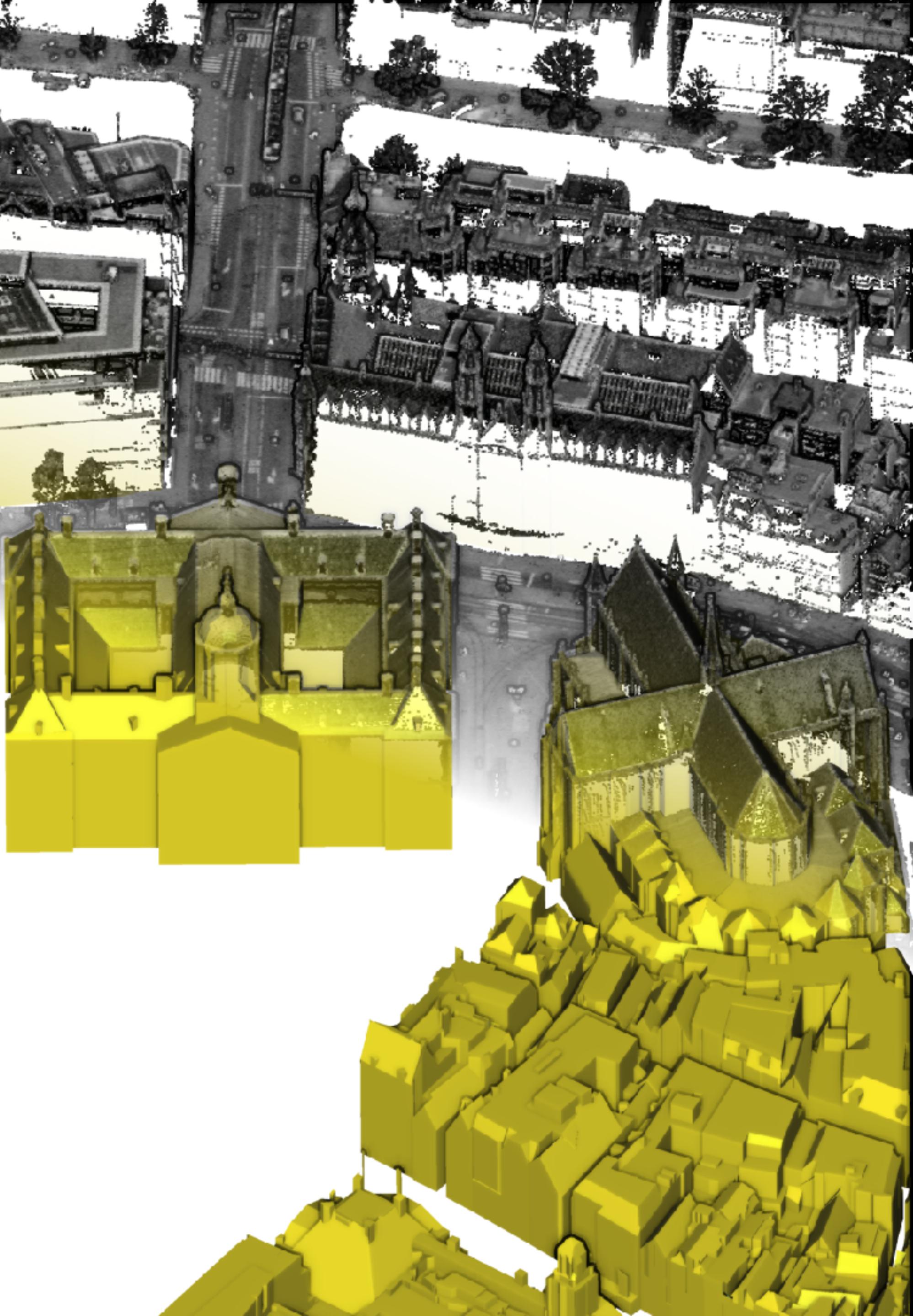
1. Dataset with 3D models for all ~ 10 million buildings in NL

- Reconstructed from open dataset
 - roofprints (BAG dataset)
 - classified LiDAR Point cloud (AHN dataset)
- Available as open data

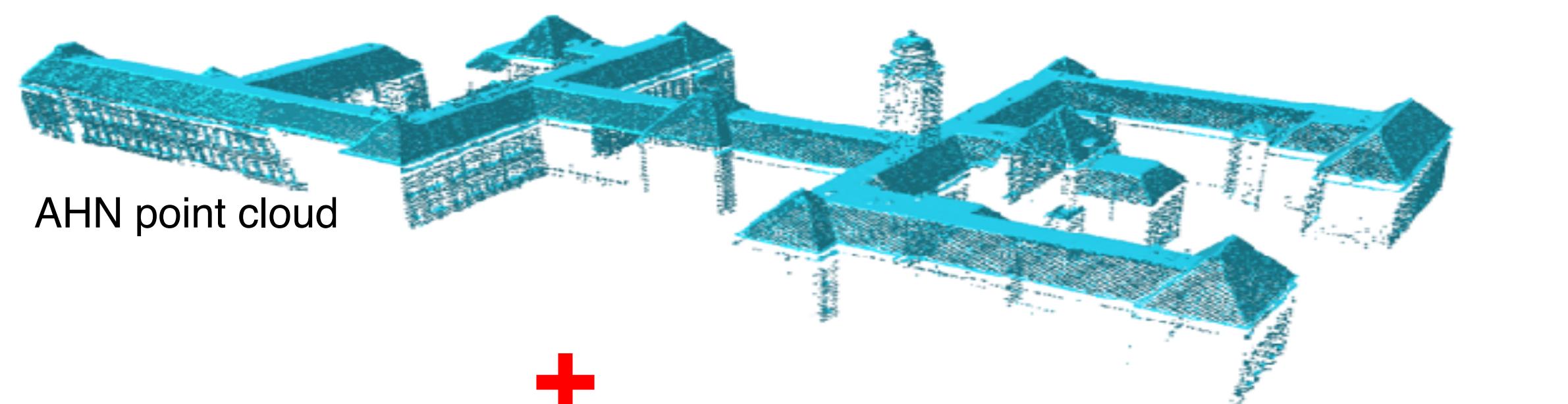
2. Software behind the dataset

- open source

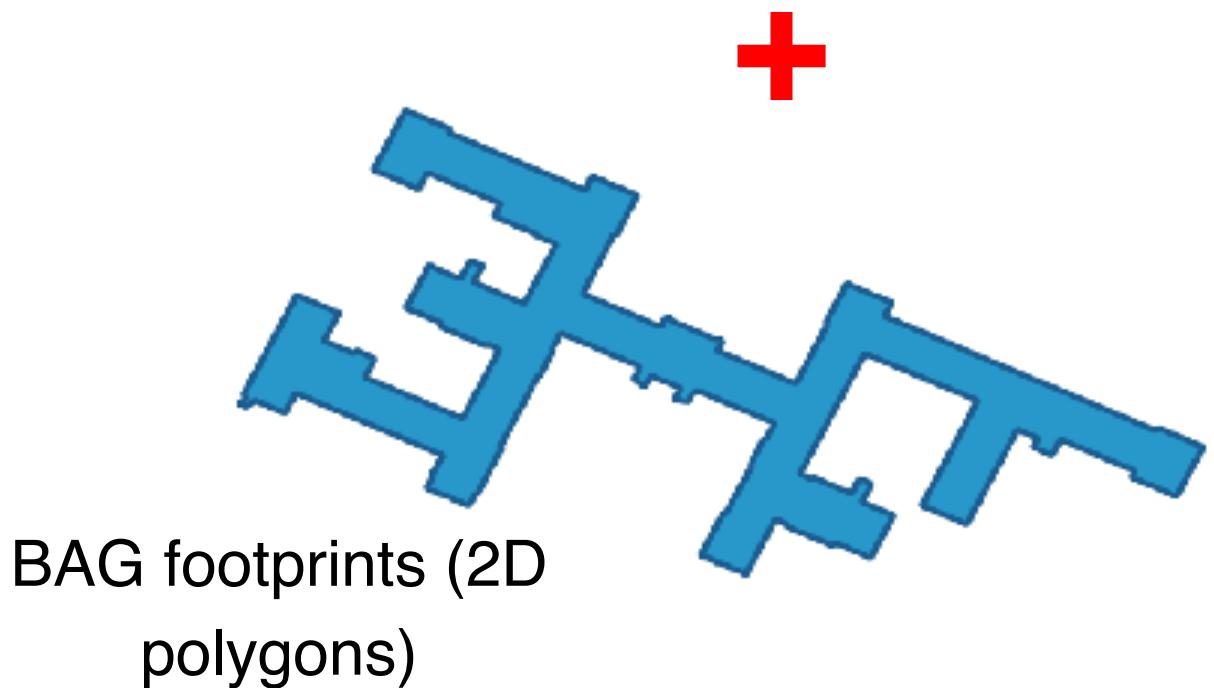
Built and maintained by



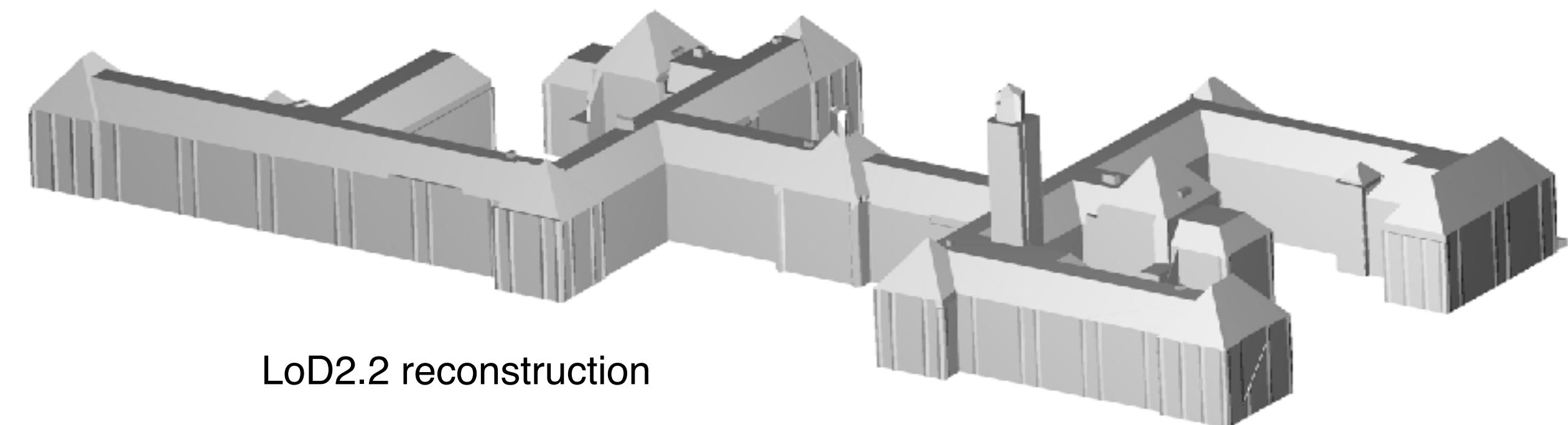
How does it work?



AHN point cloud

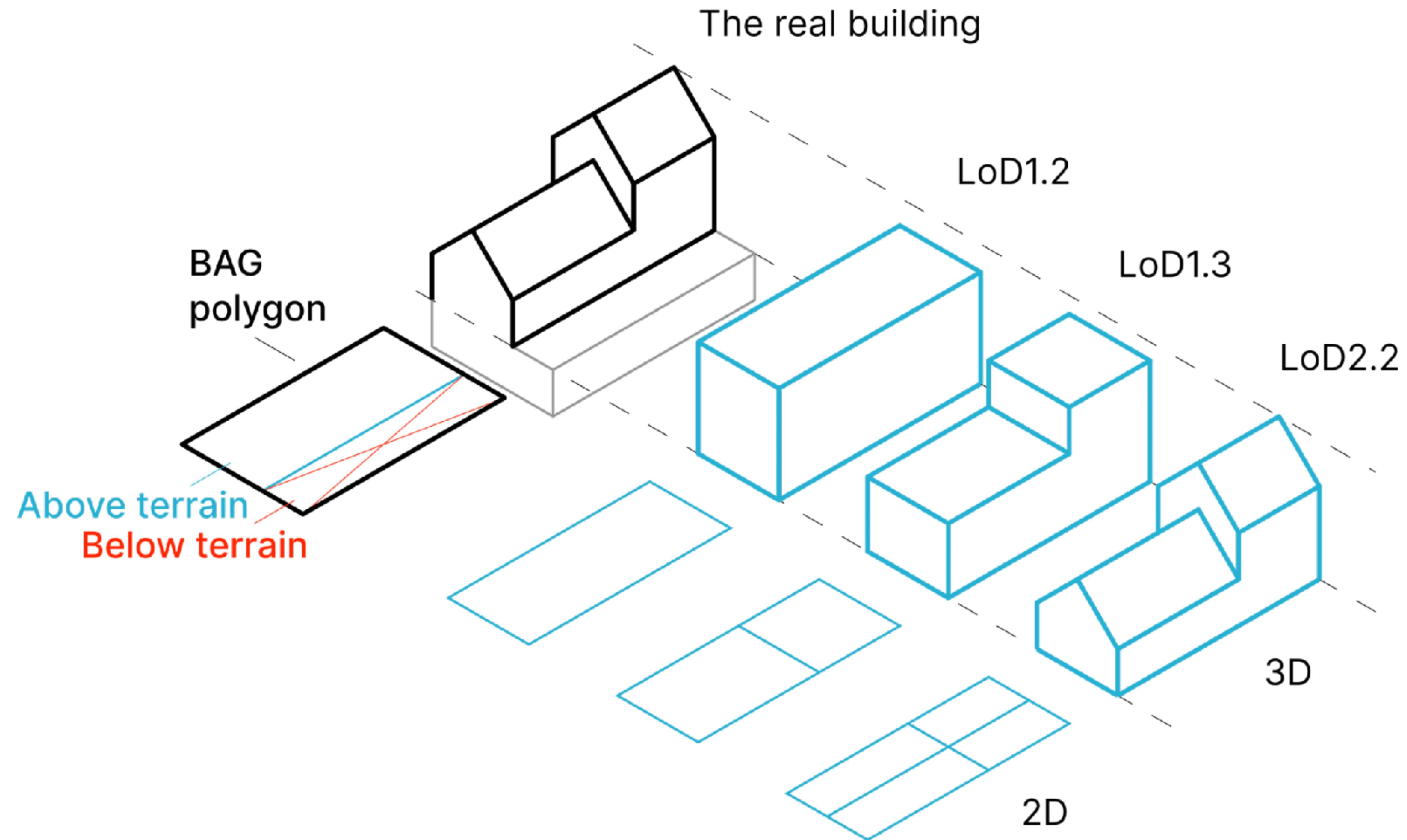


BAG footprints (2D polygons)



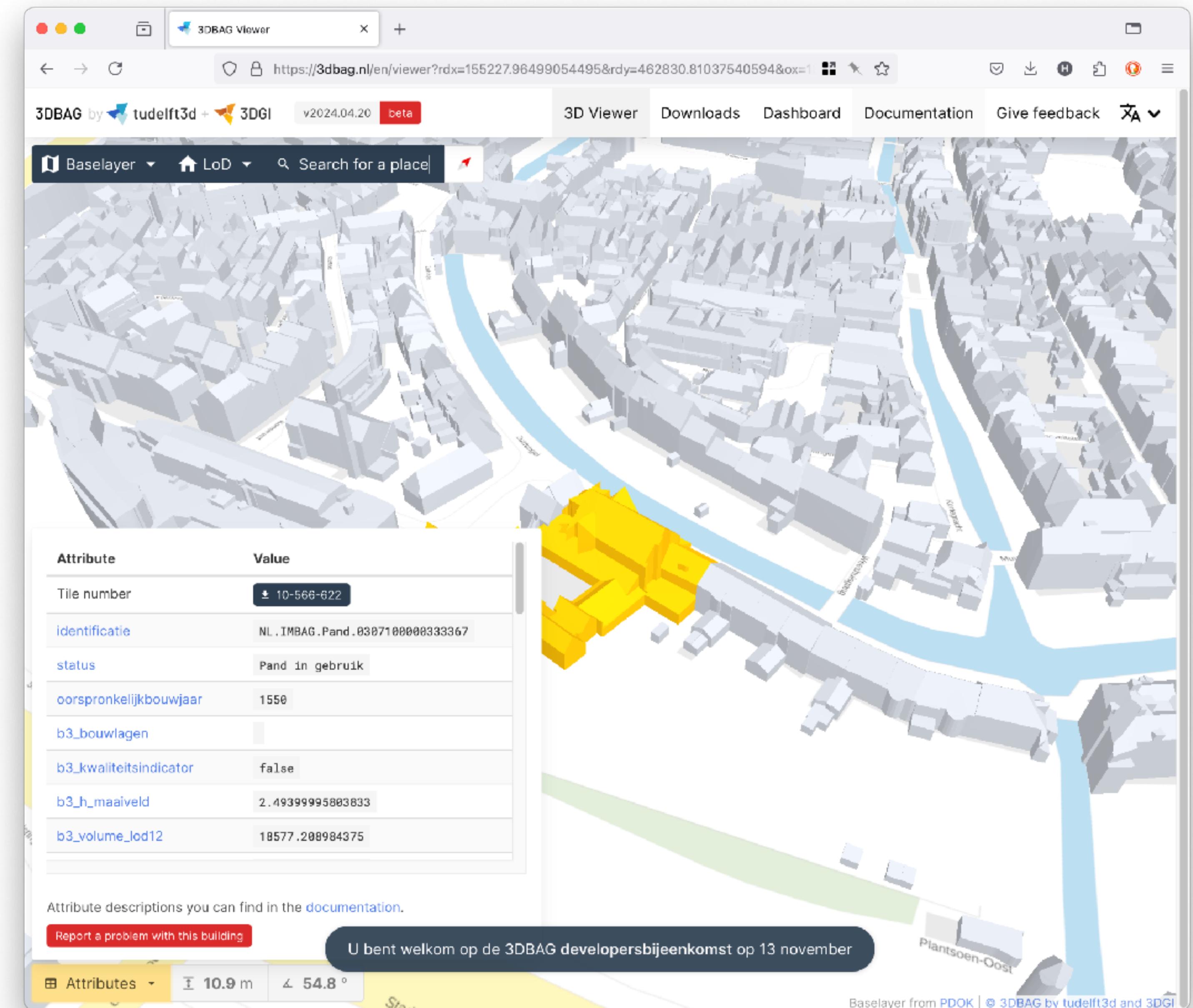
LoD2.2 reconstruction

Three levels of detail (LoD)



<https://3dbag.nl>

- 3D viewer
 - Can view 10M buildings
 - Works on a phone!



<https://3dbag.nl>

- 3D viewer
 - Can view 10M buildings
 - Works on a phone!
- Datasets in small GIS/3D formats
 - CityJSON, OBJ, GPKG
 - Also web-services (WFS, OGC API Features)

The screenshot shows the 3DBAG Viewer interface. At the top, there's a navigation bar with links for '3D Viewer', 'Downloads' (which is active), 'Dashboard', 'Documentation', and 'Give feedback'. Below the navigation is a section titled 'Downloads per tile' with a sub-section 'Webservices' and a 'GPKG data dump' section.

Downloads per tile

To keep filesizes manageable the 3DBAG dataset is subdivided in tiles. For each tile we offer the data in a number of different file formats. Use the button below to select the tile of interest to see the download options.

Pick a tile

Alternatively you can access the complete tile index directly.

File	Format	Version
https://data.3dbag.nl/v20240420/tile_index.gpkg	GPKG	v2024.04.20

Webservices

These allow you to explore the entire dataset. The 2D projection of the models is served via WMS.

Type

- WMS [?](#)
- WFS [?](#)
- 3D API (experimental) [?](#)

GPKG data dump

The GPKG file below contains the 3DBAG data as Seek-Optimized ZIP, see the documentation for more information.

File	SHA-256	U bent
3dbag_nl.gpkg.zip	71faec1f378d63e480	

Beware, this is a very large file to download. The file is about 108 GB when decompressing it first.

U bent welkom op de 3DBAG developersbijeenkomst op 13 november 2024. Size: 18 GB (108 GB) Version: v2024.04.20

- 3D viewer
 - Can view 10M buildings
 - Works on a phone!
- Datasets in small GIS/3D formats
 - CityJSON, OBJ, GPKG
 - Web-services (WFS, OGC API Features)
- Documentation
 - All attributes described
 - How to use the datasets

The screenshot shows a web browser window displaying the 'Data-attributen' section of the 3DBAG documentation. The URL in the address bar is <https://docs.3dbag.nl/nl/schema/attributes/>. The page header includes the 3DBAG logo and navigation links for Introductie, Dataschema, Dataformaten, Gebruiksvoorraarden, Contact, Viewer, and Downloads.

The main content area is titled 'Data Attributen'. It lists several attributes under the 'Dataschema' category:

- b3_azimut**: Azimut van dakdeel. Beschikbaar voor de LoD 2.2 dakdelen in de GPKG 2D lagen.
Datatype: reëel getal
Eenheid: graden
- b3_bag_bag_overlap**: Het oppervlakte van overlap van dit BAG polygon met andere BAG polygonen. Eenheid: vierkante meter.
Datatype: reëel getal
Eenheid: vierkante meter
- b3_bouwlagen**: Een schatting van het aantal bouwlagen in het gebouw. Schattingen zijn alleen beschikbaar voor gebouwen met maximaal 5 geschatte bouwlagen.
Datatype: nominaal getal
Eenheid: -
- b3_dak_type**: Daktype van het pand.

On the right side of the page, there is a vertical list of other attributes, likely part of the same schema or a related one:

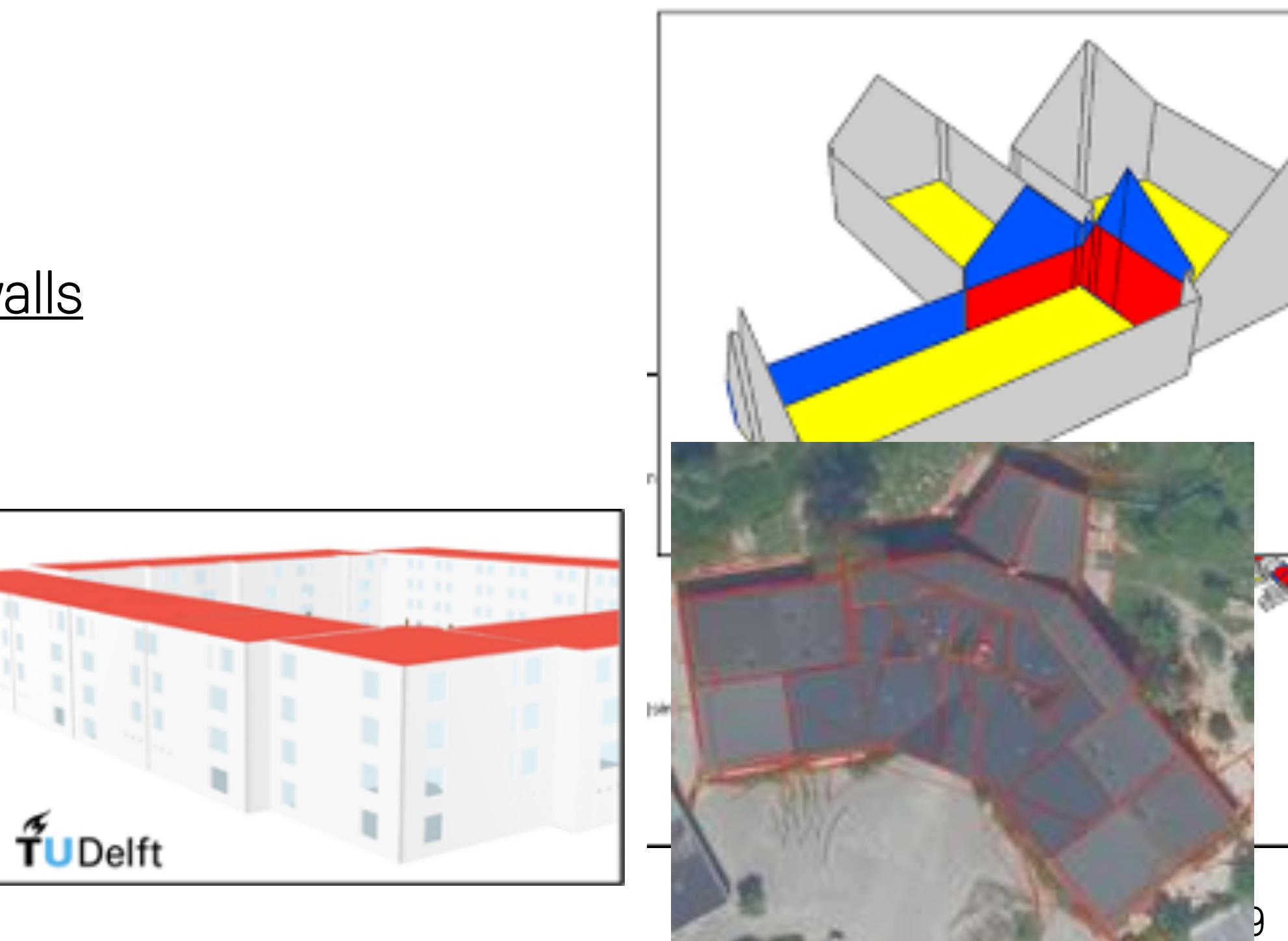
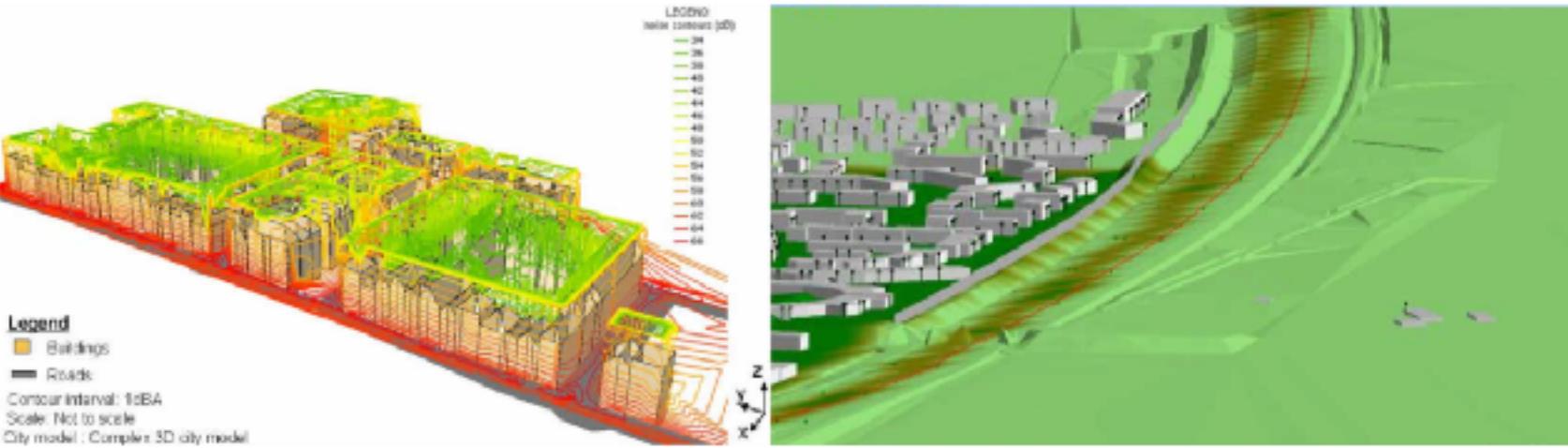
- Inhoudsopgave
- b3_azimut
- b3_bag_bag_overlap
- b3_bouwlagen
- b3_dak_type
- b3_dd_id
- b3_h_dak_50p
- b3_h_dak_70p
- b3_h_dak_max
- b3_h_dak_min
- b3_h_maaveld
- b3_hellingshoek
- b3_kas_warenhuis
- b3_kwaliteitsindicator
- b3_mutatie_ahn3_ahn4
- b3_nodata_fractie_ahn3
- b3_nodata_fractie_ahn4
- b3_nodata_radius_ahn3
- b3_nodata_radius_ahn4
- b3_opp_buitenmuur
- b3_opp_dak_plat
- b3_opp_dak_schuin
- b3_opp_grond
- b3_opp_scheidingsmuur
- b3_pand_deel_id
- b3_puntdichtheid_ahn3
- b3_puntdichtheid_ahn4
- b3_pw_bron
- b3_pw_datum
- b3_kw_selectie_reden

History and status 3DBAG



European Research Council
Established by the European Commission

- Started as research projects (since 2018)
- Testbed for 3D geoinformation
 - Push state-of-the-art 3D building reconstruction
 - Push 3D innovations in urban applications (by us + others)
 - Test and improve open data standards (CityJSON)
- First nationwide version 2021, several releases per year
 - Updates + improvements
 - New features from research: volume, areas wall/roof/floor, nr floors, party walls
- Ongoing research:
 - Add openings from oblique images, use other data sources, use in BIM



Everything is open-source and open-data

The screenshot shows a GitHub repository page for the 'roofer' project. The repository is public and has 5 branches and 0 tags. The 'Code' tab is selected. A modal window is open, stating 'Your develop branch isn't protected' and prompting to 'Protect this branch'. The repository has 22 issues, 1 pull request, and 2 security alerts. The 'About' section describes it as 'Large scale automatic LoD2.2 building reconstruction'. The repository URL is 3dbag.github.io/roofer/. The sidebar shows the repository is 40 stars, 10 forks, and 5 watching. It also lists languages (Python, HTML, Rust, CMake), Jupyter Notebook, and most used topics (geospatial, software-testing).

Your develop branch isn't protected

Protect this branch

5 Branches 0 Tags

Ylannl add no-clip option ✓

e671945 · last week 662 Commits

.github/workflows fix pin vcpkg 3 months ago

apps add no-clip option last week

cmake Update CPM to 0.40.2 3 months ago

docker enable val3dity in dockerfile 2 months ago

docs add no-tiling option to help 2 months ago

experiments formatting 7 months ago

include/roofer add computation for 98th pointcloud percentile 3 weeks ago

About

Large scale automatic LoD2.2 building reconstruction

3dbag.github.io/roofer/

Readme

GPL-3.0 license

Activity

Custom properties

40 stars

5 watching

10 forks

Report repository

Releases

No releases published

Create a new release

View as: Public

are viewing the README and pinned repositories as a public user.

People

languages

Python HTML Rust CMake

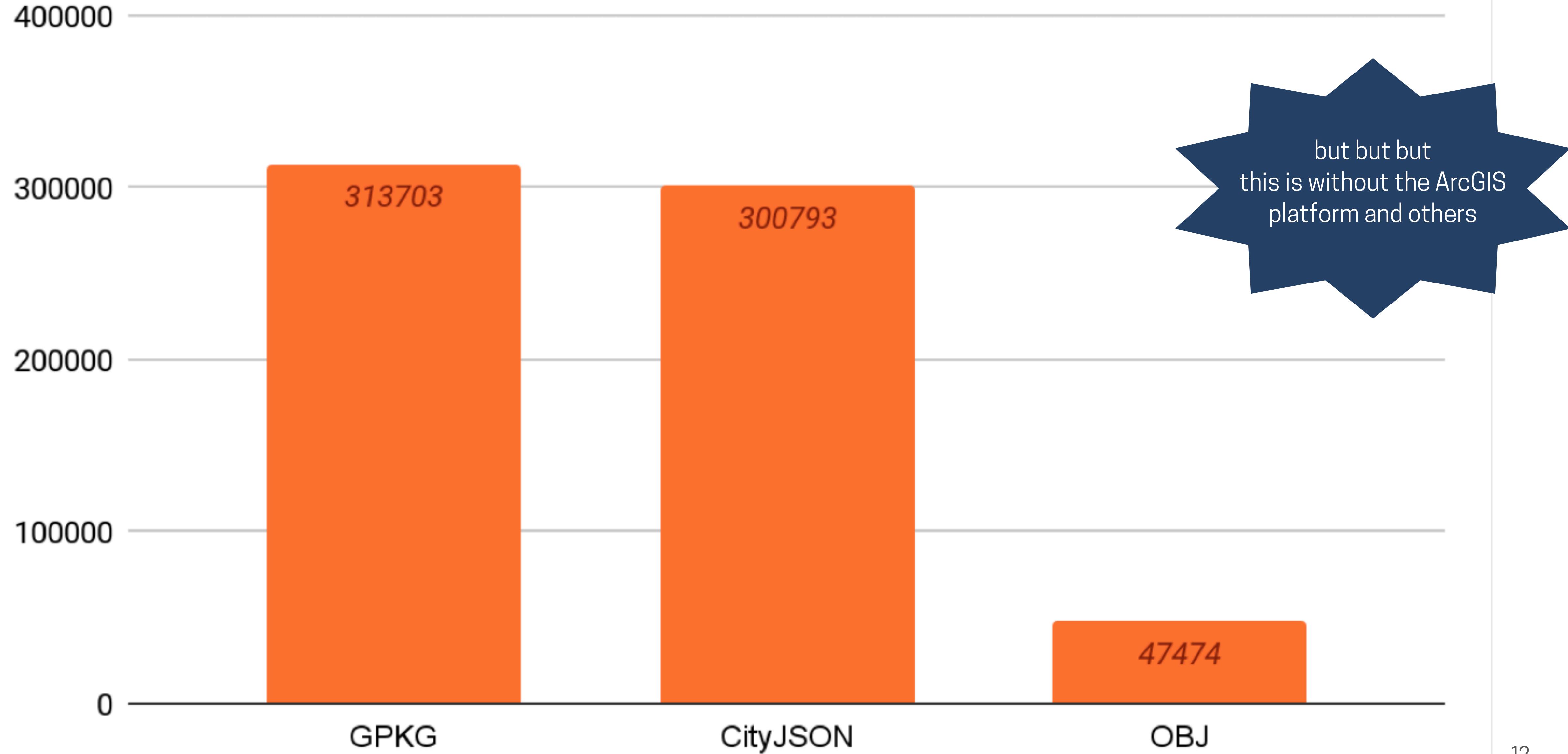
Jupyter Notebook

most used topics

geospatial software-testing

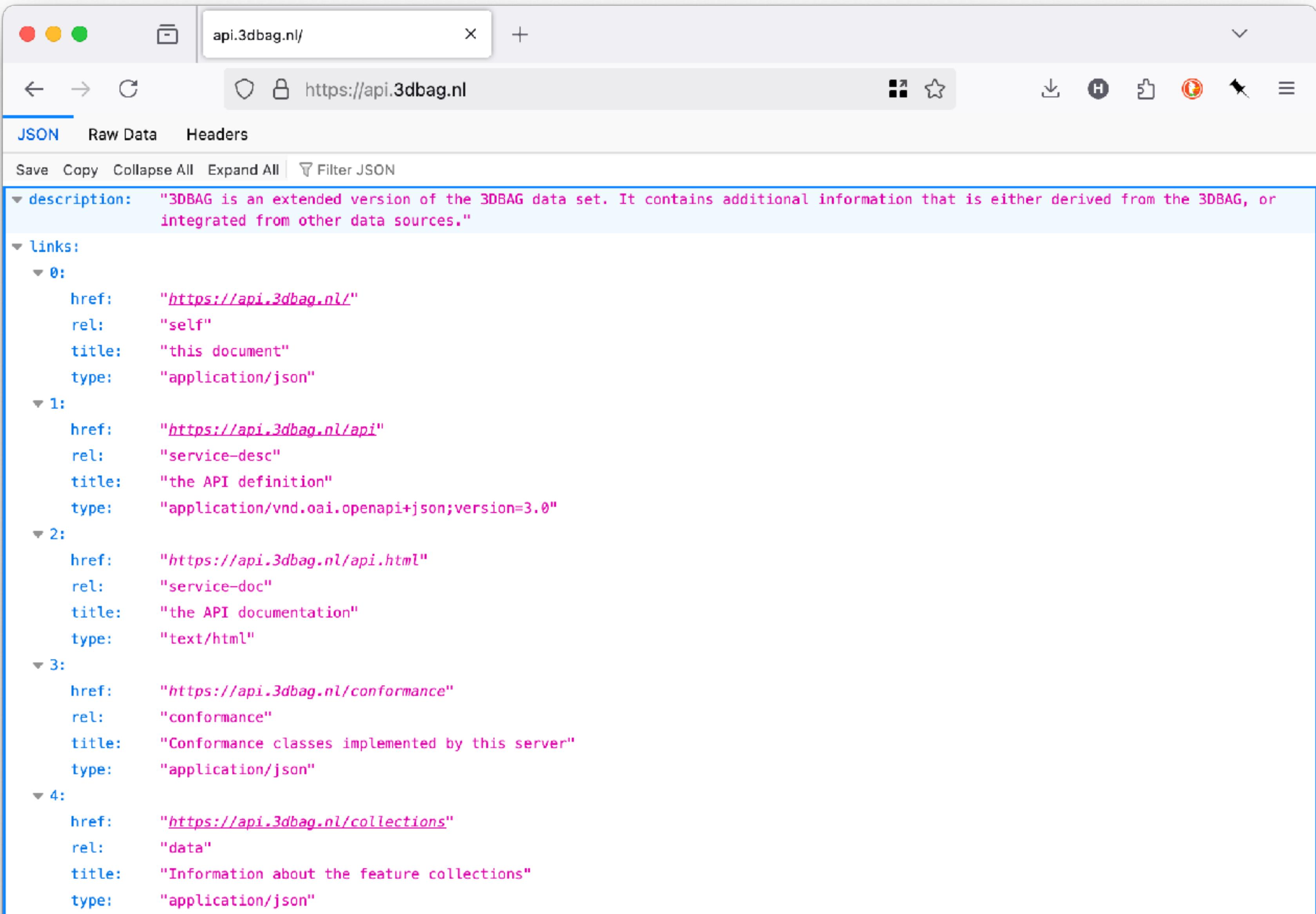
Is the 3DBAG popular?

Number of tiles downloaded (March-October 2024)



Number webservice queries (March–October 2024)

5000000



```
description: "3DBAG is an extended version of the 3DBAG data set. It contains additional information that is either derived from the 3DBAG, or integrated from other data sources."
links:
  0:
    href: "https://api.3dbag.nl/"
    rel: "self"
    title: "this document"
    type: "application/json"
  1:
    href: "https://api.3dbag.nl/api"
    rel: "service-desc"
    title: "the API definition"
    type: "application/vnd.oai.openapi+json;version=3.0"
  2:
    href: "https://api.3dbag.nl/api.html"
    rel: "service-doc"
    title: "the API documentation"
    type: "text/html"
  3:
    href: "https://api.3dbag.nl/conformance"
    rel: "conformance"
    title: "Conformance classes implemented by this server"
    type: "application/json"
  4:
    href: "https://api.3dbag.nl/collections"
    rel: "data"
    title: "Information about the feature collections"
    type: "application/json"
```

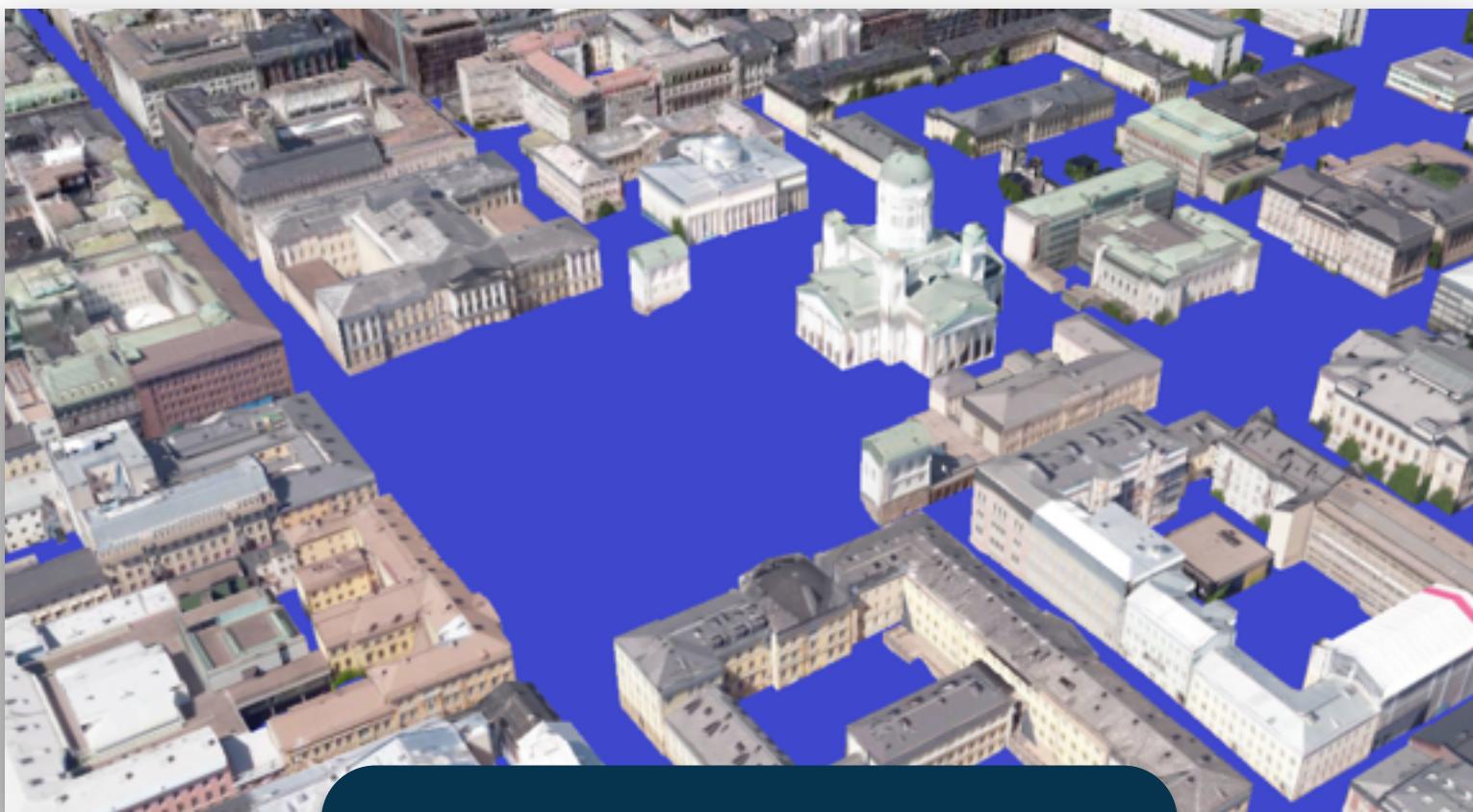
4446492

CityJSON API
<https://api.3dbag.nl/>

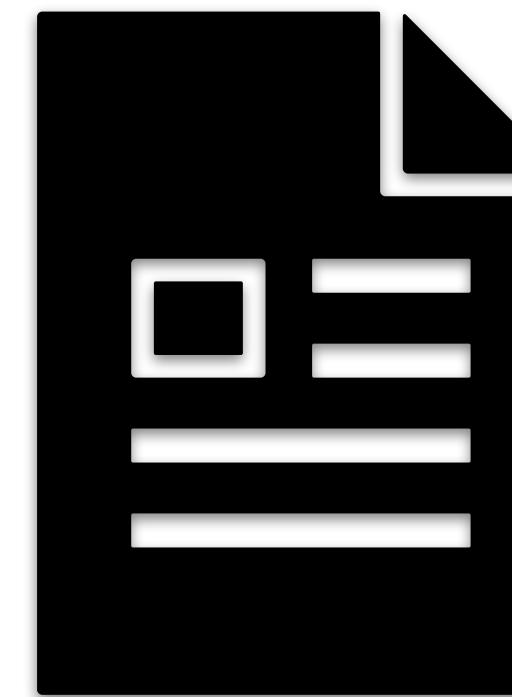
Which format should we use for the 3DBAG?



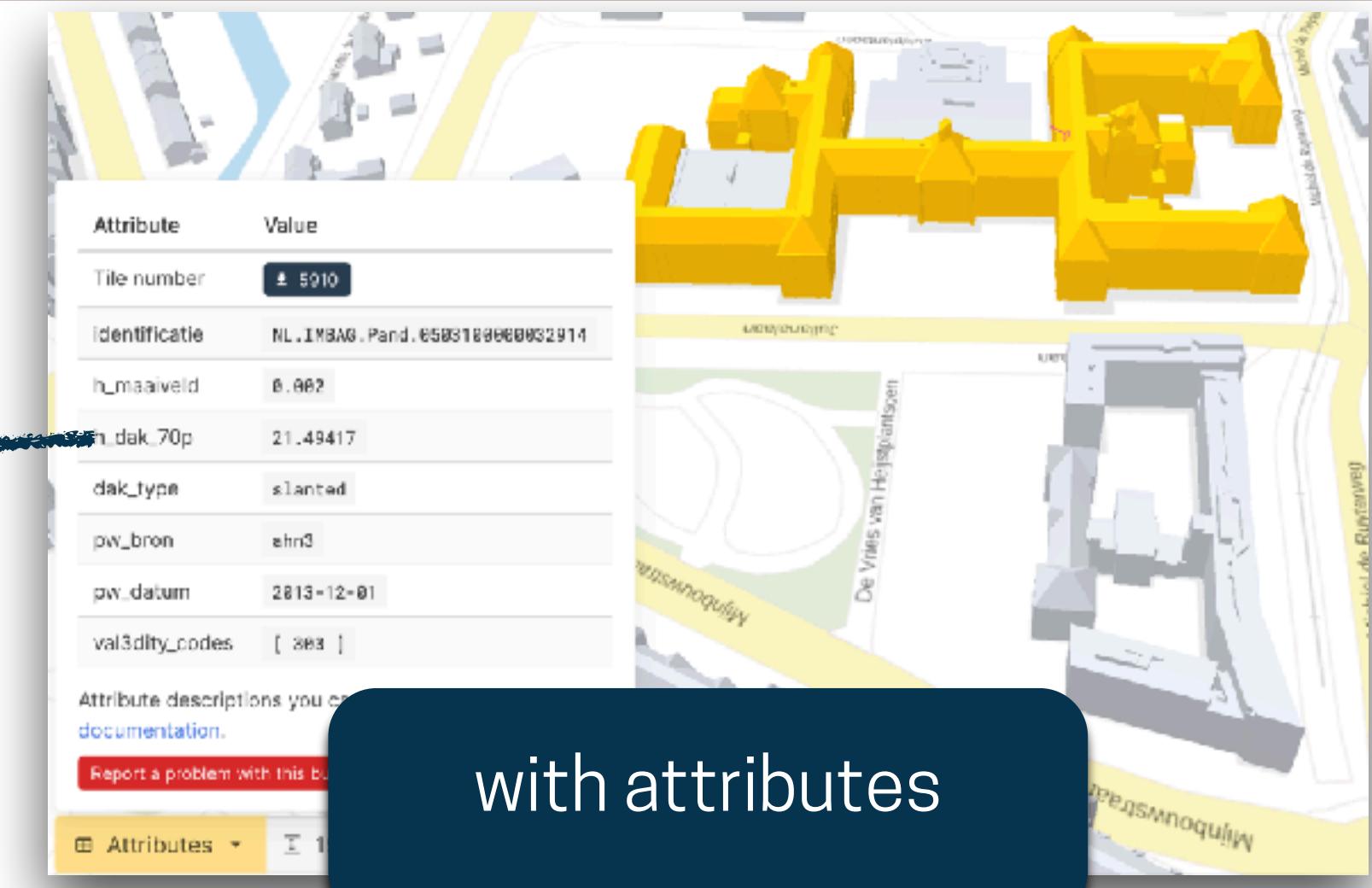
3D city models of
large area



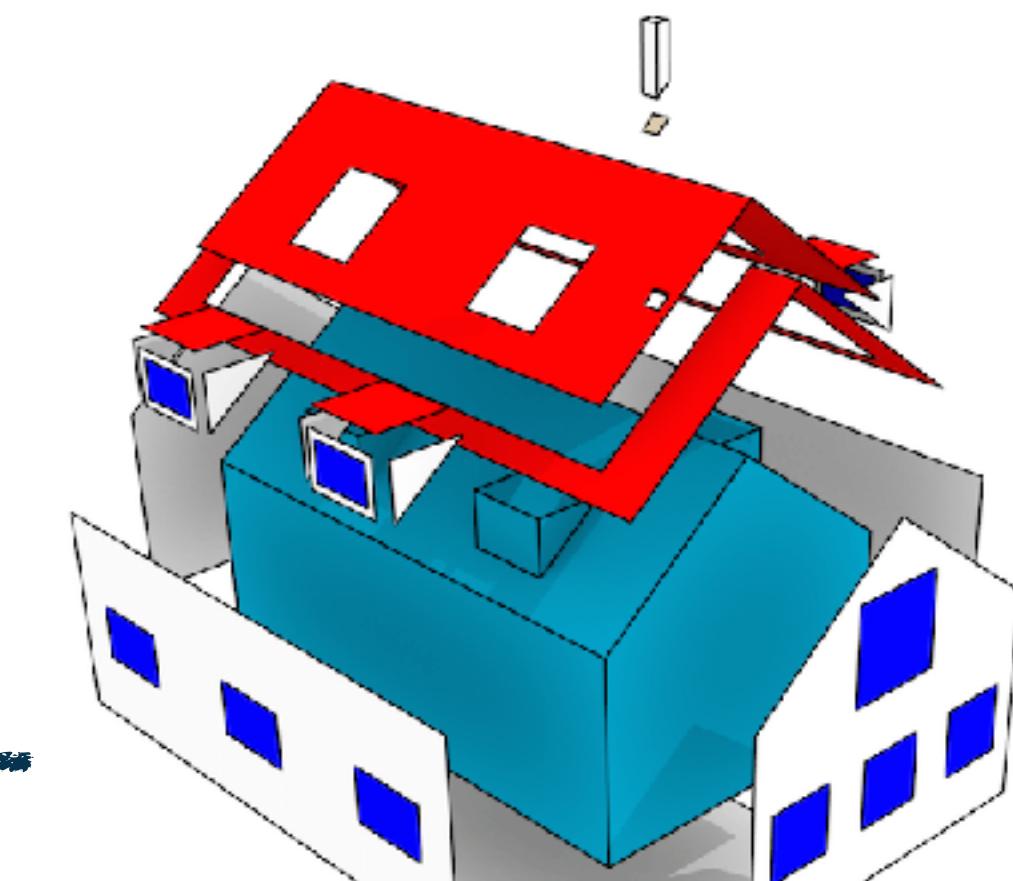
with textures



- .obj ?
- .gml ?
- .json ?
- .shp ?
- .stl ?



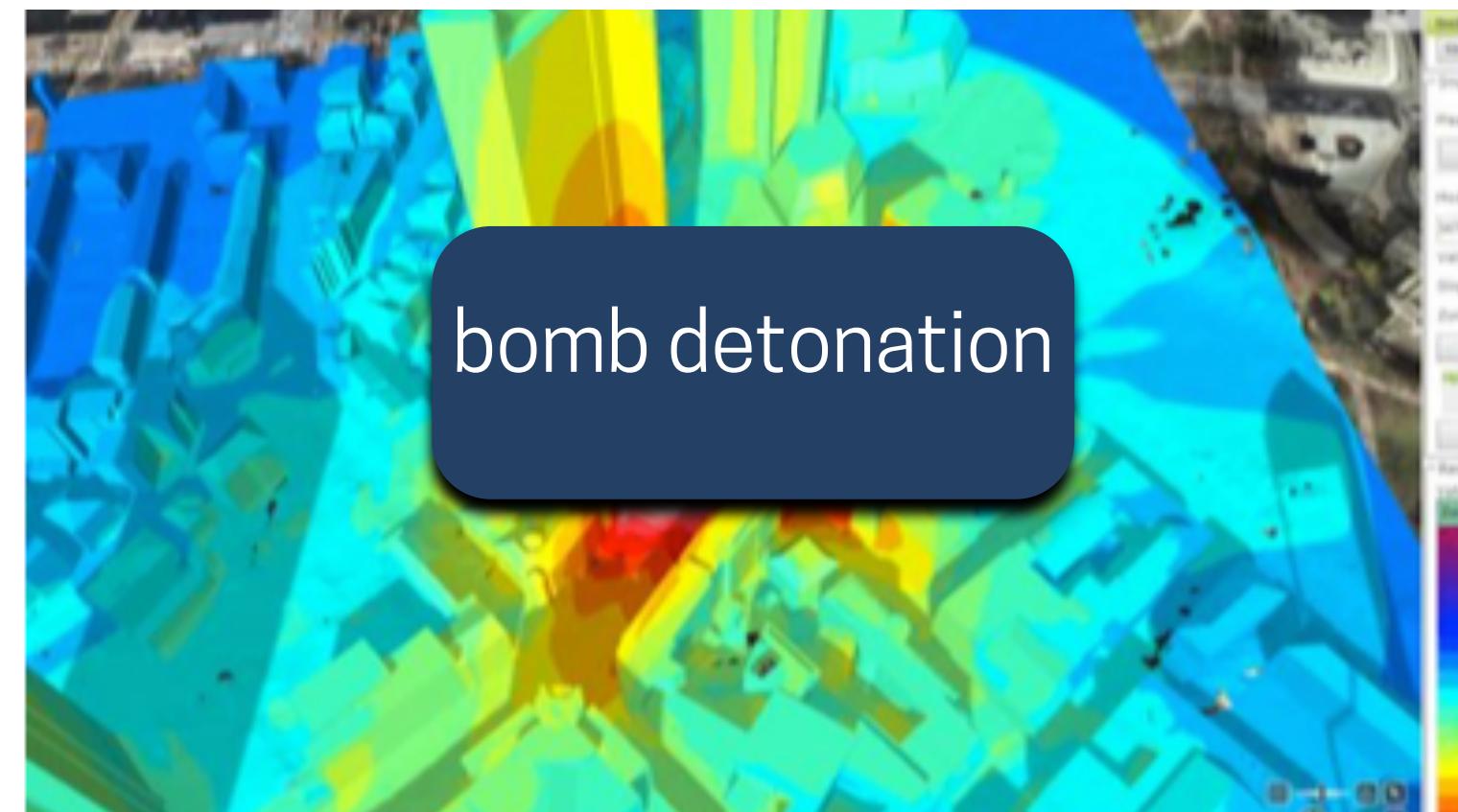
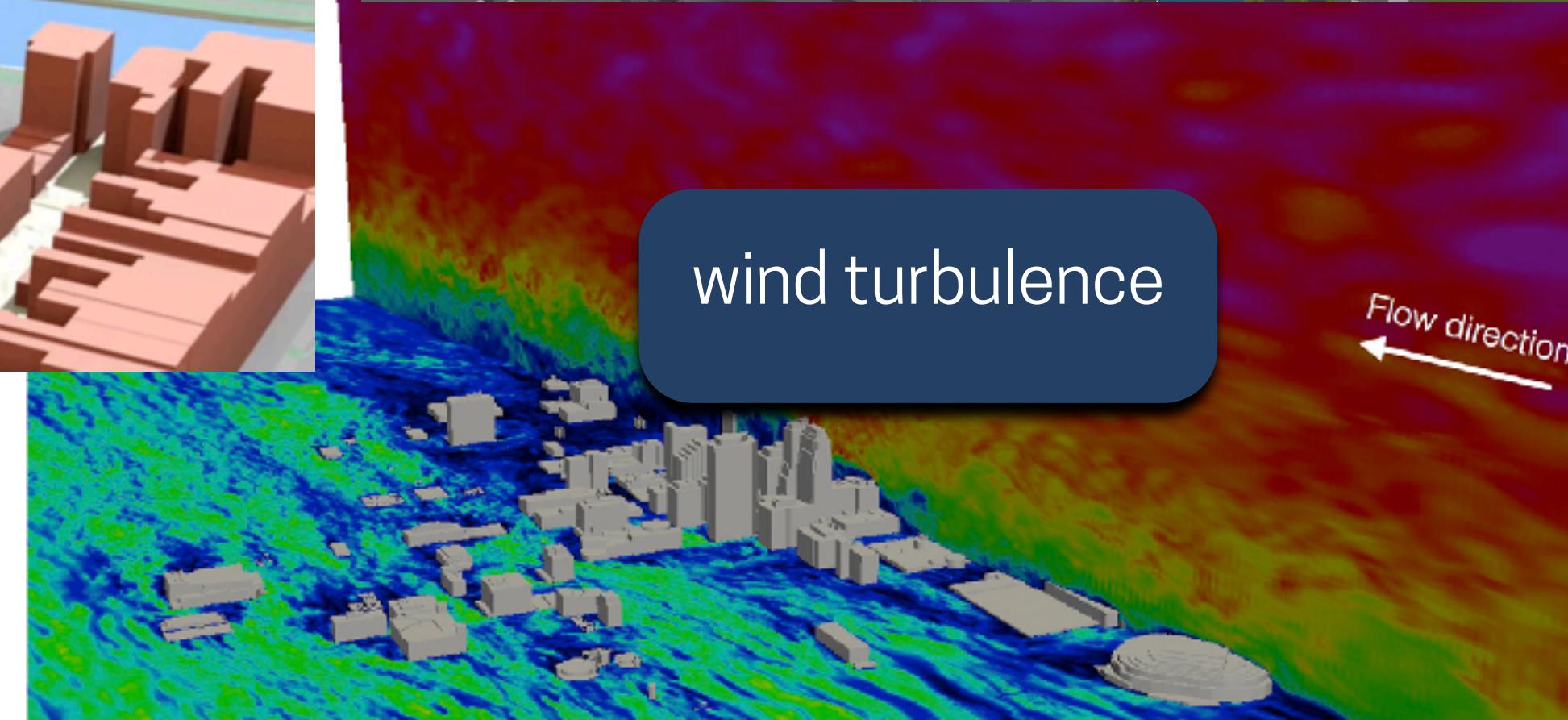
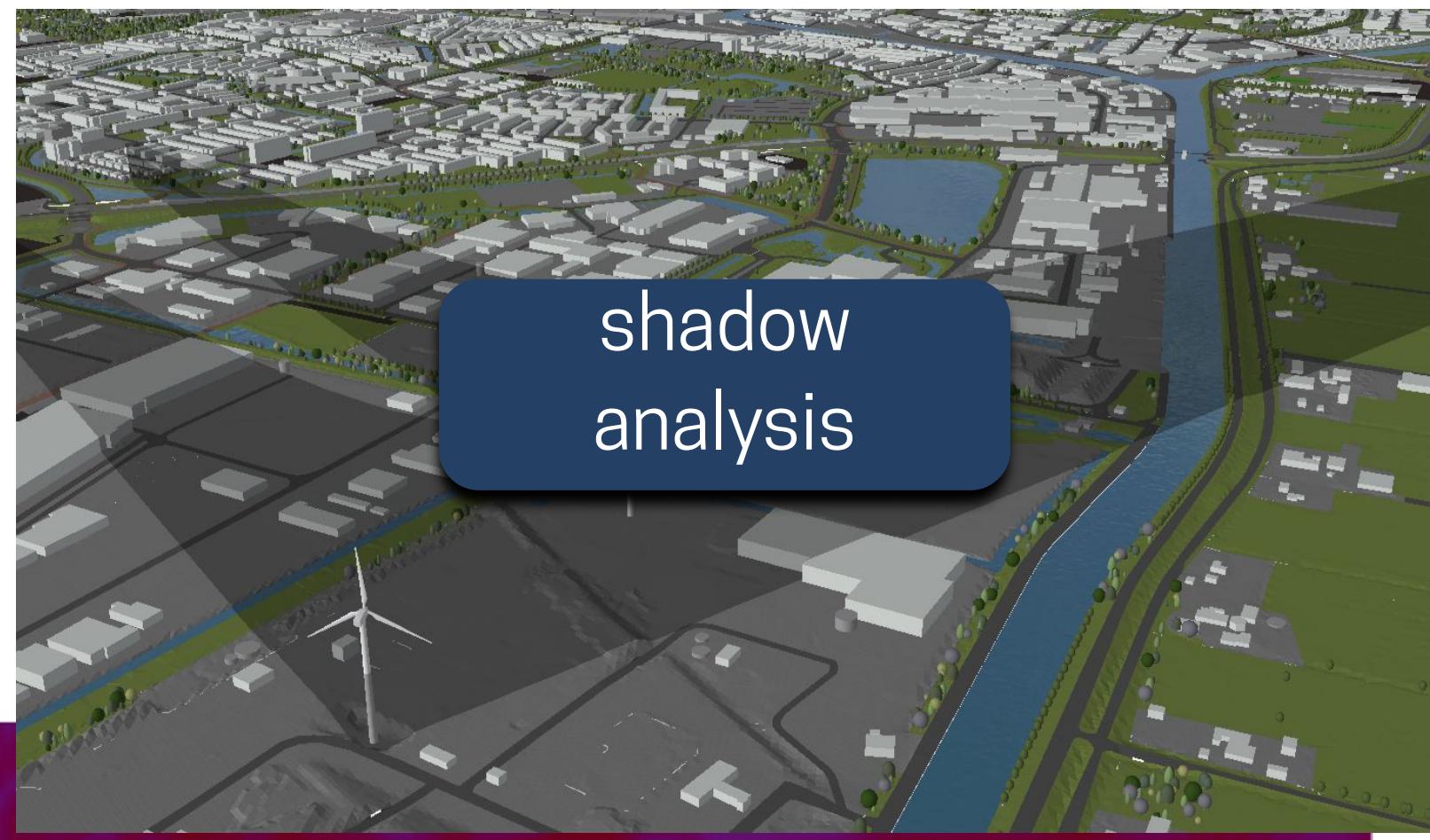
with attributes



with semantics

We want to **process** and **exchange** the information

- ideally directly on the web
- with several different software
- AutoCAD, GIS, Blender, Rhino, etc



What are our options?

OBJ/STL/PLY

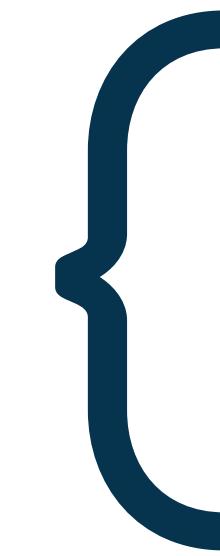
COLLADA

glTF + b3dm

CityGML

LandInfra + InfraGML

{   } CityJSON



- very simple
- used for 30y+ in computer graphics + engineering
- millions of software
- no semantics, no complex geometry, no attributes

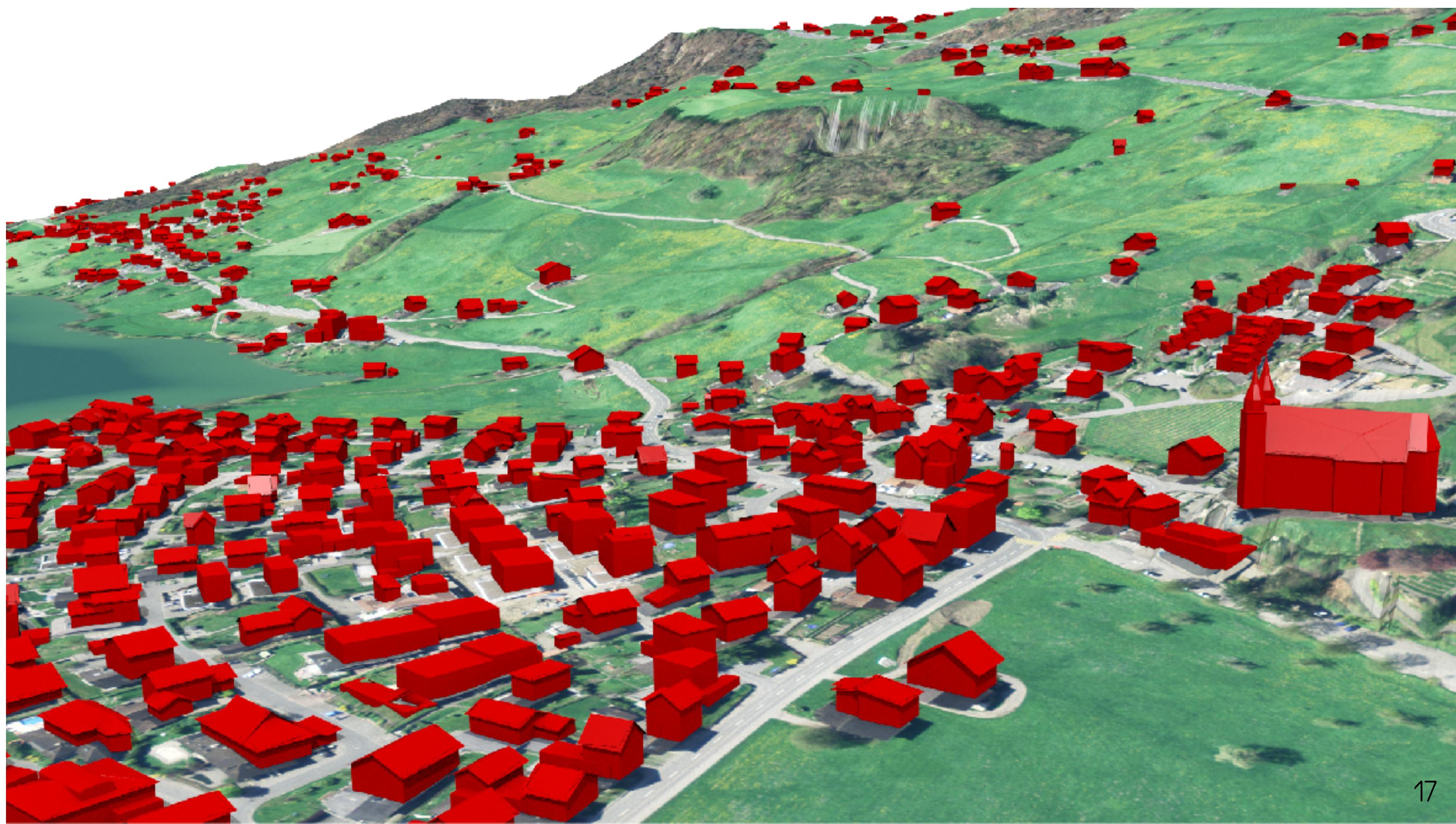
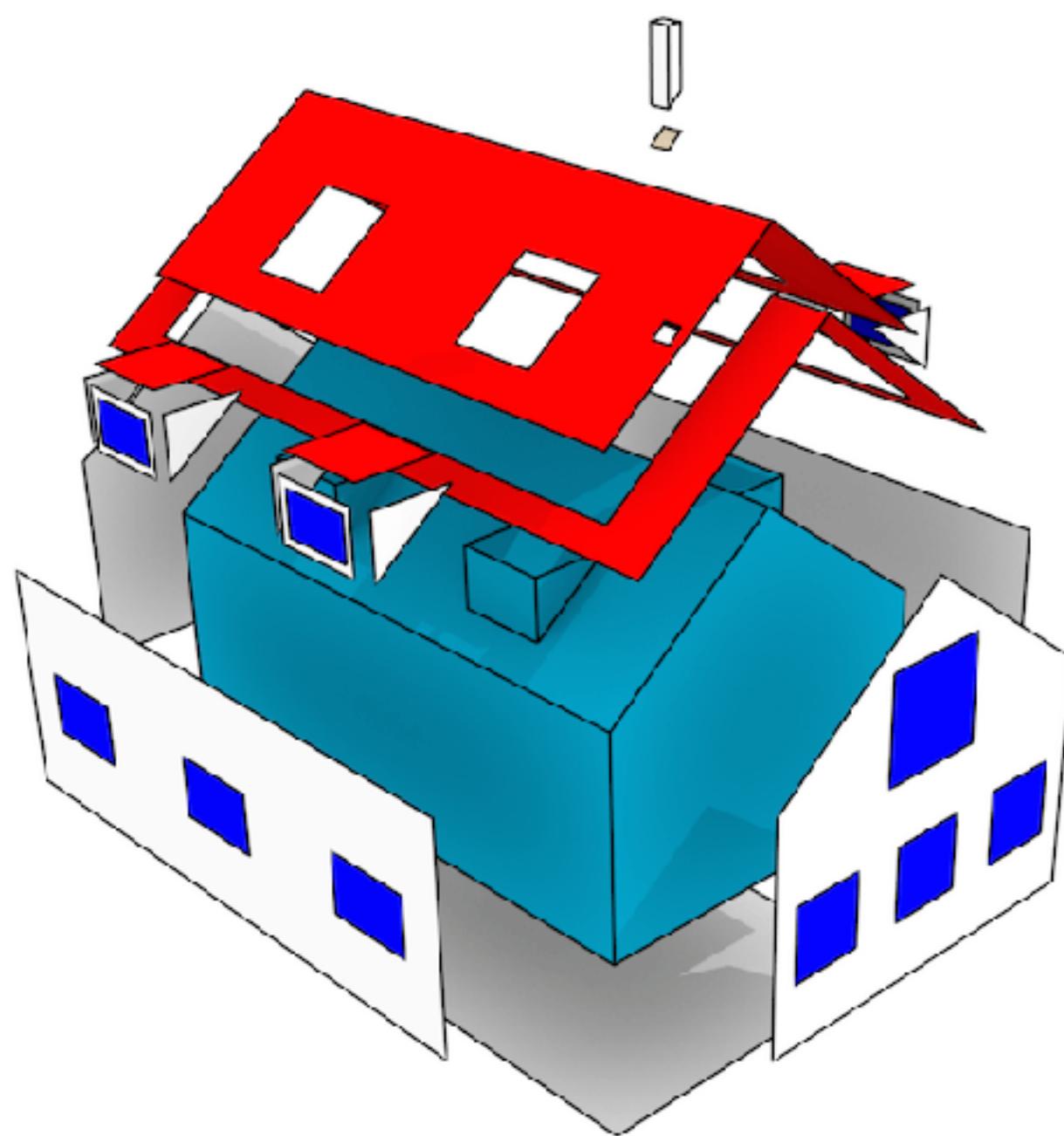
- for visualisation on the web
- great software support
- 😐 simple-ish (binary)
- no semantics, no complex geometry

- OGC standards since 2008/2016
- do everything!
- *seem* perfect
- 😐 is it the case in practice?

 what we mostly use for the 3DBAG



International standard (from OGC) for representing
and storing 3D city models



CityGML files are very complex

- files are deeply nested
- aims at solving many problems
- many “points of entry”
- many diff ways to do one thing



Typical MSc students in my 3D city modelling course...

When learning about semantic
3D city models



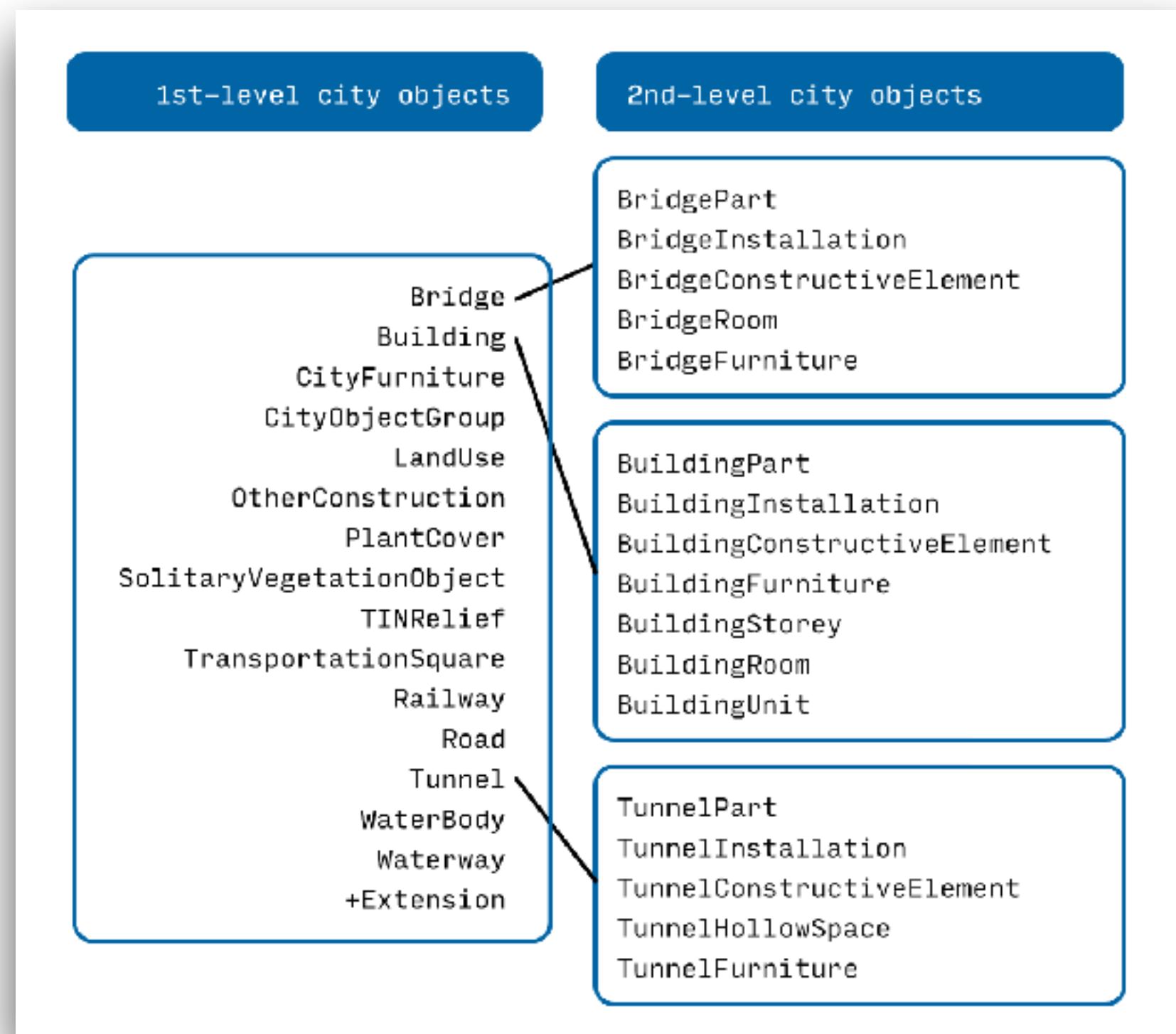
Trying to read a CityGML file
with Python



CityJSON v2.0

- OGC® community standard
- compliant with CityGML v3.0
- subset of CityGML (~90% of features)
- software for full conversion CityGML <-> CityJSON
- several software support CityJSON

The screenshot shows the homepage of the CityJSON website at <https://www.cityjson.org>. The page features a navigation bar with links to Datasets, Extensions, Software, Schemas, CityJSON Sequences, Specifications, Experimental, Help for developers, and Tutorials. The main content area includes a logo with a tree, a bar chart, and a house icon, followed by the text "CityJSON" and "A JSON-based encoding for 3D city models". It also displays the "Specs latest version: v2.0.1" and "Upgrading to v2.0" buttons, along with links for "Getting started", "Web-viewer", "Validator", and "cjio".



Same information as CityGML, but in JSON format

```
{  
  "type": "CityJSON",  
  "version": "1.1",  
  "metadata": {  
    "referenceSystem": "https://www.opengis.net/def/crs/EPSG/0/7415",  
  },  
  "CityObjects": {  
    "id-1": {  
      "type": "Building",  
      "attributes": {  
        "measuredHeight": 22.3,  
        "roofType": "gable",  
        "owner": "Elvis Presley"  
      },  
      "geometry": [  
        {  
          "type": "MultiSurface",  
          "boundaries": [[  
            [0, 3, 2, 1], [4, 5, 6, 7], [0, 1, 5, 4]  
          ]]  
        }  
      ]  
    },  
    "vertices": [  
      [23.1, 2321.2, 11.0],  
      [111.1, 321.1, 12.0],  
      ...  
    ],  
    "appearance": {  
      "materials": [],  
      "textures": [],  
      "vertices-texture": []  
    }  
  }  
}
```

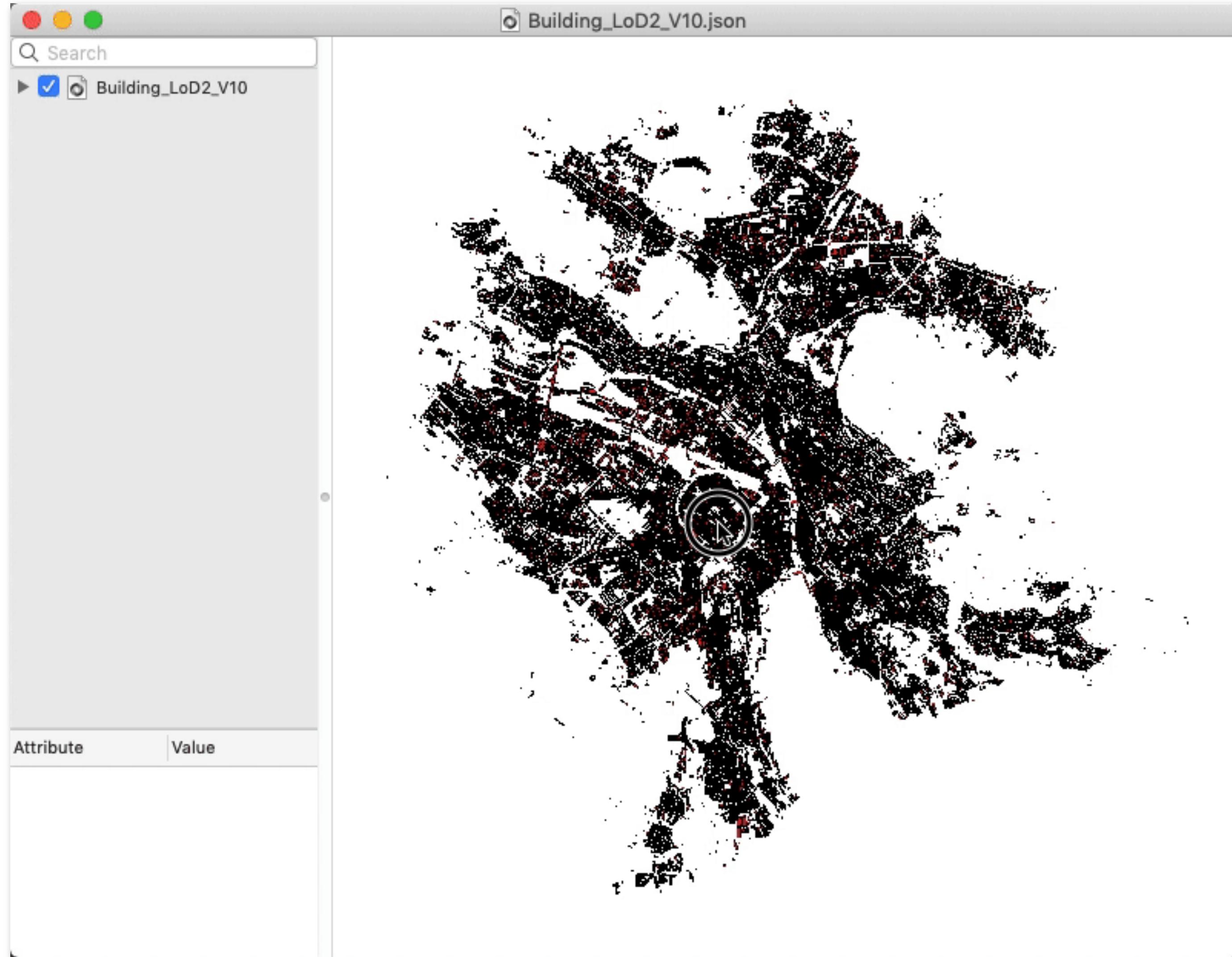
human-readable file

computers prefer this over XML

web prefers this over XML

~6X compacter than CityGML

Compression of files: Zürich LoD2 buildings



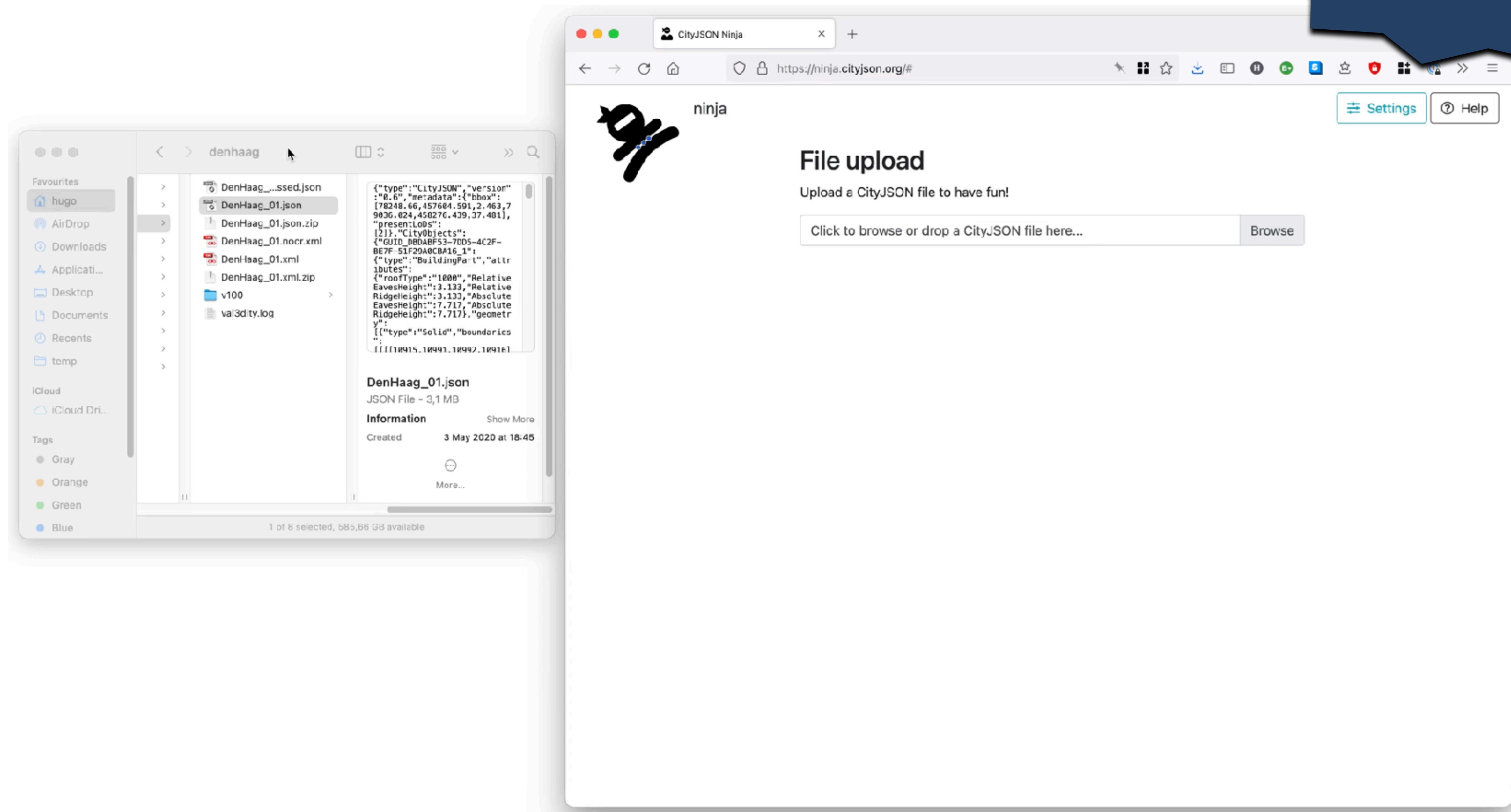
CityGML = 3.0GB

(but 1GB of spaces/CRs/tabs!)

CityJSON = 292MB

CityJSON can be easily parsed with JavaScript

Developed by MSc
students



Python parsing is very easy



```
import json

fin = open('mycity.json')
cm = json.loads(fin.read())

print "There are", len(cm['CityObjects']), "CityObjects"

# list all ids
for id in cm['CityObjects']:
    print "\t", id
```

More software

Software | CityJSON

https://www.cityjson.org/software/

CityJSON

- Datasets
- Extensions
- Software**
- Schemas
- CityJSON Sequences
- Specifications
- Experimental
- Help for developers
- Tutorials

Here is a list of software that we believe are useful to practitioners and researchers dealing with CityJSON.

Free and open-source software are marked by ⓘ.

Software for experimental features can be found in the respective pages of the [Experimental](#) section of the website.

Most of the software are recent and well-maintained; if you believe your software should be there please [let us know](#).

Summary table

Software				View	Generate	Edit
3D City DB ⓘ	↳	🔗				
3dfier ⓘ	↳	🔗			⚙️	
Autoconverter	↳	🔗		⚙️		
azul ⓘ	↳	🔗		⚙️		
C# library ⓘ	↳	🔗				
citygml-tools ⓘ	↳	🔗	📁			
citygml4j ⓘ	↳	🔗				
cityjson2jsonfg ⓘ	↳	🔗	📁			
cjdb ⓘ	↳	🔗	📁			
cjiio ⓘ	↳	🔗	📁			
cjseq ⓘ	↳	🔗	📁			
cjval ⓘ	↳	🔗	📁			
cmf	↳	🔗	📁			

Need help? Want to contribute?
Spotted an error?

merci.

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3dbg.tudelft.nl/hledoux

{} CityJSON

<https://cityjson.org>
<https://3dbag.nl>