CityGML 3D City Database Suite in a nutshell

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27 October 2023

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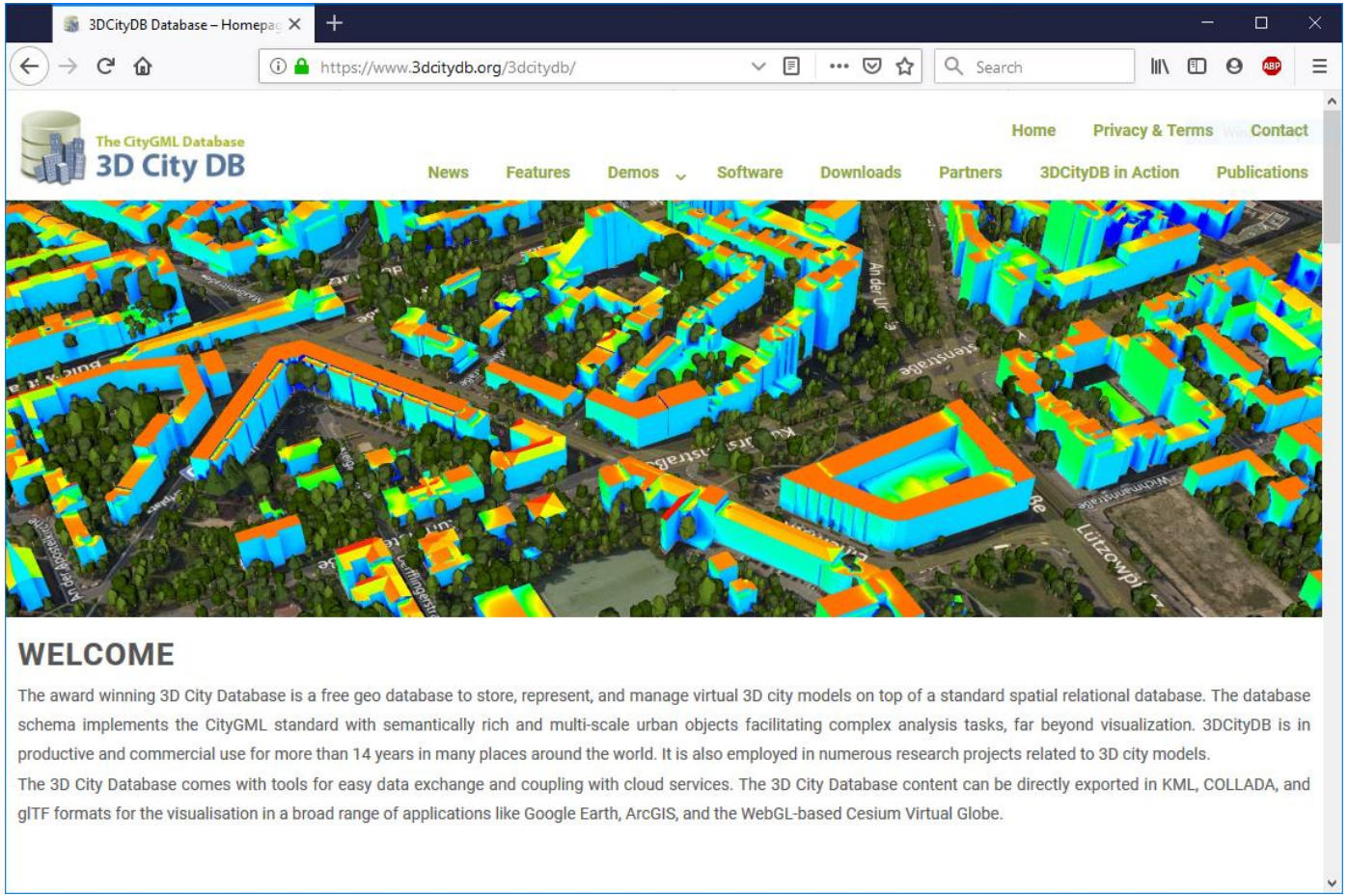
3D City Database

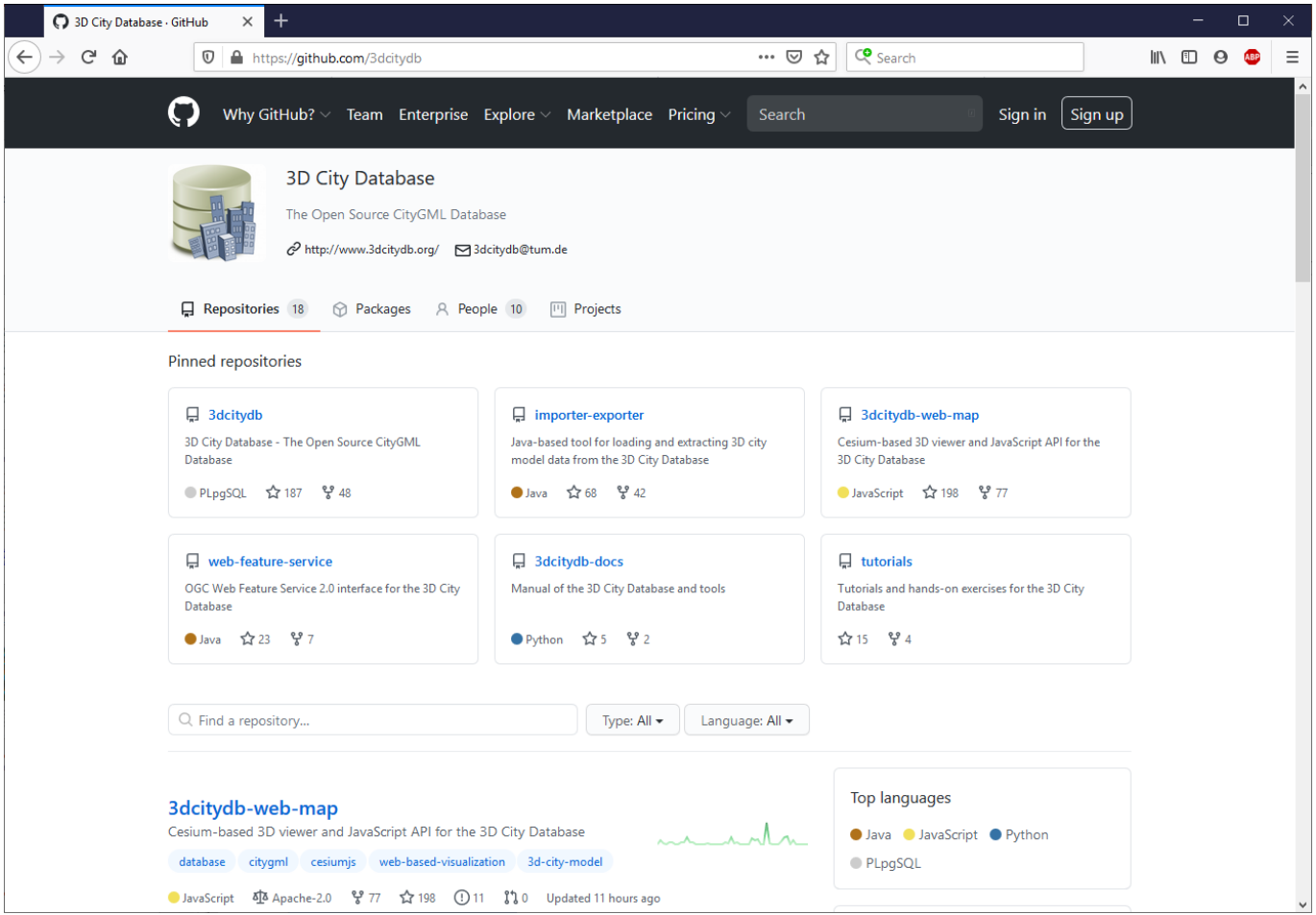
- Free and open-source database implementation of the CityGML data model
  - For PostgreSQL / PostGIS (and for Oracle Spatial)
    - Consists of 66 predefined tables and several functions written in PL/SQL
  - Can validate CityGML instance documents
  - Comes with an importer / exporter for CityGML data from / to the database
    - Imports XML-CityGML/CityJSON
    - Exports XML-CityGML/CityJSON, KML/Collada (e.g. for Google Earth) and glTF/glb (for CesiumJS)
    - Exports attributes as csv files
    - Possibility to use it via GUI or via command line (allows scripting)
  - From version 4.x documentation is online

- Resources:
  - https://www.3dcitydb.org/3dcitydb/
  - https://github.com/3dcitydb/3dcitydb-suite/releases (suggested for download)
  - https://3dcitydb-docs.readthedocs.io/en/latest/index.html

3D City Database: Homepage



3D City Database: GitHub



3D City Database

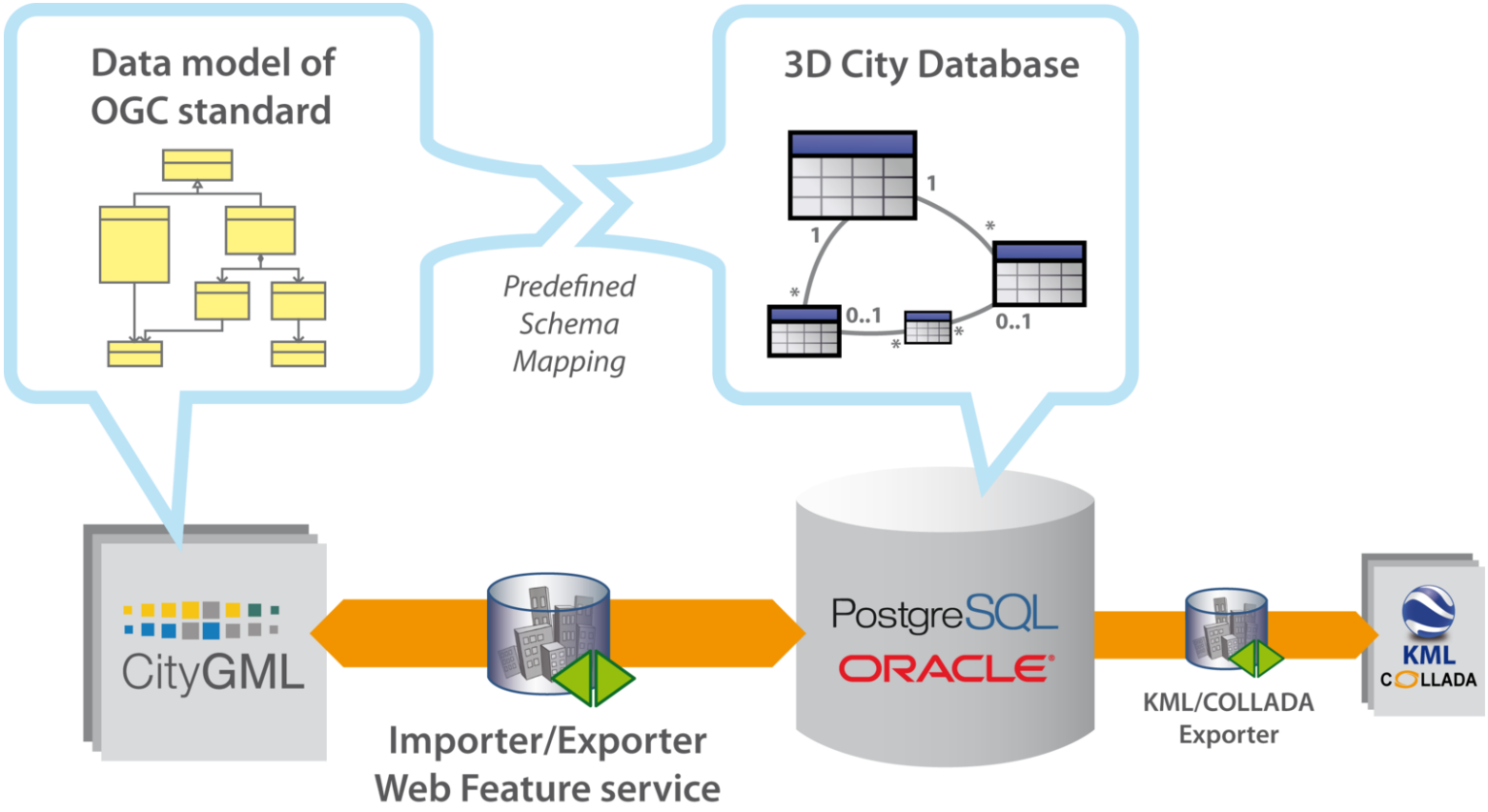
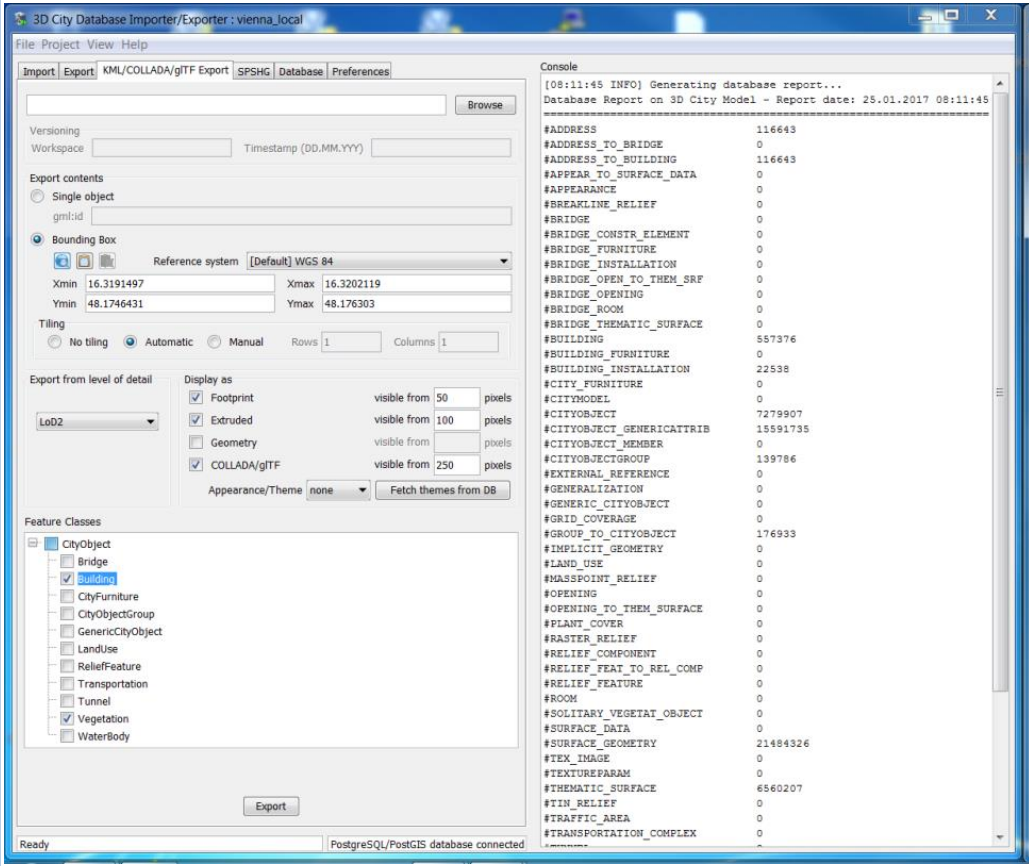
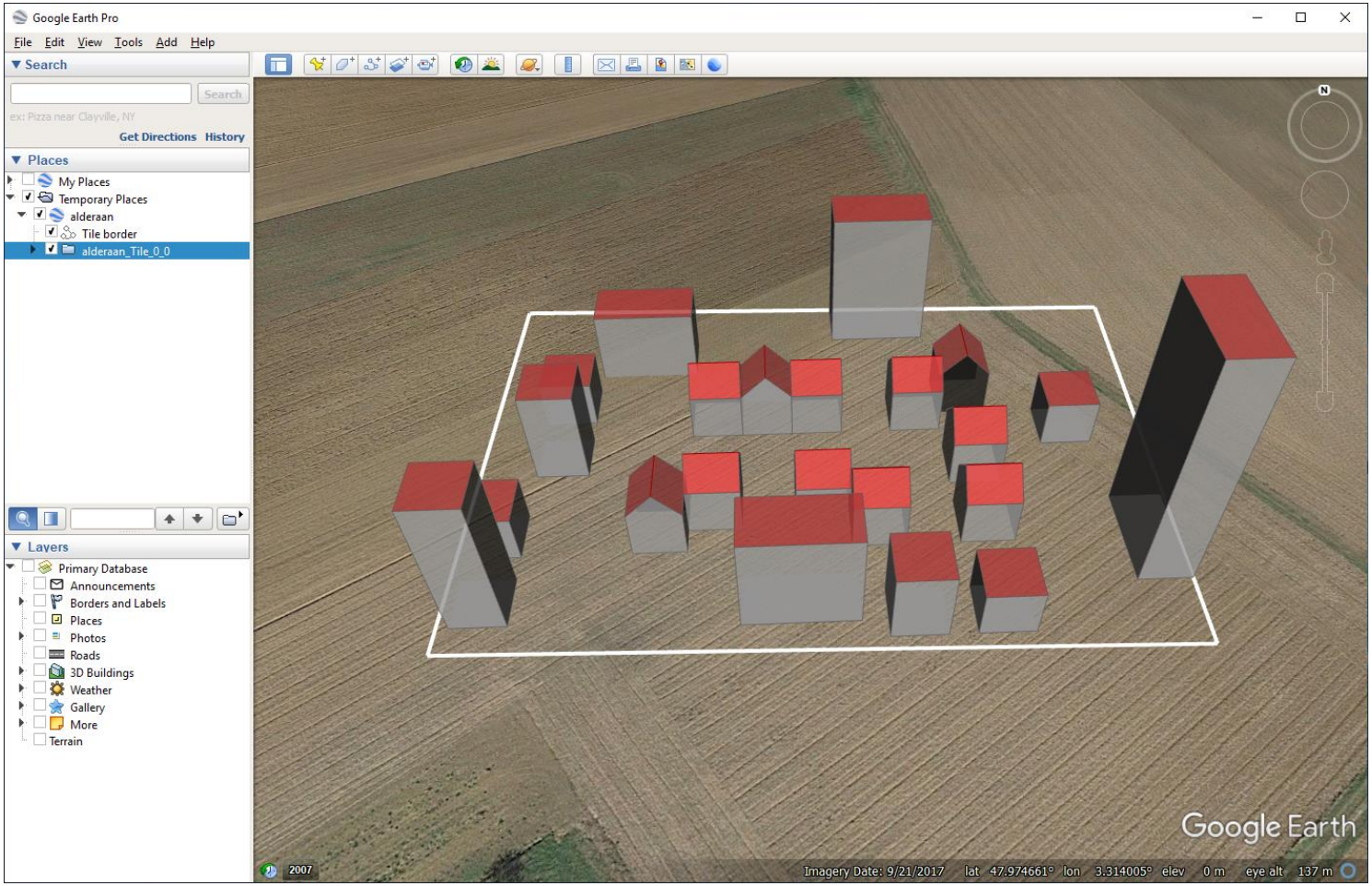


Image source: Kunde (2014)

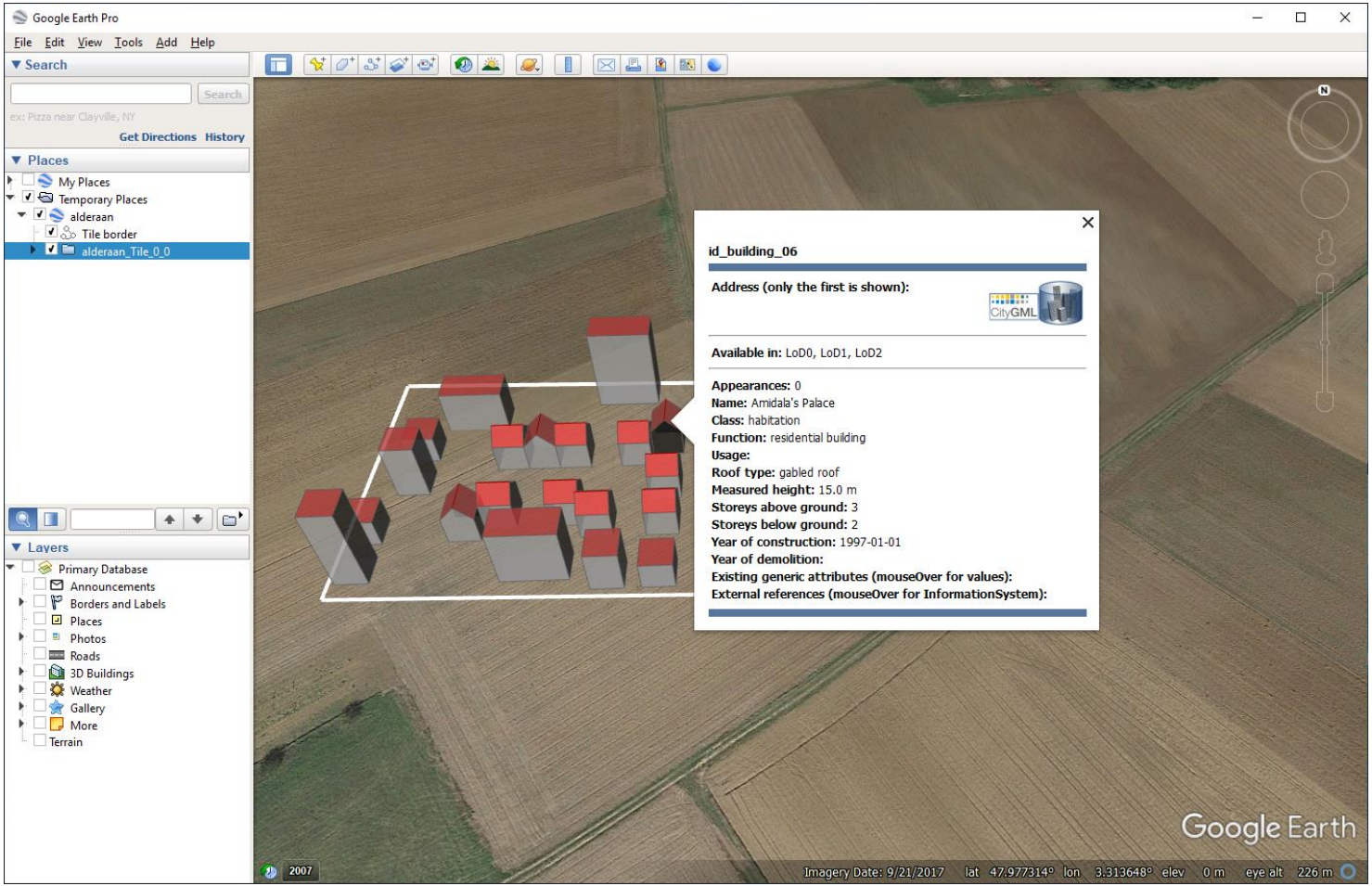
3D City Database: Importer/Exporter



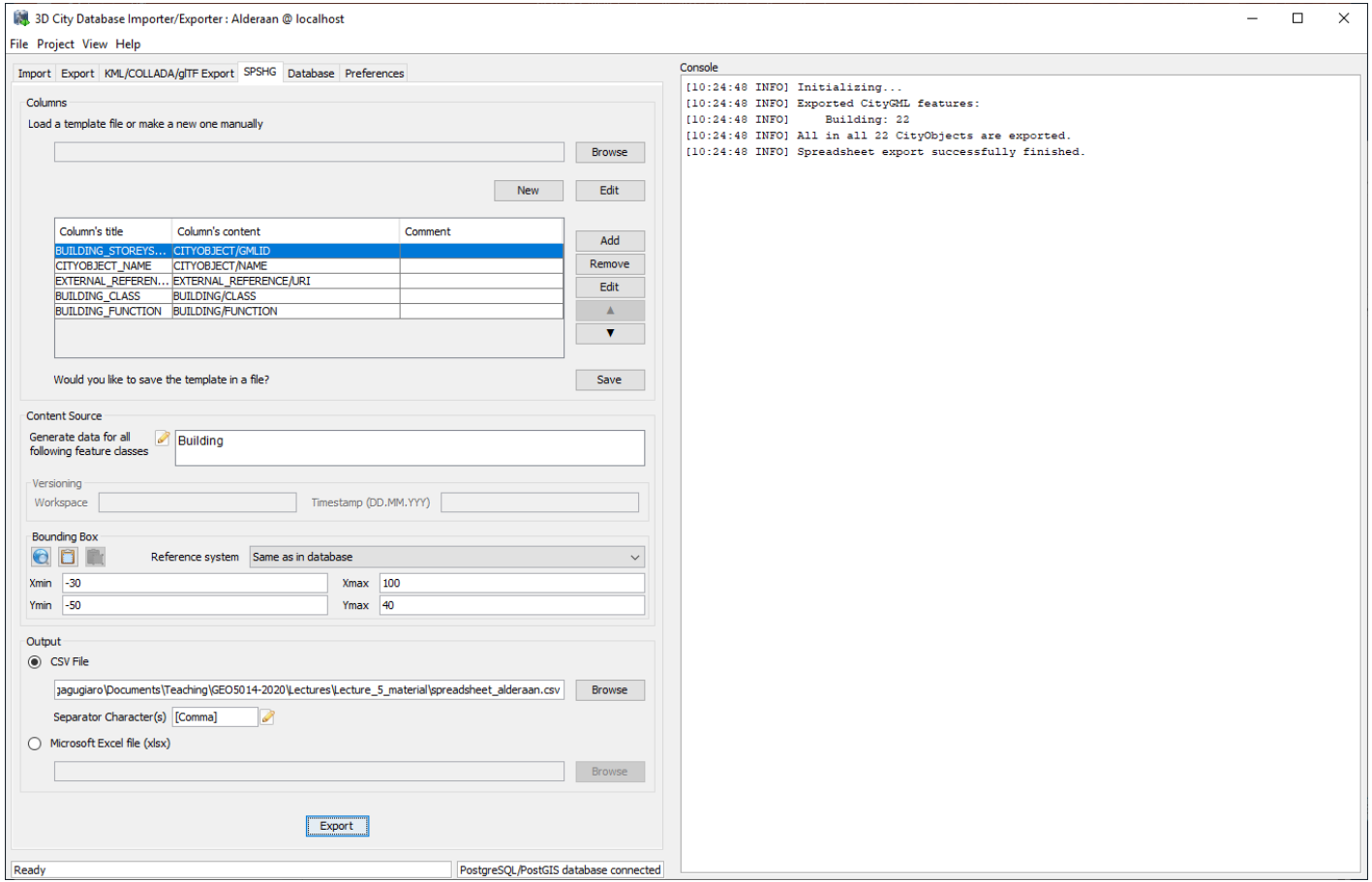
3D City Database: KML/Collada/glTF exporter



3D City Database: KML/Collada/glTF exporter



3D City Database: Spreadsheet generator



3D City Database: Spreadsheet generator

D:\gagugiaro\Documents\Teaching\GEO5014-2020\Lectures\Lecture_5_material\spreadsheet_alderaan.csv - Notepad++

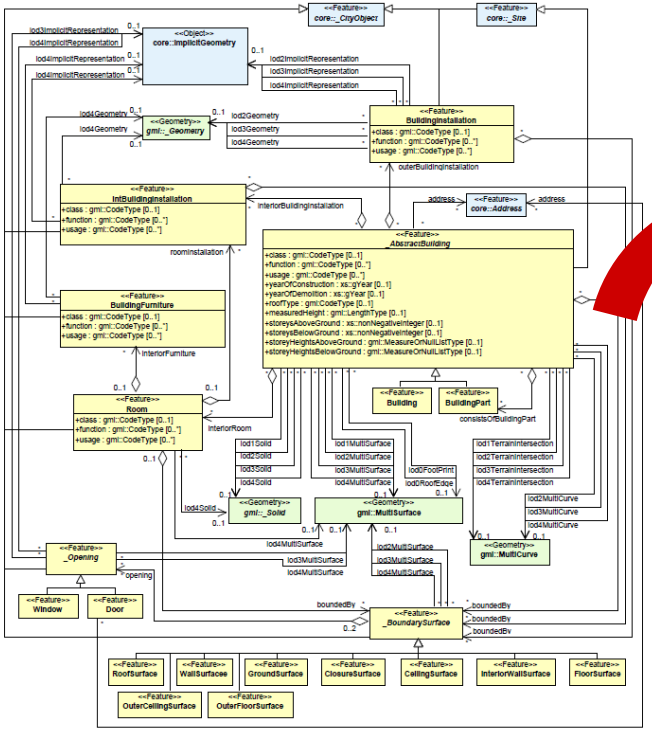
File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?

spreadsheet_alderaan.csv

```
"GMLID","BUILDING_STOREYS_ABOVE_GROUND","CITYOBJECT_NAME","EXTERNAL_REFERENCE_URI","BUILDING_CLASS","BUILDING_FUNCTION"
"id_box_building_24","id_box_building_24","Box building 24"
"id_building_12","id_building_12","Death Star II","","habitation","residential building"
"id_box_building_23","id_box_building_23","Box building 23"
"id_building_10","id_building_10","Boba Fett's Lair","","habitation","residential building"
"id_box_building_25","id_box_building_25","Box building 25"
"id_box_building_27","id_box_building_27","Box building 27"
"id_box_building_26","id_box_building_26","Box building 26"
"id_box_building_28","id_box_building_28","Box building 28"
"id_box_building_30","id_box_building_30","Box building 30"
"id_building_04","id_building_04","Fin's Cabin","","habitation","residential building"
"id_building_06","id_building_06","Amidala's Palace","","habitation","residential building"
"id_building_11","id_building_11","Death Star I","","habitation","residential building"
"id_building_02","id_building_02","Rey's Hut","","habitation","residential building"
"id_building_03","id_building_03","Poe's Hangar","","habitation","residential building"
"id_building_07","id_building_07","Palapatine's Residence","","habitation","residential building"
"id_building_05","id_building_05","Yoda's Hut","","habitation","residential building"
"id_building_08","id_building_08","Darth Vader's Palace","","habitation","residential building"
"id_box_building_20","id_box_building_20","Box building 20"
"id_box_building_21","id_box_building_21","Box building 21"
"id_box_building_29","id_box_building_29","Box building 29"
"id_building_09","id_building_09","Jabba's Palace","","habitation","residential building"
"id_box_building_22","id_box_building_22","Box building 22"
```

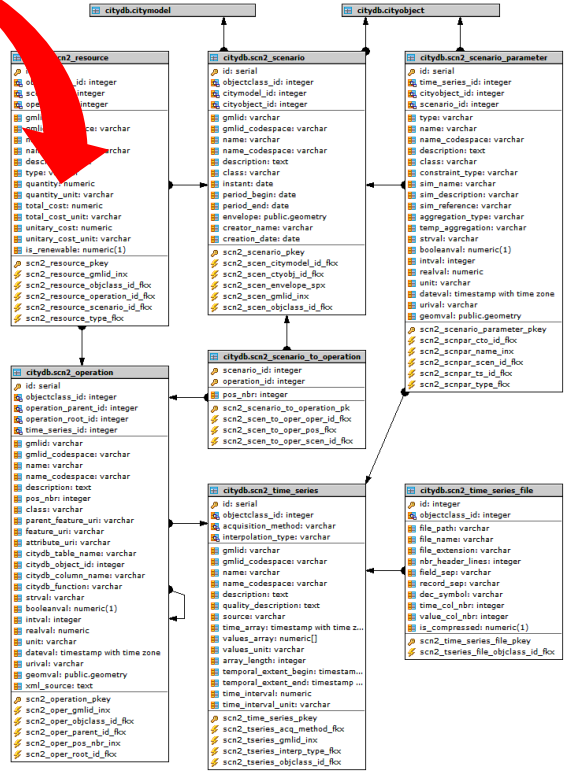
Normal text file | length : 1.794 lines : 24 | Ln : 1 Col : 1 Sel : 0 | 0 | Windows (CR LF) | UTF-8 | INS

TU Delft 3Dgeoinfo

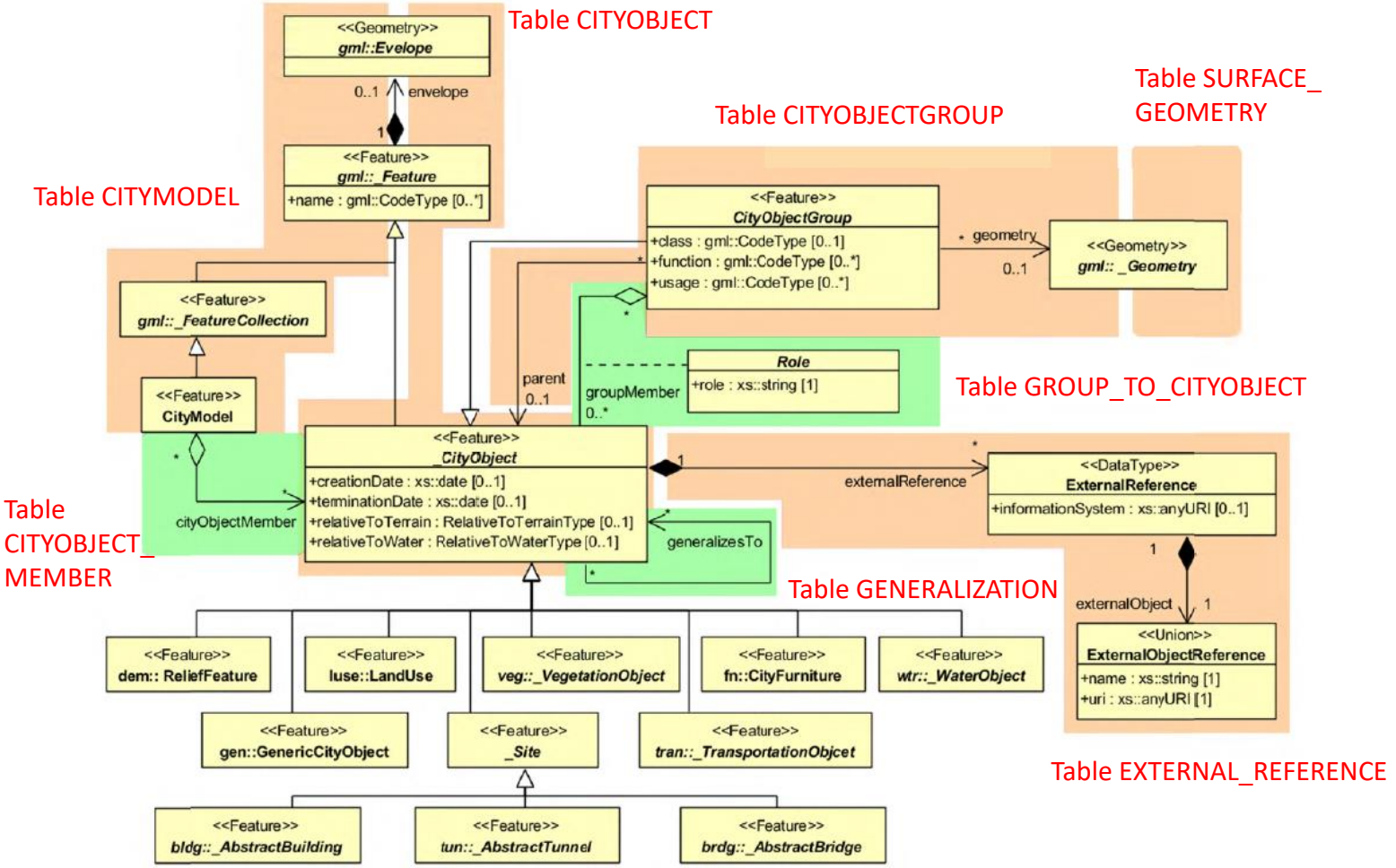


Object-Oriented model

Entity-Relationship model



3DCityDB: Example mapping rules



Tables CITYOBJECT + BUILDING

Table CITYOBJECT

	id [PK] integer	objectclass_id integer	gmlid character varying (256)	gmli chara	name character varying (1000)	nam chara	description character varying (4000)	envelope geometry
1	1	26	id_building_02	GE...	Rey's Hut		This is Building 2	01030000A040710000010000005000...
2	2	26	id_building_01	GE...	Snoke's Palace		This is Building 1	01030000A040710000010000005000...
3	3	26	id_box_building_25	GE...	Box building 25		This is a simple, primastic building meant to provi...	01030000A040710000010000005000...
4	4	26	id_box_building_28	GE...	Box building 28		This is a simple, primastic building meant to provi...	01030000A040710000010000005000...
5	5	26	id_building_04	GE...	Fin's Cabin		This is Building 4	01030000A040710000010000005000...
6	6	33	id_building_2_roofsurface_1	GE...	RoofSurface 1 (Building 2)		This is Roofsurface 1 (South) (Building 2)	01030000A040710000010000005000...
7	7	33	id_building_4_roofsurface_1	GE...	RoofSurface 1 (Building 4)		This is Roofsurface 1 (South) (Building 4)	01030000A040710000010000005000...

Table BUILDING

	id [PK] in	buildin integer	building_root_id integer	class character var	clas char	function character varying (10	funct chara	usage character	usag char	year_of_construction date	year date	roof_type character varying	roof char	measur double	measur characte	storeys_above numeric (8)	stor num	stor char	stor char	stor char	stor char
1	1	[null]	1	habitation	ht...	residential building	htt...	[null]	[null]	1955-01-01	[null]	gabled roof	ht...	15	m	3	0	3.0	m	[null]	[null]
2	2	[null]	2	habitation	ht...	residential building	htt...	[null]	[null]	1955-01-01	[null]	gabled roof	ht...	15	m	3	0	3.0	m	[null]	[null]
3	3	[null]	3	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]
4	4	[null]	4	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]
5	5	[null]	5	habitation	ht...	residential building	htt...	[null]	[null]	1955-01-01	[null]	gabled roof	ht...	15	m	3	0	3.0	m	[null]	[null]
6	26	[null]	26	habitation	ht...	residential building	htt...	[null]	[null]	1955-01-01	[null]	gabled roof	ht...	15	m	3	0	3.0	m	[null]	[null]
7	28	[null]	28	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]
8	29	[null]	29	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]	[null]

Tables CO + BUILDING + SURFACE_GEOMETRY

Table CITYOBJECT

	id [PK] integer	objectclass_id integer	gmlid character varying (256)	gmli char	name character varying (1000)	nam char	description character varying (4000)	envelope geometry
1	1	26	id_building_02	GE...	Rey's Hut		This is Building 2	01030000A040710000010000005000...
2	2	26	id_building_01	GE...	Snoke's Palace		This is Building 1	01030000A040710000010000005000...
3	3	26	id_box_building_25	GE...	Box building 25		This is a simple, primastic building meant to provi...	01030000A040710000010000005000...

Table BUILDING

	id [PK] in	buildin integer	building_root_id integer	class character var	clas char	function character varying (10	funct chara	usage character	usag char	year_of_const date
1	1	[null]	1	habitation	ht...	residential building	htt...	[null]	[null]	1955-01-01
2	2	[null]	2	habitation	ht...	residential building	htt...	[null]	[null]	1955-01-01
3	3	[null]	3	[null]	[null]	[null]	[null]	[null]	[null]	[null]

	lod0_footprint_id integer	lod0 integ	lod1 integ	lod2_ integ	lod3 integ	lod4_ integ	lod1_solid_id integer	i
1	5	[null]	[null]	[null]	[null]	[null]	7	[r
2	3	[null]	[null]	[null]	[null]	[null]	23	r
3	1	[null]	[null]	[null]	[null]	[null]	8	[r

Table SURFACE_GEOMETRY

	id [PK]	gmlid character varying (256)	gmli char	parent_id integer	root_id integer	is_solid numeric	is_composite numeric	is_triangulated numeric	is_xlink numeric	is_reverse numeric	solid_geometry geometry	geometry geometry	implicitg geometry	cityobject_id integer
10	21	id_building_02_lod1_Polygon_12	G...	9	7	0	0	0	0	0		01030000A040710000001000...		1
11	3	id_building_1_footprint_multisurf_1	G...	[null]	3	0	0	0	0	0				2
12	4	id_building_1_polygon_3	G...	3	3	0	0	0	1	1		01030000A040710000001000...		2
13	23	id_building_01_lod1_Solid_1	G...	[null]	23	1	0	0	0	0	010F0000A0407100000...			2
14	24	id_building_01_lod1_CompSurf_1	G...	23	23	0	1	0	0	0				2
15	25	id_building_01_lod1_Polygon_1	G...	24	23	0	0	0	0	0		01030000A040710000001000...		2
16	26	id_building_01_lod1_Polygon_2	G...	24	23	0	0	0	0	0		01030000A040710000001000...		2
17	27	id_building_01_lod1_Polygon_3	G...	24	23	0	0	0	0	0		01030000A040710000001000...		2
18	28	id_building_01_lod1_Polygon_4	G...	24	23	0	0	0	0	0		01030000A040710000001000...		2
19	29	id_building_01_lod1_Polygon_5	G...	24	23	0	0	0	0	0		01030000A040710000001000...		2
20	30	id_building_01_lod1_Polygon_6	G...	24	23	0	0	0	0	0		01030000A040710000001000...		2
21	1	id_lod0_MultiSurf_25	G...	[null]	1	0	0	0	0	0				3

SOLID

COMPOSITE SURFACE

POLYGONS

NULL

PostGIS geometry type: POLYGONZ

Additional 3DCityDB features

- Several functions are provided to facilitate data maintenance
  - Delete functions to delete objects
  - Other useful functions to deal with spatial indices, etc.

- From version 4.x it is possible to store multiple "citydb" schemas
  - Each schema can be used to store a different "scenario" of the same city model
  - You can choose which schema to access from the Importer/Exporter GUI
  - Details: https://3dcitydb-docs.readthedocs.io/en/latest/3dcitydb/multi-schema.html

- Version 4.x adds some preliminary ADE support
  - Given any XSD-file, tables and delete functions can be generated *automatically*
  - There is however still need for additional Java-based modules in order to enable the Importer/Exporter to read/write ADE-data into/from the database

Thank you for your attention!

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