Report — CIS25

💡 Historical Center of Vienna City

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For the course of Cartographic Information Systems 2025 — Prof. Köbben Barend

1 PostgreSQL

1.1 Restore and study data

Very first step was to get the data. The data was restored as it is described in Final Assignment dcoument.

The data has a lot of attributes as it is combined frorm multiple feature classes (Figure 1).

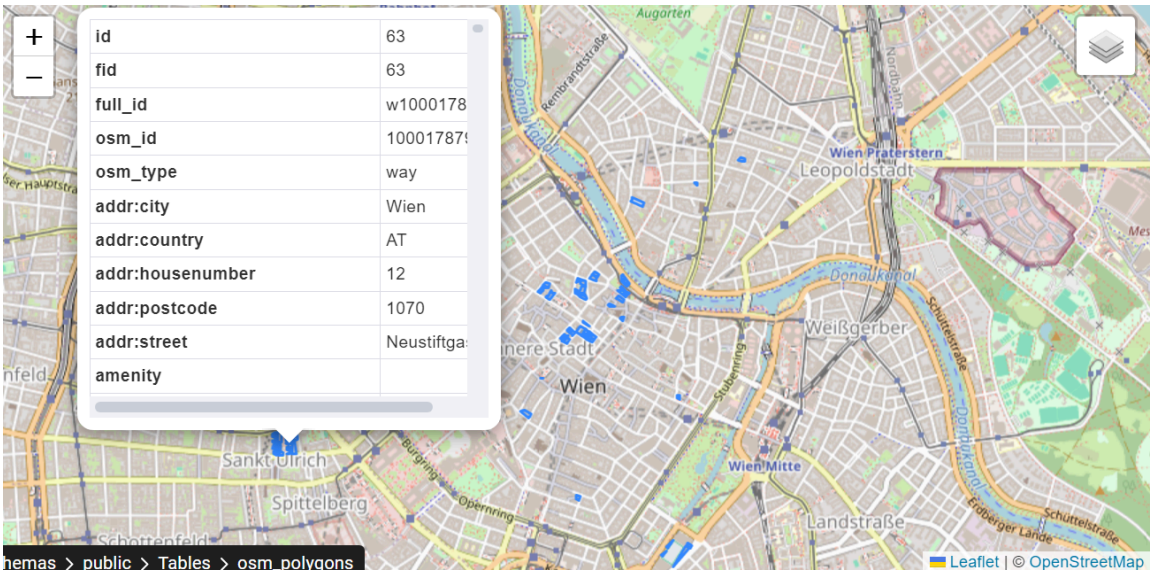


Figure 1. Subset of first hundred rows form osm polygons

After studying the data, I noticed “start_date” column which means the year of construction and I thought it would be a cool idea to showcase historical buildings and and monuments within Inner Stadt

1.2 Processing data

As the dataset provided goes beyond the boundaries of Inner Stadt, I found and downloaded Vienna city district boundaries [1]. I extracted only Inner Stadt boundaries from Vienna city (Figure 2).

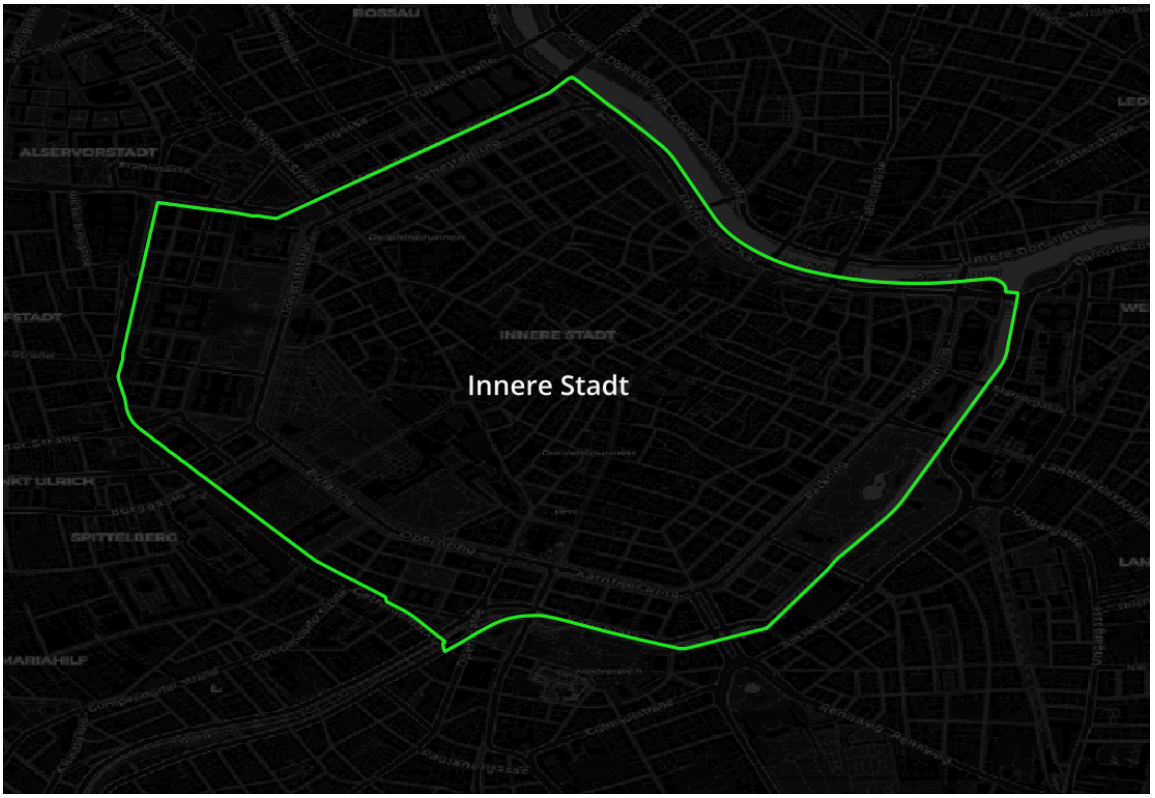


Figure 2. Boundaries of Innere Stadt

I will use it to conduct spatial filtering on the layers. As I discovered the data, I only need polygons to keep it simple (Possible extension of the project could be adding points — artworks, historic places, monuments, etc.).

For the future web map I also need a blanket that will cover everything around my Area Of Interest (AOI) except AOI itself. So, I just draw random rectangle to cover the whole Vienna and even a bit beyond capital. Then I performed spatial processin — ‘Symmetrical difference’ to get blanket (Figure 3).

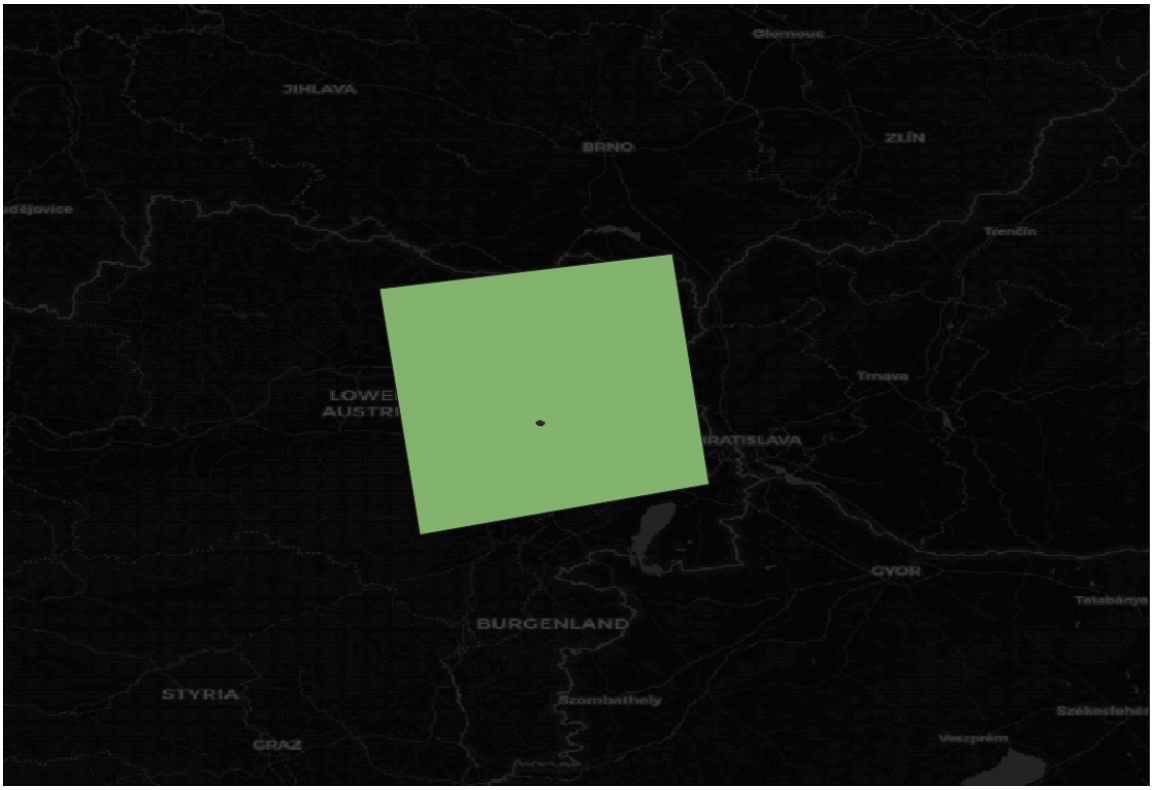


Figure 3. Blanket layer from country-level zoom

Now, in order to perform my spatial queries I need for the osm_polygon layer, I need to upload my blanket and AOI layers to PostgtreSQL using PostGIS. The following steps were done (Figure 4):

- Export as .shp file (because PostGIS only accept shp)
- Connected to my database
- Set SRID in PostGIS to 4326 as this default for web mapping and osm layers also have 4326
- Import to PostgreSQL

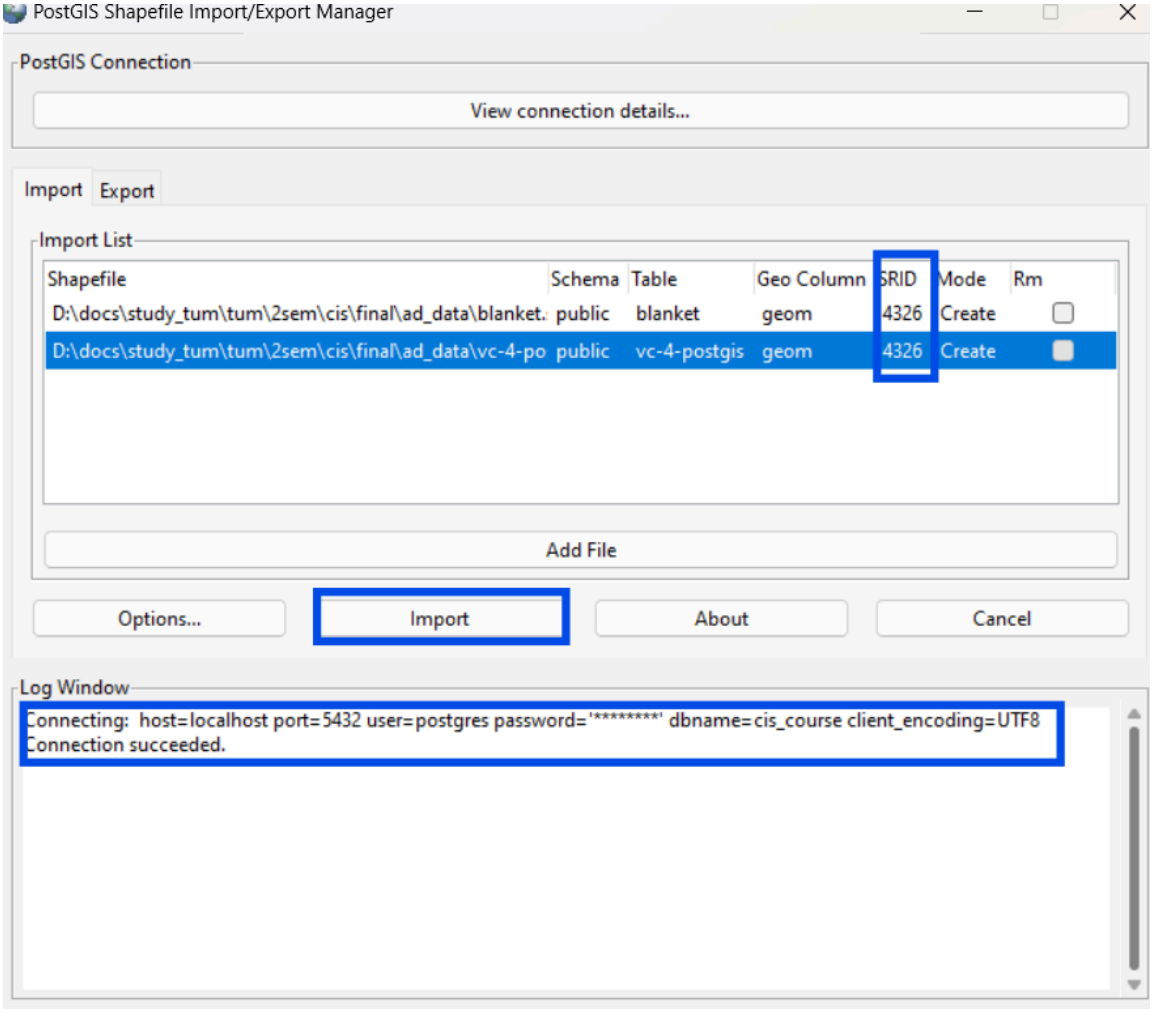


Figure 4. PostGIS import

My next was to get only relevant data from the provided osm. As mentioned before, I only need osm_polygons layer and also choose attributes I need. I stick with only 18 attributes from original.

For filtering, I performed the following query:

- Buildings

```
CREATE TABLE buildings AS  // create table from existing table
SELECT
    p.fid, p.geom, p."addr:housenumber", p."addr:street", p.amenity, p.architect,
    p.building, p."building:levels", p."description:en", p.height, p.name,
    p.start_date, p.tourism, p."building:material", p.old_name,
    p."roof:levels", p.description, p."building:architecture" // choosing relevant attributes
FROM osm_polygons AS p
JOIN "vc-4-postgis" AS v  // spatial joining to get only features that intersects with AOI
  ON ST_Intersects(p.geom, v.geom)
WHERE
    (
        p.amenity IN ('theatre', 'townhall', 'place_of_worship', 'monastery', 'arts_centre')
        OR p.building IN ('cathedral', 'church', 'government', 'monastery', 'museum', 'synagogue', 'pu
        OR p.tourism IN ('attraction', 'museum')
```

```
    ) // filtering by attributes
    AND p.building IS NOT NULL // get only buildings from polygons
    AND p.building <> ''; // since in the original data there 2 types of non-buildings, I also specifiec
```

- Monuments

```
CREATE TABLE monuments AS
SELECT
    p.fid, p.geom, p."addr:housenumber", p."addr:street", p.heritage, p.architect,
    p."architect:wikidata", p.historic, p."description:en", p.height, p.name,
    p.start_date, p.tourism, p."artist_name", p.old_name,
    p."wikidata", p.description, p."year_of_construction"
FROM osm_polygons AS p
JOIN "vc-4-postgis" AS v
  ON ST_Intersects(p.geom, v.geom)
WHERE
    (
        p.historic IN ('memorial', 'monument')
    )
    AND p.name IS NOT NULL
    AND p.name <> '';
```

Now I have optimized dataset of what I need (Figure 5).

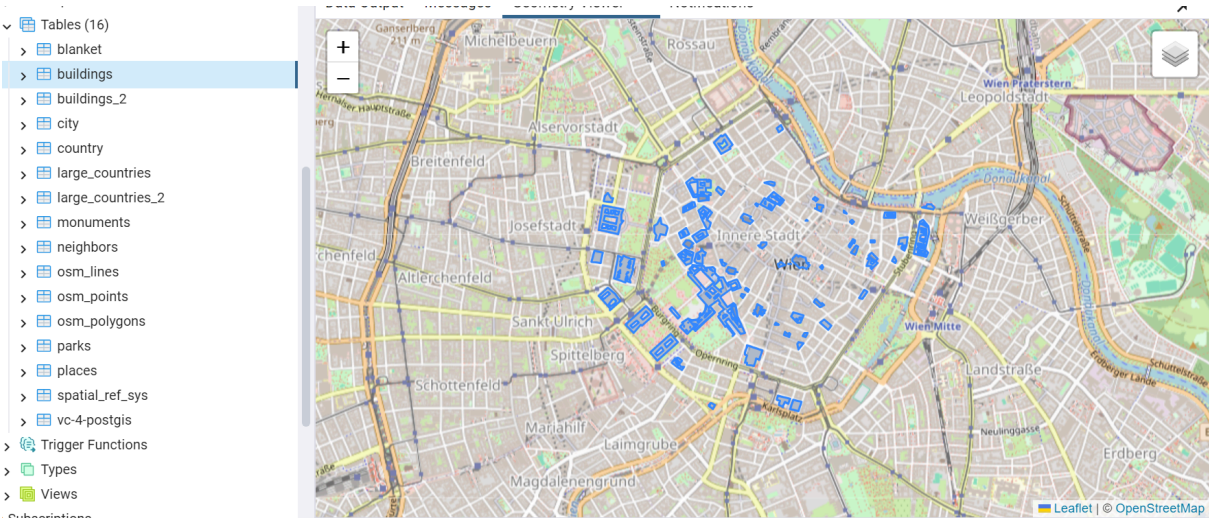
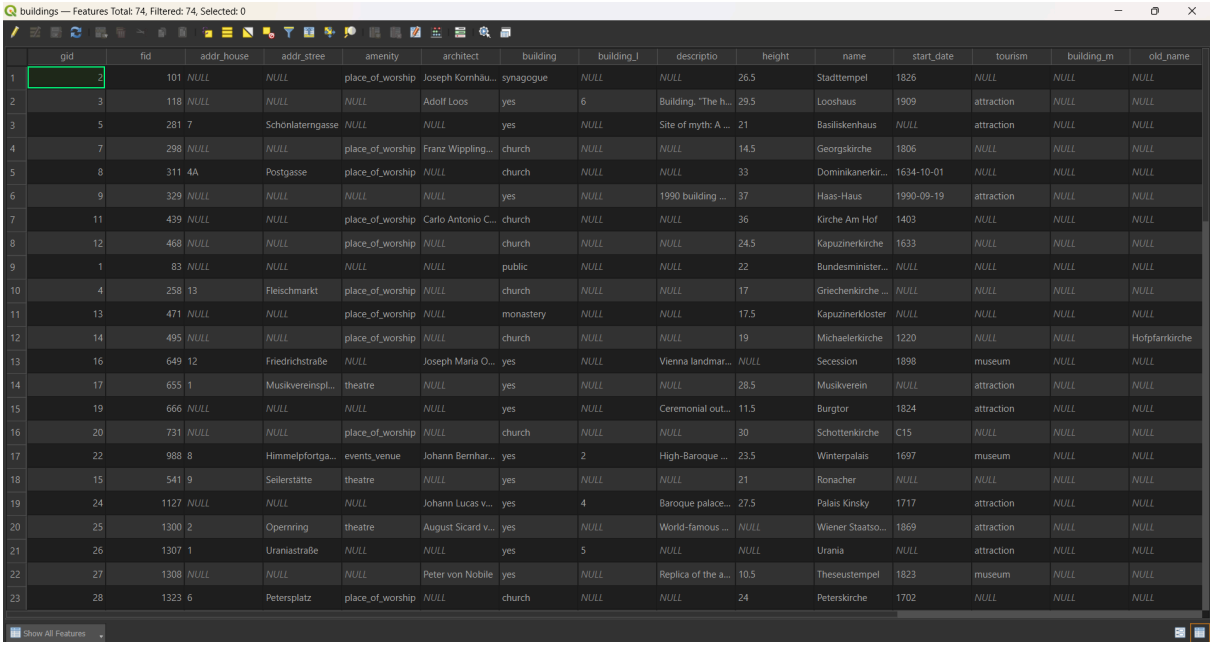


Figure 5. Visualization of buildings layer after processing

Before uploading it to the GeoServer I am missing is the full data for the year of construction for some building and also the original attribute 'start_date' is a string and some has just a year and some has the full date (Figure 6), so I need to normalize it:

- get only year
- convert to number to visualize it based on value



buildings — Features Total: 74, Filtered: 74, Selected: 0

	gid	fid	addr_house	addr_stree	amenity	architect	building	building_l	descriptio	height	name	start_date	tourism	building_m	old_name
1	2	101	NULL	NULL	place_of_worship	Joseph Kornhäu...	synagogue	NULL	NULL	26.5	Stadttempel	1826	NULL	NULL	NULL
2	3	118	NULL	NULL	NULL	Adolf Loos	yes	6	Building. "The h...	29.5	Looshaus	1909	attraction	NULL	NULL
3	5	281	7	Schönlaterngasse	NULL	NULL	yes	NULL	Site of myth: A ...	21	Basiliskenhaus	NULL	attraction	NULL	NULL
4	7	298	NULL	NULL	place_of_worship	Franz Wippling...	church	NULL	NULL	14.5	Georgskirche	1806	NULL	NULL	NULL
5	8	311	4A	Postgasse	place_of_worship	NULL	church	NULL	NULL	33	Dominikanerkir...	1634-10-01	NULL	NULL	NULL
6	9	329	NULL	NULL	NULL	NULL	yes	NULL	1990 building ...	37	Haas-Haus	1990-09-19	attraction	NULL	NULL
7	11	439	NULL	NULL	place_of_worship	Carlo Antonio C...	church	NULL	NULL	36	Kirche Am Hof	1403	NULL	NULL	NULL
8	12	468	NULL	NULL	place_of_worship	NULL	church	NULL	NULL	24.5	Kapuzinerkirche	1633	NULL	NULL	NULL
9	1	83	NULL	NULL	NULL	NULL	public	NULL	NULL	22	Bundesminister...	NULL	NULL	NULL	NULL
10	4	258	13	Fleischmarkt	place_of_worship	NULL	church	NULL	NULL	17	Griechenkirche ...	NULL	NULL	NULL	NULL
11	13	471	NULL	NULL	place_of_worship	NULL	monastery	NULL	NULL	17.5	Kapuzinerkloster	NULL	NULL	NULL	NULL
12	14	495	NULL	NULL	place_of_worship	NULL	church	NULL	NULL	19	Michaelerkirche	1220	NULL	NULL	Hofpfarrkirche
13	16	649	12	Friedrichstraße	NULL	Joseph Maria O...	yes	NULL	Vienna landmar...	NULL	Secession	1898	museum	NULL	NULL
14	17	655	1	Musikvereinspl...	theatre	NULL	yes	NULL	NULL	28.5	Musikverein	NULL	attraction	NULL	NULL
15	19	666	NULL	NULL	NULL	NULL	yes	NULL	Ceremonial out...	11.5	Burgtor	1824	attraction	NULL	NULL
16	20	731	NULL	NULL	place_of_worship	NULL	church	NULL	NULL	30	Schottenkirche	C15	NULL	NULL	NULL
17	22	988	8	Himmelpfortga...	events_venue	Johann Bernhar...	yes	2	High-Baroque ...	23.5	Winterpalais	1697	museum	NULL	NULL
18	15	541	9	Seilerstätte	theatre	NULL	yes	NULL	NULL	21	Ronacher	NULL	NULL	NULL	NULL
19	24	1127	NULL	NULL	NULL	Johann Lucas v...	yes	4	Baroque palace...	27.5	Palais Kinsky	1717	attraction	NULL	NULL
20	25	1300	2	Opernring	theatre	August Sicard v...	yes	NULL	World-famous ...	NULL	Wiener Staatso...	1869	attraction	NULL	NULL
21	26	1307	1	Uraniastraße	NULL	NULL	yes	5	NULL	NULL	Urania	NULL	attraction	NULL	NULL
22	27	1308	NULL	NULL	NULL	Peter von Nobile	yes	NULL	Replica of the a...	10.5	Theseustempel	1823	museum	NULL	NULL
23	28	1323	6	Petersplatz	place_of_worship	NULL	church	NULL	NULL	24	Peterskirche	1702	NULL	NULL	NULL

Show All Features

Figure 6. Attribute table of buildings layer

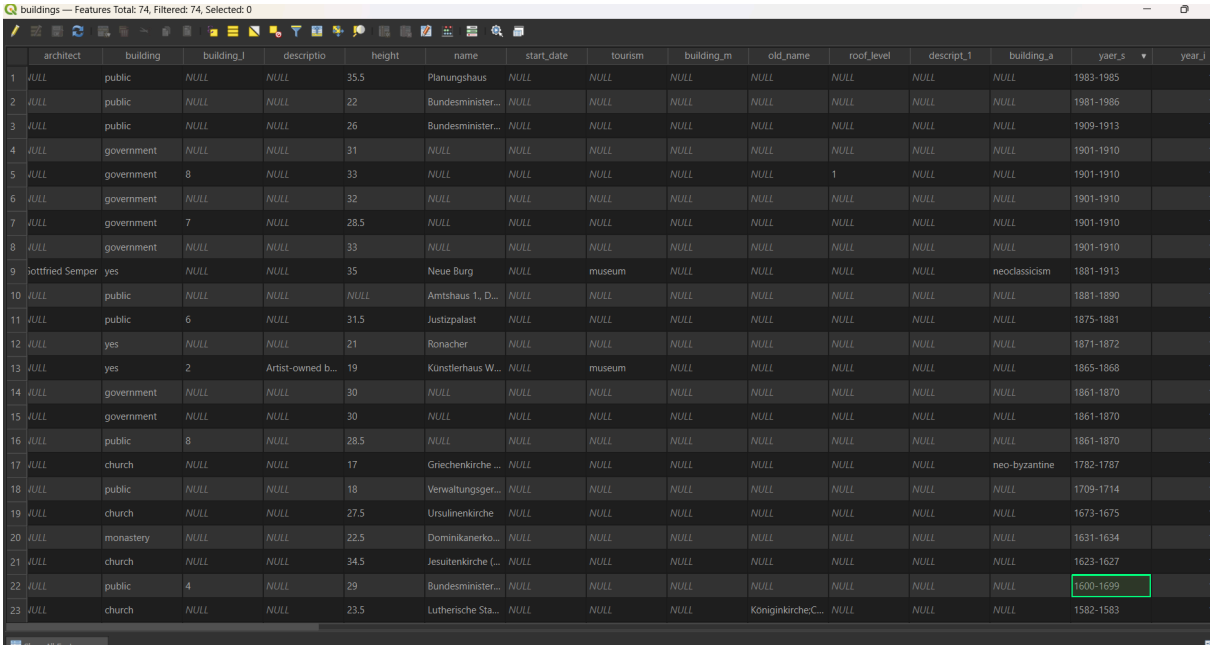
I create a new column called ‘year_i’ which will hold integers of year of completion. In order to convert and get only years from ‘start_date’ I performed sql query:

```
UPDATE buildings
SET year_i = SUBSTRING(start_date, 1, 4)::double precision
WHERE SUBSTRING(start_date, 1, 1) NOT IN ('C') // since I have some fields that starts with C,
                                                // I take in consideration and saying to ski
```

The same was applied for the monuments. The only difference is that all fields in monuments layer have start_date, so I do not need to perform additional collection of data. I need to collect data only for buildings.

For buildings, I also noticed that some buildings does not have excat year but period, so I also created year_s. After I just manually filled in attributes [2].

But it is not over. Now, since I filled all the data, I still have missing year_i since I said before there are some buildings that have specific timeframe (Figure 7).



buildings — Features Total: 74, Filtered: 74, Selected: 0

	architect	building	building_l	descriptio	height	name	start_date	tourism	building_m	old_name	roof_level	descript_1	building_a	yaer_s	year_i
1	NULL	public	NULL	NULL	35.5	Planungshaus	NULL	NULL	NULL	NULL	NULL	NULL	NULL	1983-1985	
2	NULL	public	NULL	NULL	22	Bundesminister...	NULL	NULL	NULL	NULL	NULL	NULL	NULL	1981-1986	
3	NULL	public	NULL	NULL	26	Bundesminister...	NULL	NULL	NULL	NULL	NULL	NULL	NULL	1909-1913	
4	NULL	government	NULL	NULL	31	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	1901-1910	
5	NULL	government	8	NULL	33	NULL	NULL	NULL	NULL	NULL	1	NULL	NULL	1901-1910	
6	NULL	government	NULL	NULL	32	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	1901-1910	
7	NULL	government	7	NULL	28.5	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	1901-1910	
8	NULL	government	NULL	NULL	33	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	1901-1910	
9	Gottfried Semper	yes	NULL	NULL	35	Neue Burg	NULL	museum	NULL	NULL	NULL	NULL	neoclassicism	1881-1913	
10	NULL	public	NULL	NULL	NULL	Amtshaus 1., D...	NULL	NULL	NULL	NULL	NULL	NULL	NULL	1881-1890	
11	NULL	public	6	NULL	31.5	Justizpalast	NULL	NULL	NULL	NULL	NULL	NULL	NULL	1875-1881	
12	NULL	yes	NULL	NULL	21	Ronacher	NULL	NULL	NULL	NULL	NULL	NULL	NULL	1871-1872	
13	NULL	yes	2	Artist-owned b...	19	Künstlerhaus W...	NULL	museum	NULL	NULL	NULL	NULL	NULL	1865-1868	
14	NULL	government	NULL	NULL	30	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	1861-1870	
15	NULL	government	NULL	NULL	30	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	1861-1870	
16	NULL	public	8	NULL	28.5	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	1861-1870	
17	NULL	church	NULL	NULL	17	Griechenkirche ...	NULL	NULL	NULL	NULL	NULL	NULL	neo-byzantine	1782-1787	
18	NULL	public	NULL	NULL	18	Verwaltungsger...	NULL	NULL	NULL	NULL	NULL	NULL	NULL	1709-1714	
19	NULL	church	NULL	NULL	27.5	Ursulinenkirche	NULL	NULL	NULL	NULL	NULL	NULL	NULL	1673-1675	
20	NULL	monastery	NULL	NULL	22.5	Dominikanerko...	NULL	NULL	NULL	NULL	NULL	NULL	NULL	1631-1634	
21	NULL	church	NULL	NULL	34.5	Jesuitenkirche (...	NULL	NULL	NULL	NULL	NULL	NULL	NULL	1623-1627	
22	NULL	public	4	NULL	29	Bundesminister...	NULL	NULL	NULL	NULL	NULL	NULL	NULL	1600-1699	
23	NULL	church	NULL	NULL	23.5	Lutherische Sta...	NULL	NULL	NULL	Königinkirche;C...	NULL	NULL	NULL	1582-1583	

Figure 7. String year in buildings layer

Then I performed a query to the middle value rounded to the bigger number in SQL:

```
UPDATE your_table
SET year_i = CEIL((
    SPLIT_PART(year_s, '-', 1)::int +
    SPLIT_PART(year_s, '-', 2)::int
) / 2.0)
WHERE year_i IS NULL AND year_s ~ '^\d{4}-\d{4}$'; // regex: d - digit, {number} - how many tim
```

Now, all my data is ready to be uploaded to GeoServer.

2 GeoServer

2.1 Installing extension and creating workspace

For this project, I wanted to use mapbox vector tiles for performance. I installed the following extensions [3]:

- Vector tiles
- MBStyle Styling???

After, I started server and created workspace and connected database in stores. Then in Add Lyaers i get all available layers from my database (Figure 8).

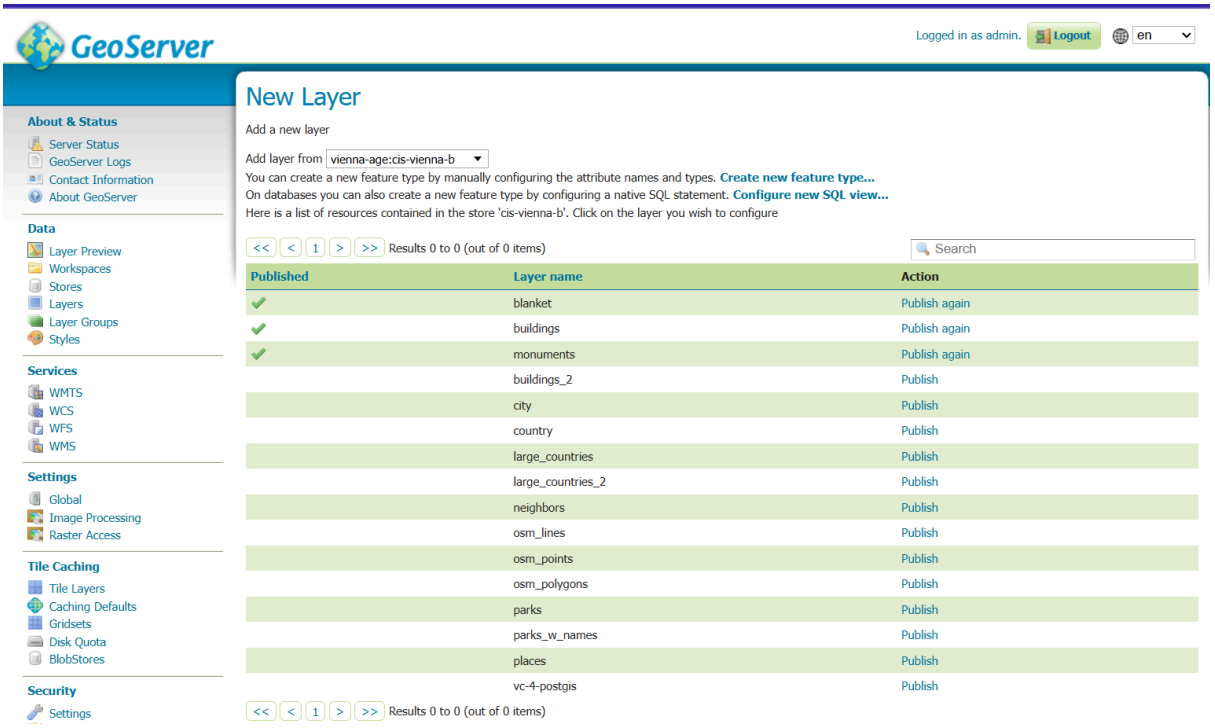


Figure 8. Adding layer in GeoServer

To make layers available as vector tiles, in Layer settings then Tile Caching tab I checked on application/vnd.mapbox-vector-tile (Figure 9).

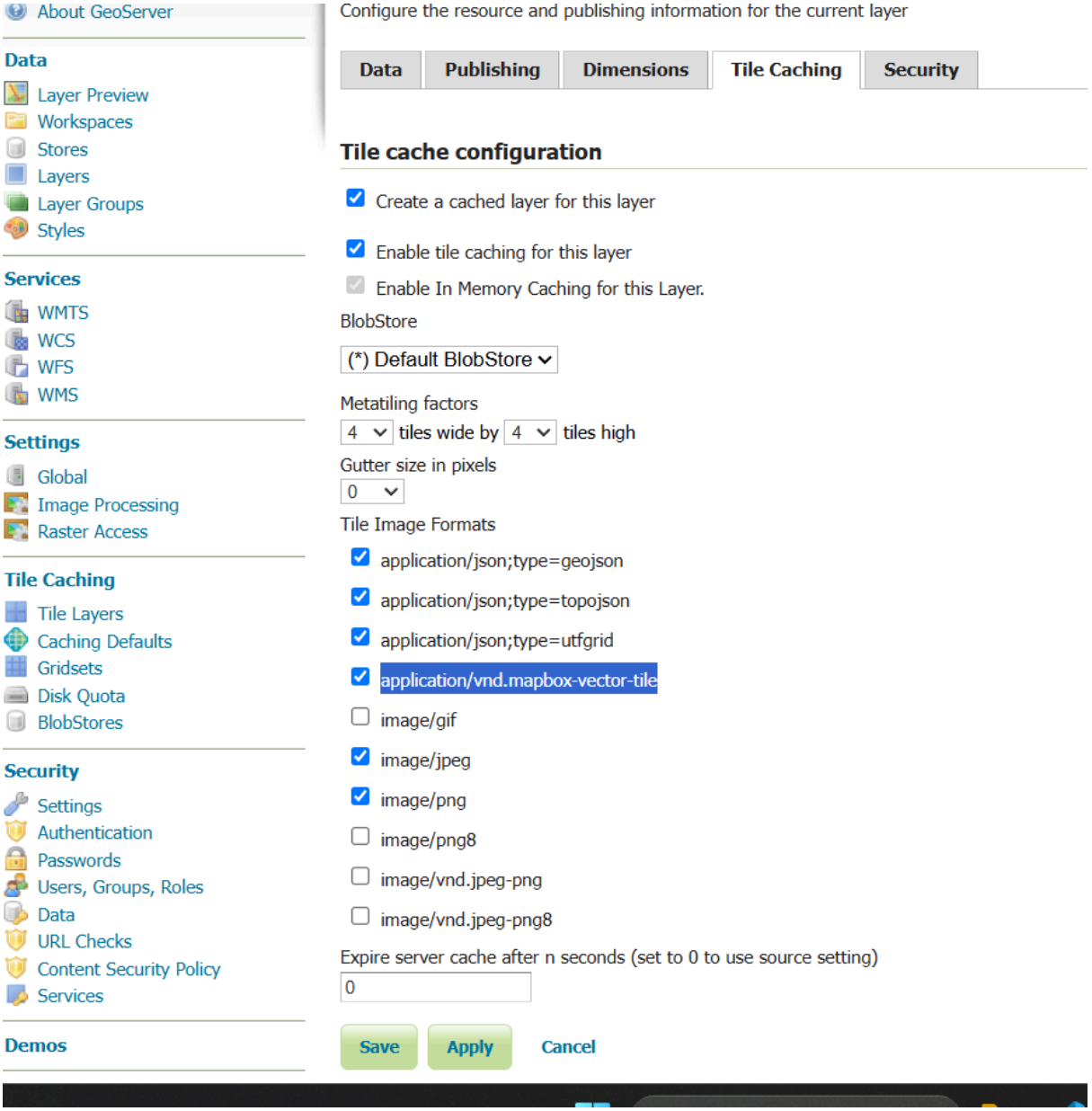


Figure 9. Turning on vector tiles

After this, my layers are available at the following url:

- *http://localhost:8080/geoserver/gwc/service/tms/1.0.0/vienna-age:{layer-name}@EPSG:900913@pbf/{z}/{x}/{y}.pbf*

3 Web map

For the visualization I wanted to create a dark theme map to showcase historical trace in the center of Vienna.

For the Front-End Stack I chose:

- Vite
- React
- Maplibre gl js

Different color palettes were developed to showcase different year of construction (Figure 10).

```
const colorPalettes = {
  historical: {
    name: 'Imperial Vienna',
    description: 'Inspired by Habsburg era architecture',
    colors: {
      background: 'linear-gradient(135deg, #1a1611 0%, #2c251a 100%)',
      cardBg: 'rgba(255, 250, 245, 0.95)',
      cardBgGlass: 'rgba(255, 250, 245, 0.85)',
      primary: '#8B4513',
      secondary: '#DAA520',
      accent: '#CD853F',
      text: '#2F1B14',
      textLight: '#5D4E37',
      border: 'rgba(210, 180, 140, 0.3)',
      shadow: 'rgba(139, 69, 19, 0.15)'
    },
    buildingColors: [
      { year: 800, color: '#8B4513' },
      { year: 1200, color: '#A0522D' },
      { year: 1500, color: '#CD853F' },
      { year: 1700, color: '#DAA520' },
      { year: 1800, color: '#B8860B' },
      { year: 1900, color: '#D2691E' },
      { year: 2000, color: '#FF6347' }
    ]
  },
  baroque: {
    name: 'Baroque Elegance',
    description: 'Rich colors of Austrian baroque',
    colors: {
      background: 'linear-gradient(135deg, #0f0f1a 0%, #1a0f1a 100%)',
      cardBg: 'rgba(255, 248, 240, 0.95)',
      cardBgGlass: 'rgba(255, 248, 240, 0.85)',
      primary: '#800020',
      secondary: '#FFD700',
```

Figure 10. Various color palettes for layers

GeoServer was utilized to provide tiles (Figure 11) but for the github, I used just json files.

```
const MapView = ({
    useEffect(() => {
        map.on('load', () => {
            map.addSource('vienna-monuments', {
                type: 'vector',
                tiles: [
                'http://localhost:8080/geoserver/gwc/service/tms/1.0.0/vienna-age:monuments@EPSG:900913@pbf/{z}/{x}/{y}.pbf'
                ],
                scheme: 'tms',
                minzoom: 0,    "minzoom": Unknown word.
                maxzoom: 14    "maxzoom": Unknown word.
            });      You, 1 second ago • Uncommitted changes

            map.addLayer({
                id: 'vienna-buildings-fill',
                type: 'fill',
                source: 'vienna-buildings',
                'source-layer': 'buildings',
                paint: {
                'fill-color': [
                    'case',
                    ['has', 'year_i'],
                    [
                    'interpolate',
                    ['linear'],
                    ['get', 'year_i'],
                    ...currentPalette.buildingColors.flatMap(({ year, color }) => [year, color])
                    ],
                    '#ccc'
                ],
                'fill-opacity': 1
                },

                filter: true
            })
```

Figure 11. Connection of vector tiles in Maplibre React app

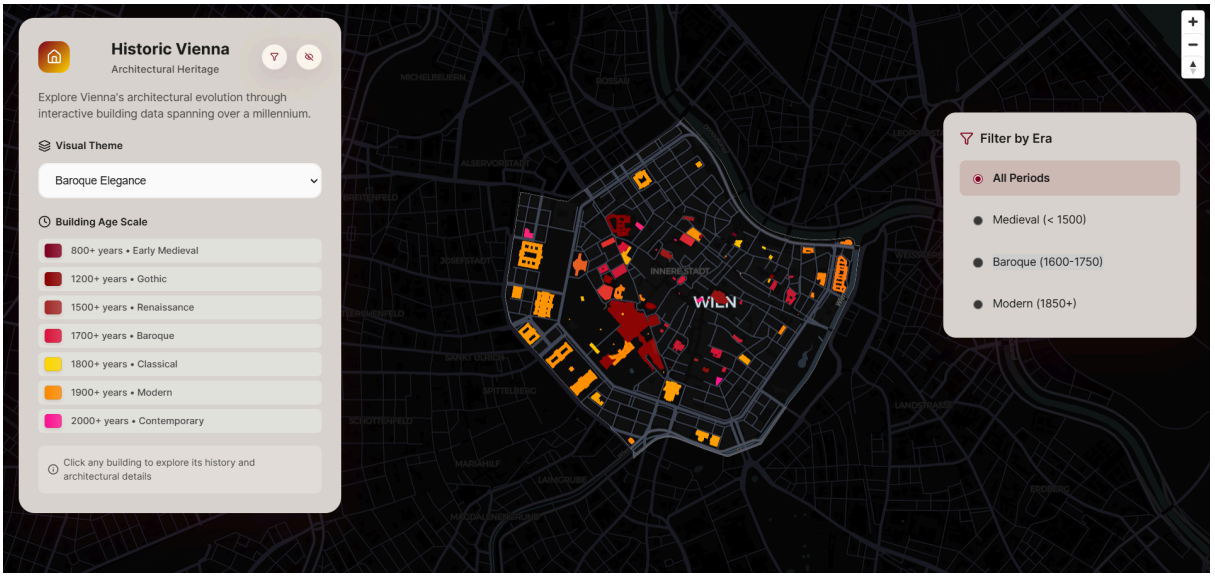
4 Final links

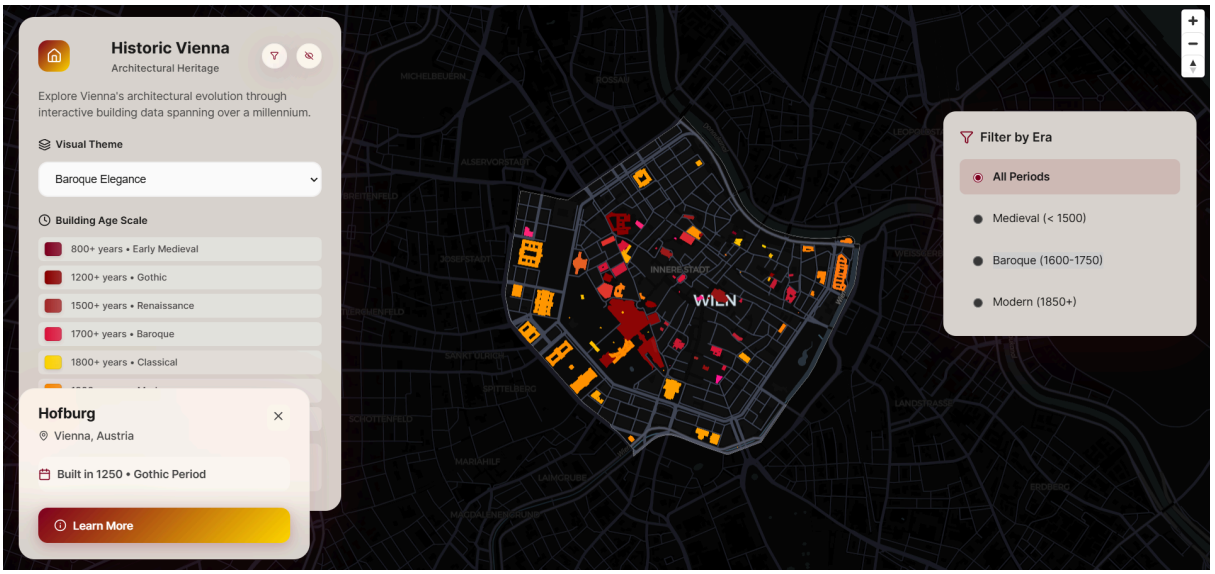
Github repository — https://github.com/RassCrom/historical-vienna_center

Web map — https://rasscrom.github.io/historical-vienna_center/

SQL queries — https://github.com/RassCrom/historical-vienna_center/tree/main/src/sql/allQueries.sql

Final screenshots


Historic Vienna
Architectural Heritage
Explore Vienna's architectural evolution through interactive building data spanning over a millennium.
Visual Theme
Baroque Elegance
Building Age Scale
800+ years • Early Medieval
1200+ years • Gothic
1500+ years • Renaissance
1700+ years • Baroque
1800+ years • Classical
1900+ years • Modern
2000+ years • Contemporary
Click any building to explore its history and architectural details
Filter by Era
All Periods
Medieval (< 1500)
Baroque (1600-1750)
Modern (1850+)
WIEN


Historic Vienna
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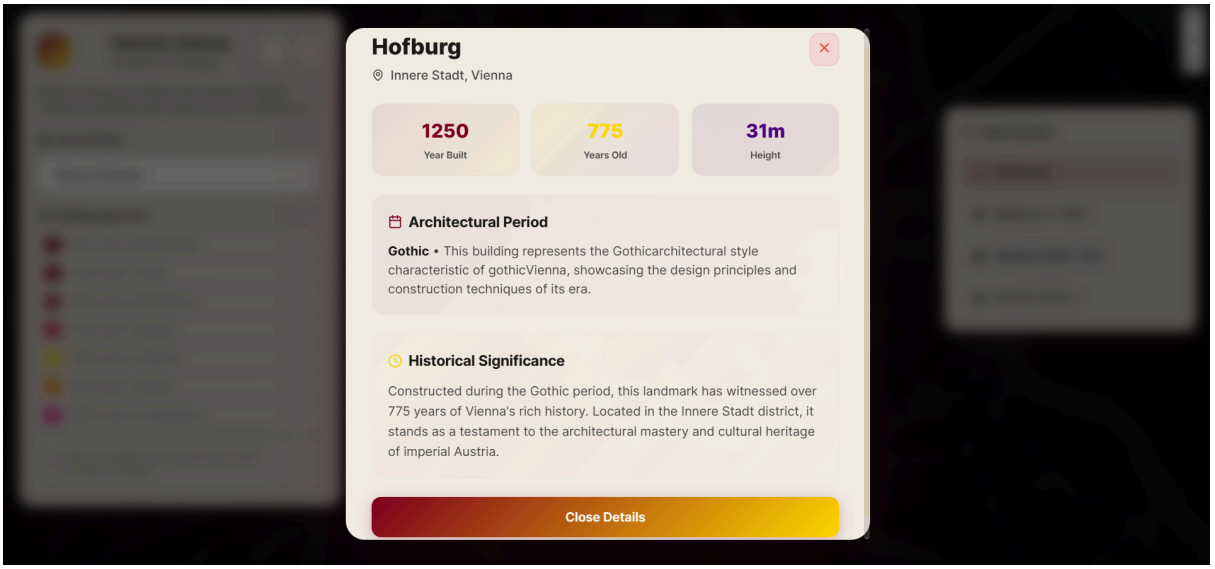
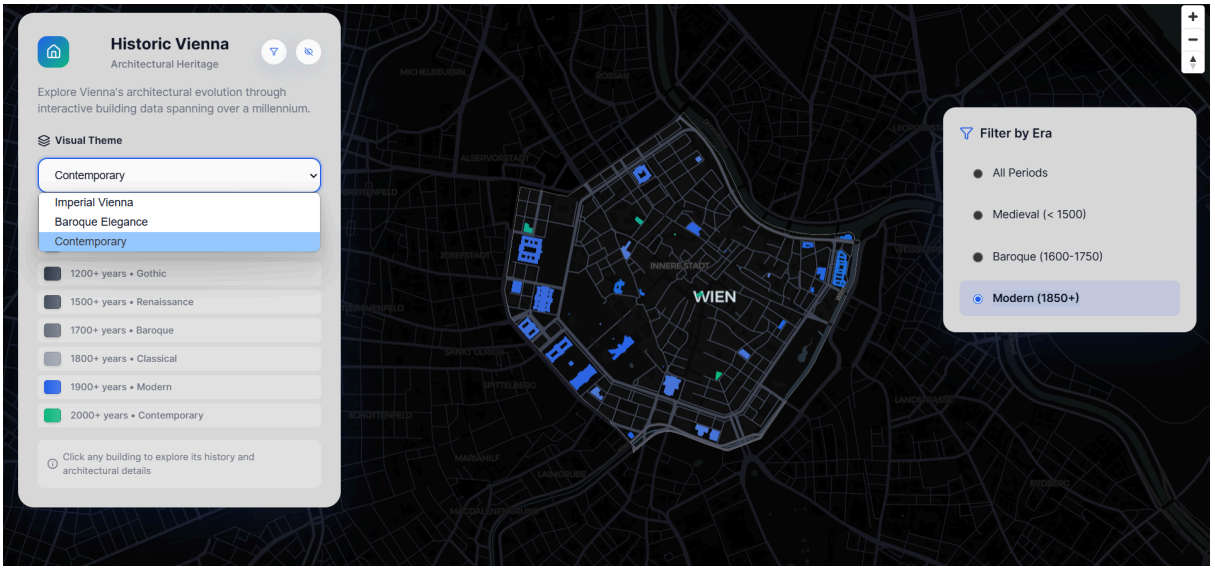
Explore Vienna's architectural evolution through interactive building data spanning over a millennium.
Visual Theme
Baroque Elegance
Building Age Scale
800+ years • Early Medieval
1200+ years • Gothic
1500+ years • Renaissance
1700+ years • Baroque
1800+ years • Classical
Hofburg
Vienna, Austria
Built in 1250 • Gothic Period
Learn More
Filter by Era
All Periods
Medieval (< 1500)
Baroque (1600-1750)
Modern (1850+)
WIEN


Hofburg
Innere Stadt, Vienna
1250
Year Built
775
Years Old
31m
Height
Architectural Period
Gothic • This building represents the Gothicarchitectural style characteristic of gothicVienna, showcasing the design principles and construction techniques of its era.
Historical Significance
Constructed during the Gothic period, this landmark has witnessed over 775 years of Vienna's rich history. Located in the Innere Stadt district, it stands as a testament to the architectural mastery and cultural heritage of imperial Austria.
Close Details



5 References

* — credits for the background image to https://www.wko.at/wien/innere-stadt — For background cover

1. https://www.data.gv.at/katalog/dataset/2ee6b8bf-6292-413c-bb8b-bd22dbb2ad4b#resources — for Vienna city boundaries
2. List of resources — for year of construction for buildings layer
   a. Gemini AI search
   b. https://www.sciencedirect.com/science/article/pii/S2352340922000762#bib0003
   c. https://wikimapia.org/#lang=en&lat=48.220098&lon=16.370316&z=11&m=w&search=vienna
   d. https://wiki.openstreetmap.org/wiki
   e. https://www.wikipedia.org/
3. https://geoserver.org/release/stable/ — to install extensions (& GeoServer)
4. https://medium.com/@go2garret/free-basemap-tiles-for-maplibre-18374fab60cb — to get dark theme basemap
5. https://bella-mir.github.io/city-palimpsest/ — inspiration for the web map

Useful Links:

- https://www.w3schools.com/sql/
- https://maplibre.org/maplibre-gl-js/docs/