



# Centro Nexa su Internet & Società

*Politecnico di Torino*



Future  
*Urban Legacy*  
Lab

An aerial, top-down view of a city grid. The streets are represented by white lines on a black background. A red grid is overlaid on the city, with red lines intersecting the white street lines. The grid is composed of small squares, some of which are filled with a pattern of small white dots. The text "DOUT" is overlaid on the right side of the image, and "Digital Open Urban Twin" is written below it in a smaller font.

# DOUT

*Digital Open Urban Twin*

# OUTLINE

- **Context**
- **Digital infrastructure**
- **Representations**
- **Experiments**

**Context**

# Data Commons



**BERKMAN  
KLEIN CENTER**  
FOR INTERNET & SOCIETY  
AT HARVARD UNIVERSITY

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INPUT

OUTPUT

**Fonte:** Data Commons Version 1.0: A Framework to Build Toward AI for Good  
A roadmap for data from the 2018 AI for Good Summit  
Elena Goldstein, Urs Gasser and Ryan Budish - <https://bit.ly/2P3J61R>

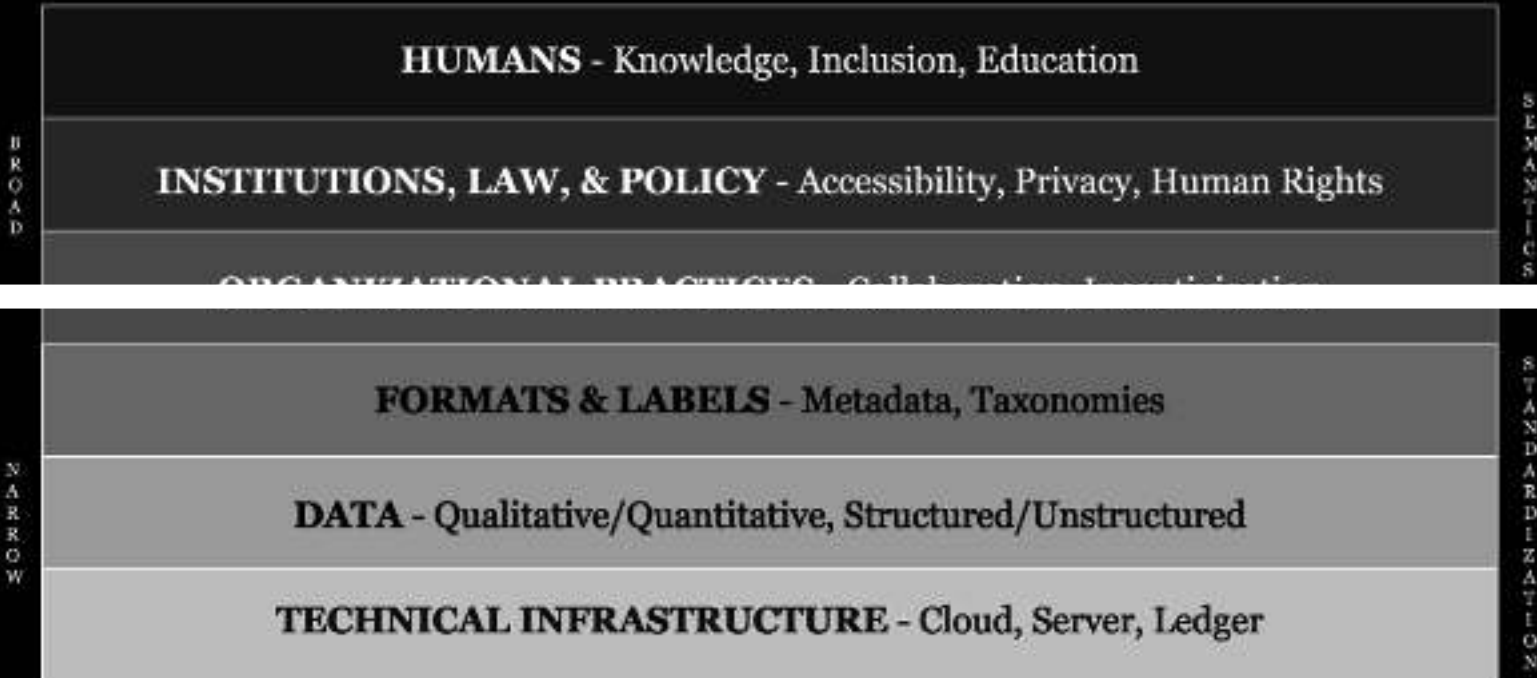
# Data Commons



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INPUT

OUTPUT

***Focus on: digital infrastructure***

# Data Commons



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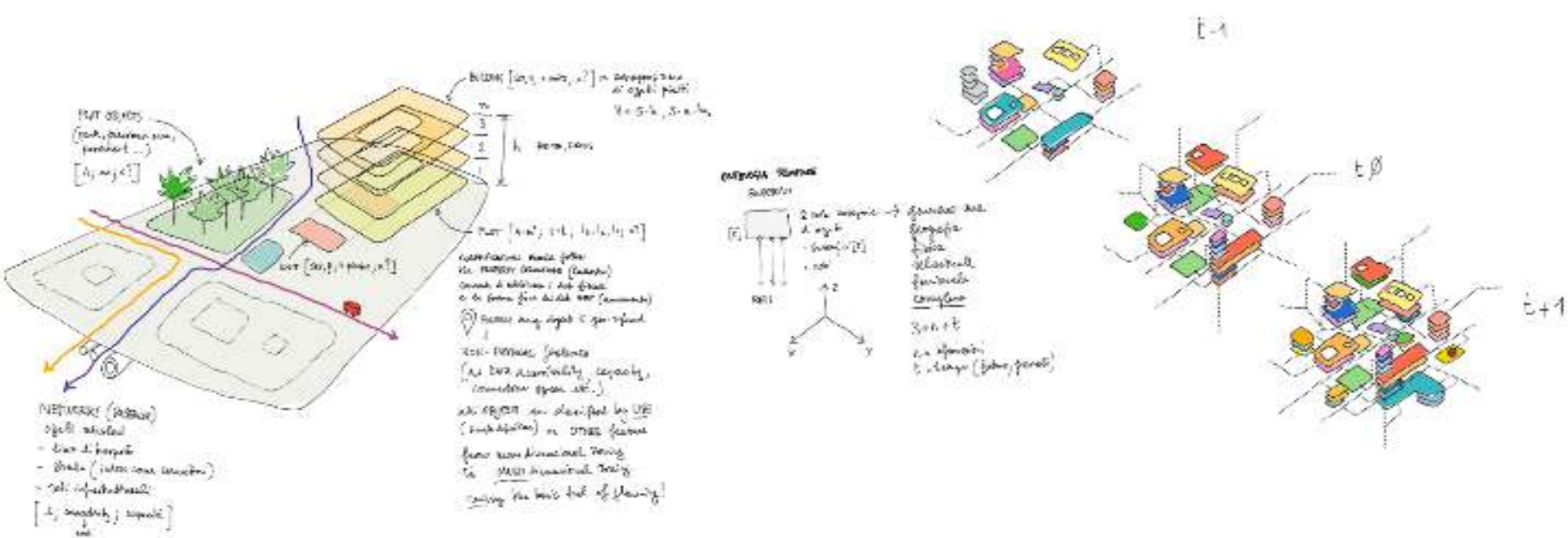
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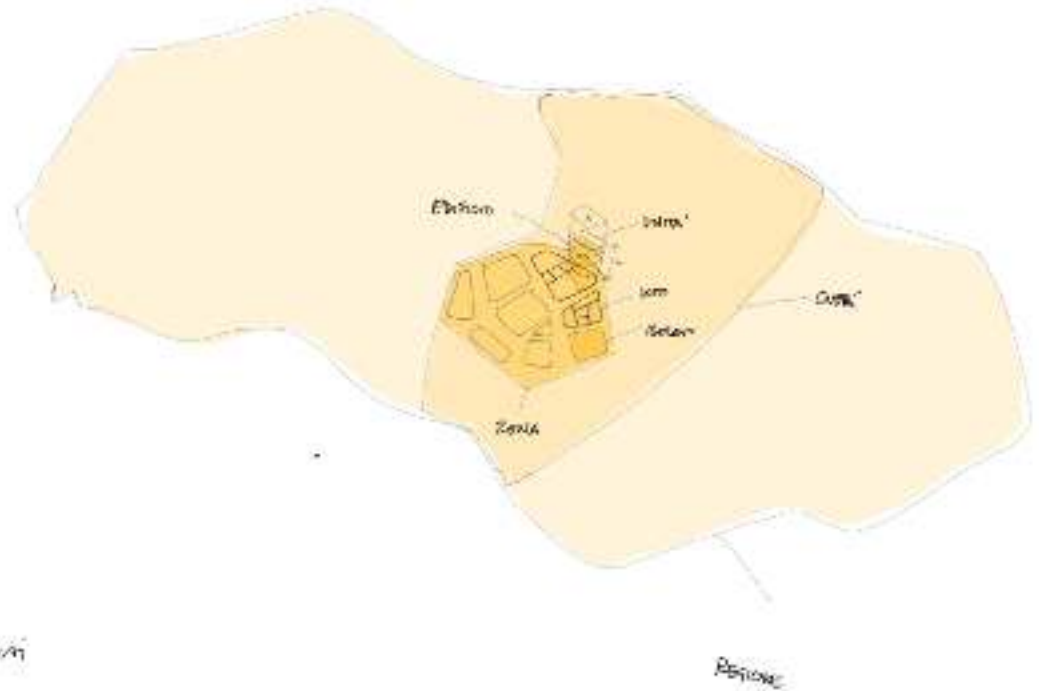
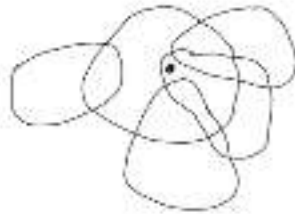
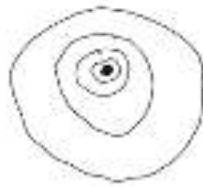
*Focus on: representations*

# **Digital infrastructure**





- ② per crescere l'ecosistema, ogni livello è contenuto in modo circolare nel superiore
  - ③ quando la fase di dati non sia disponibile e quella è la prima, ogni livello è la prima caratteristica del primo livello aperto disponibile
  - ④ gli oggetti reali non rappresentano l'entità (oggetti fisici)
- quindi ricorrono le proprietà
- possono essere contraddittorie appartenenti a insiemi diversi, anche con scale e gradi di dettaglio diversi



## DIGITAL OPEN URBAN TWIN

Interoperability and standards (CityGML, OGC, ISO TC211, Inspire)

Some data necessarily located in the servers of Politecnico

Data retrievable from external services

Accessibility from web interface

Data usage licence

Security

# Comparative analysis: data models and tools



ArcGIS Online



CityEngine



three.js



CityEngine  
Web Viewer



CESIUM  
CONSORTIUM



AUTODESK<sup>®</sup>  
INFRAWORKS<sup>™</sup> 360



PostgreSQL

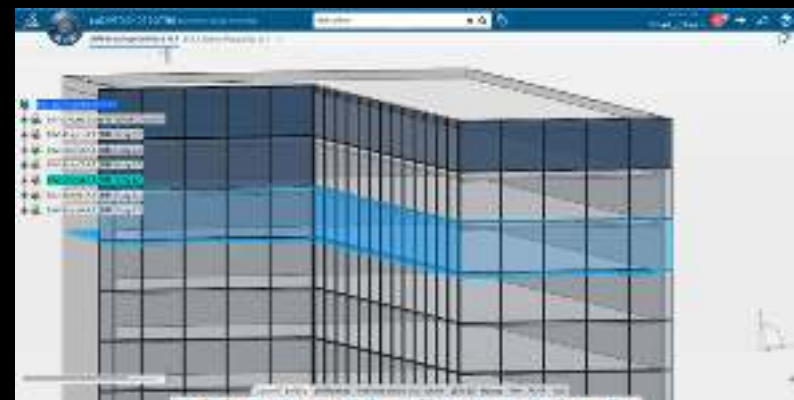
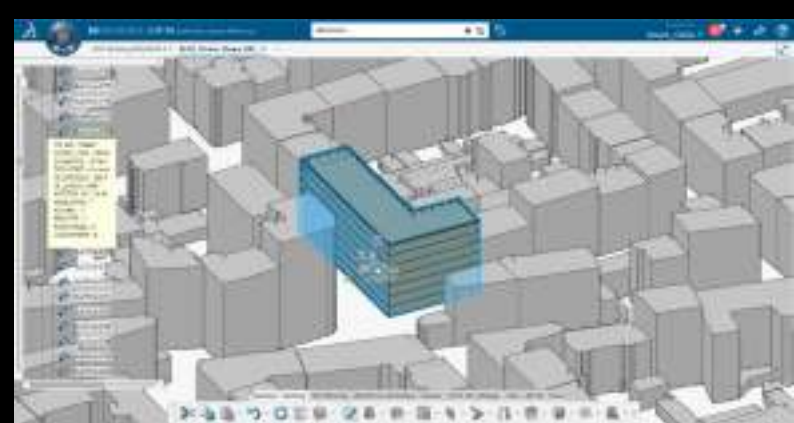
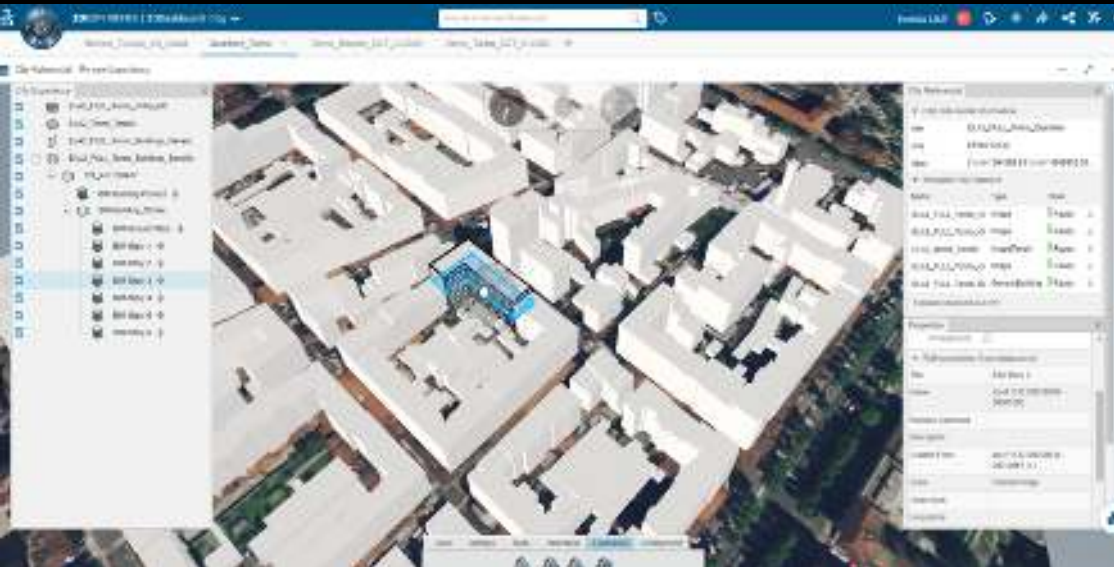


ArcGIS





# Feasibility study with Dassault Systèmes



# **Representations**

## Focus on: representations

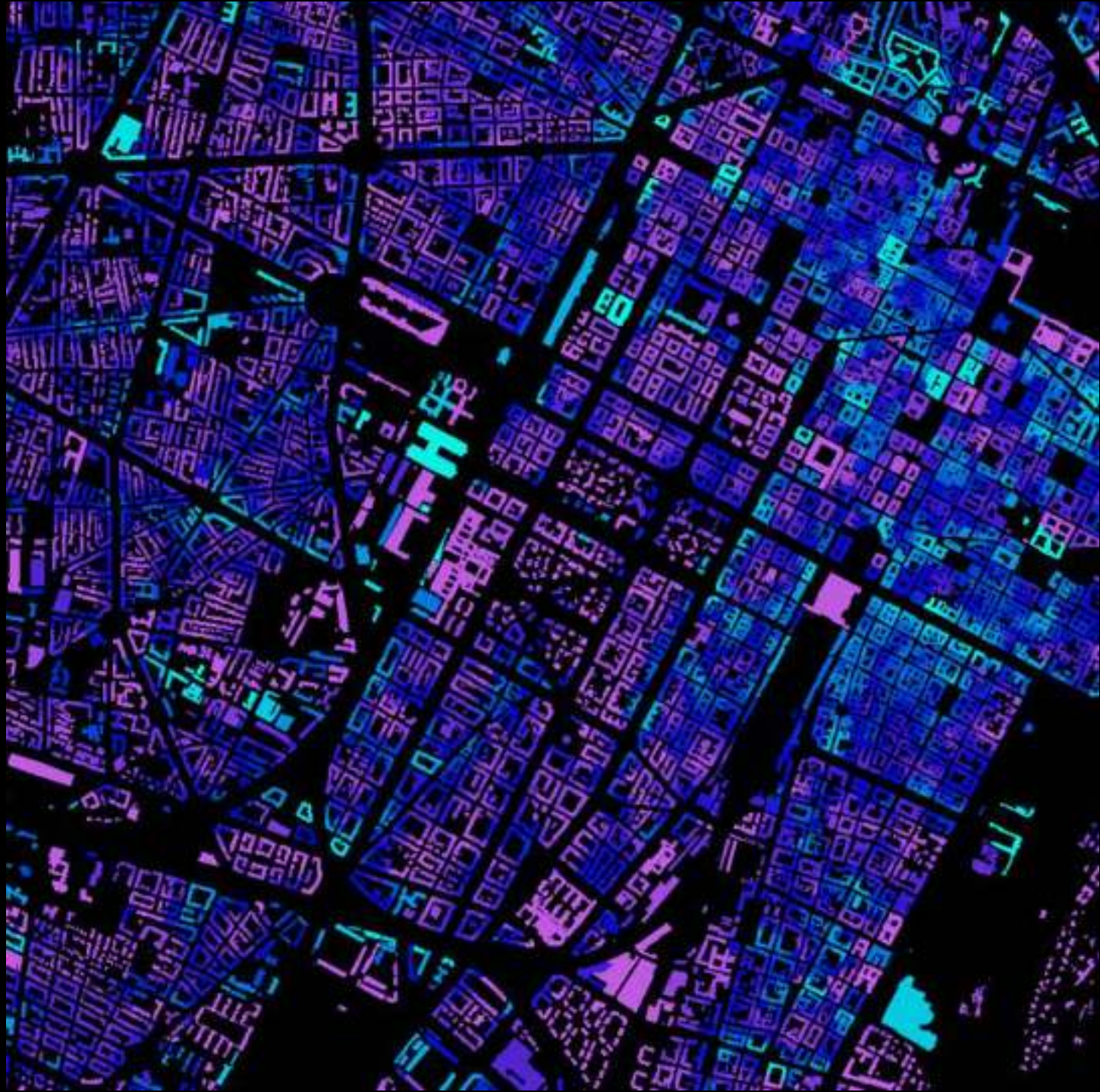
- **Improved maps**  
better level of details, time dimension
- **New maps**  
representations of recent urban phenomena
- **Matching maps**  
relations between phenomena
- **Critical maps**  
highlighting urban issues (wicked problems)

**Improved maps**



# Urban form and retail location patterns

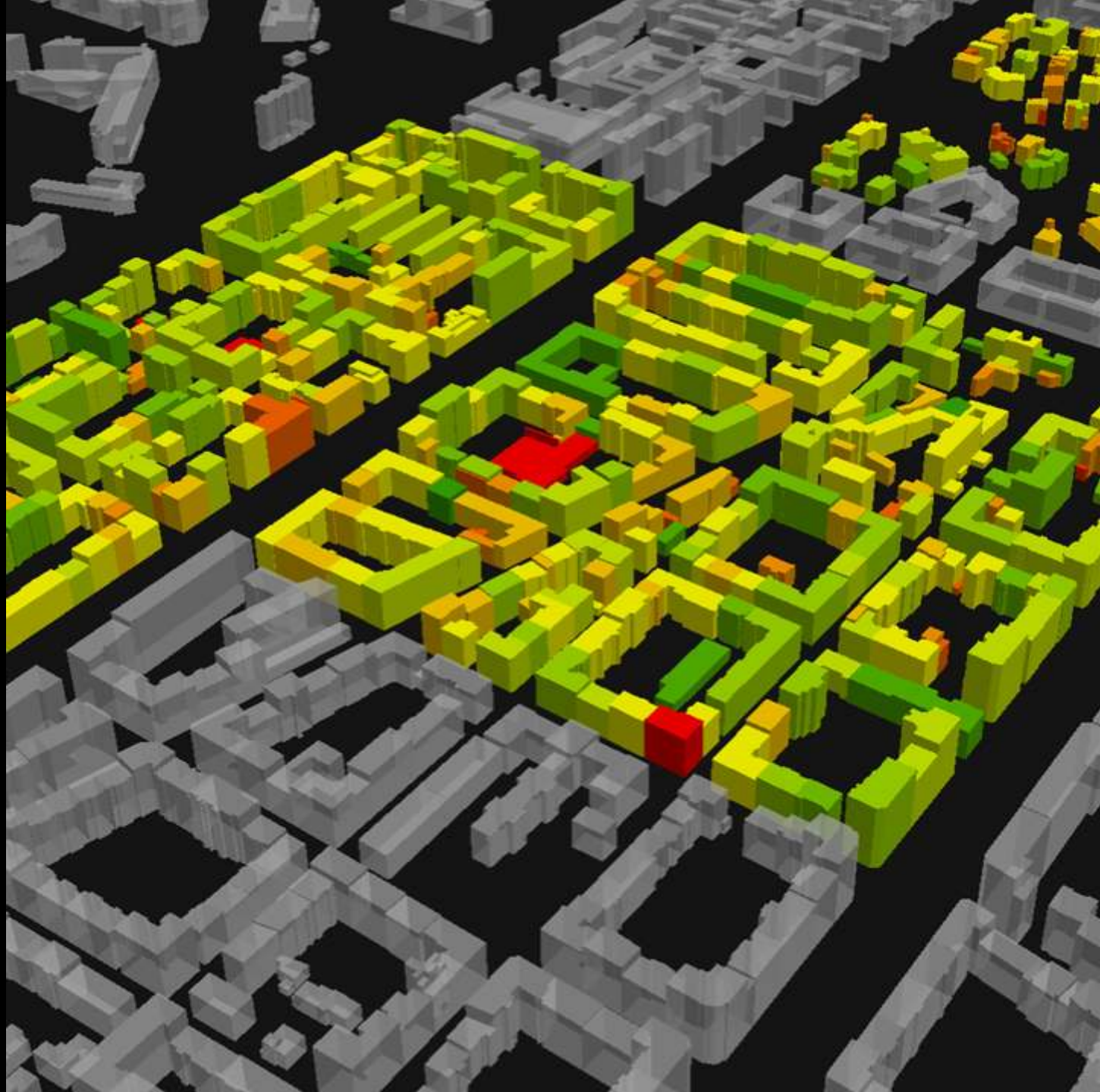
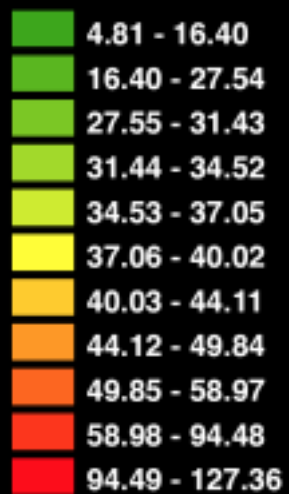
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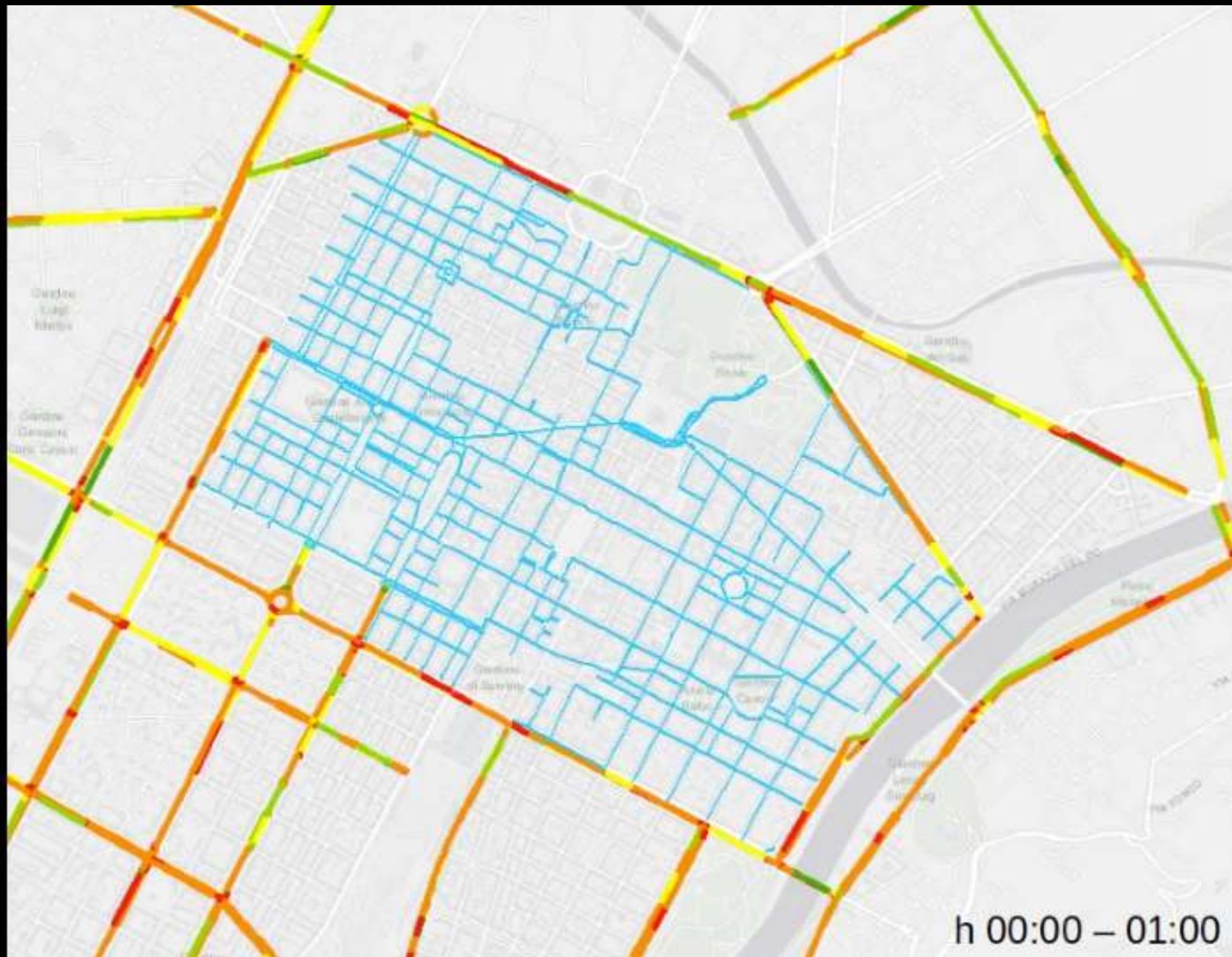




# GIS-based Energy Model

EPgl [kWh/m<sup>3</sup>/year]

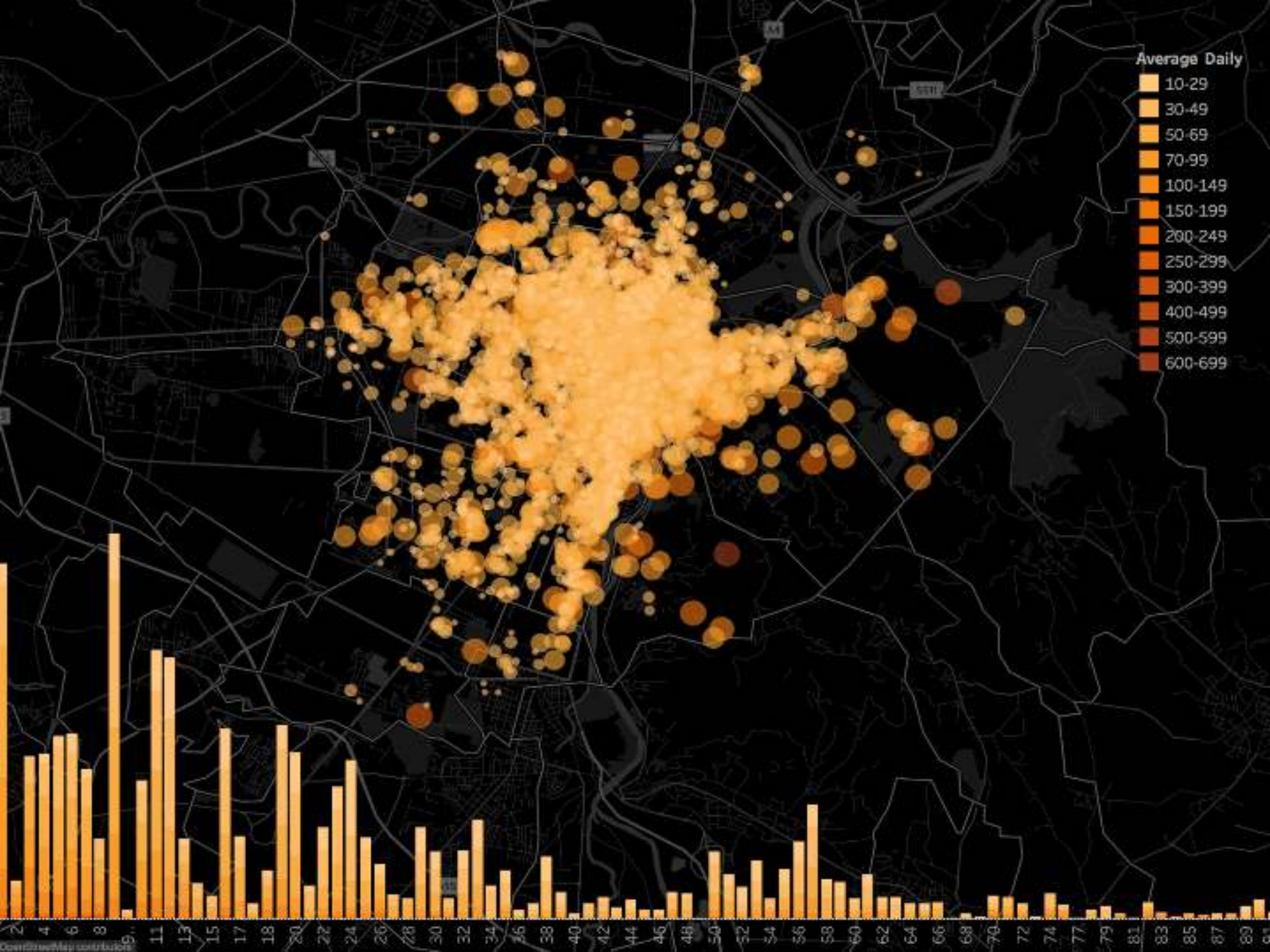




link

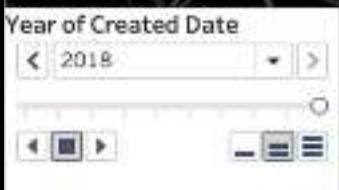
**New maps**





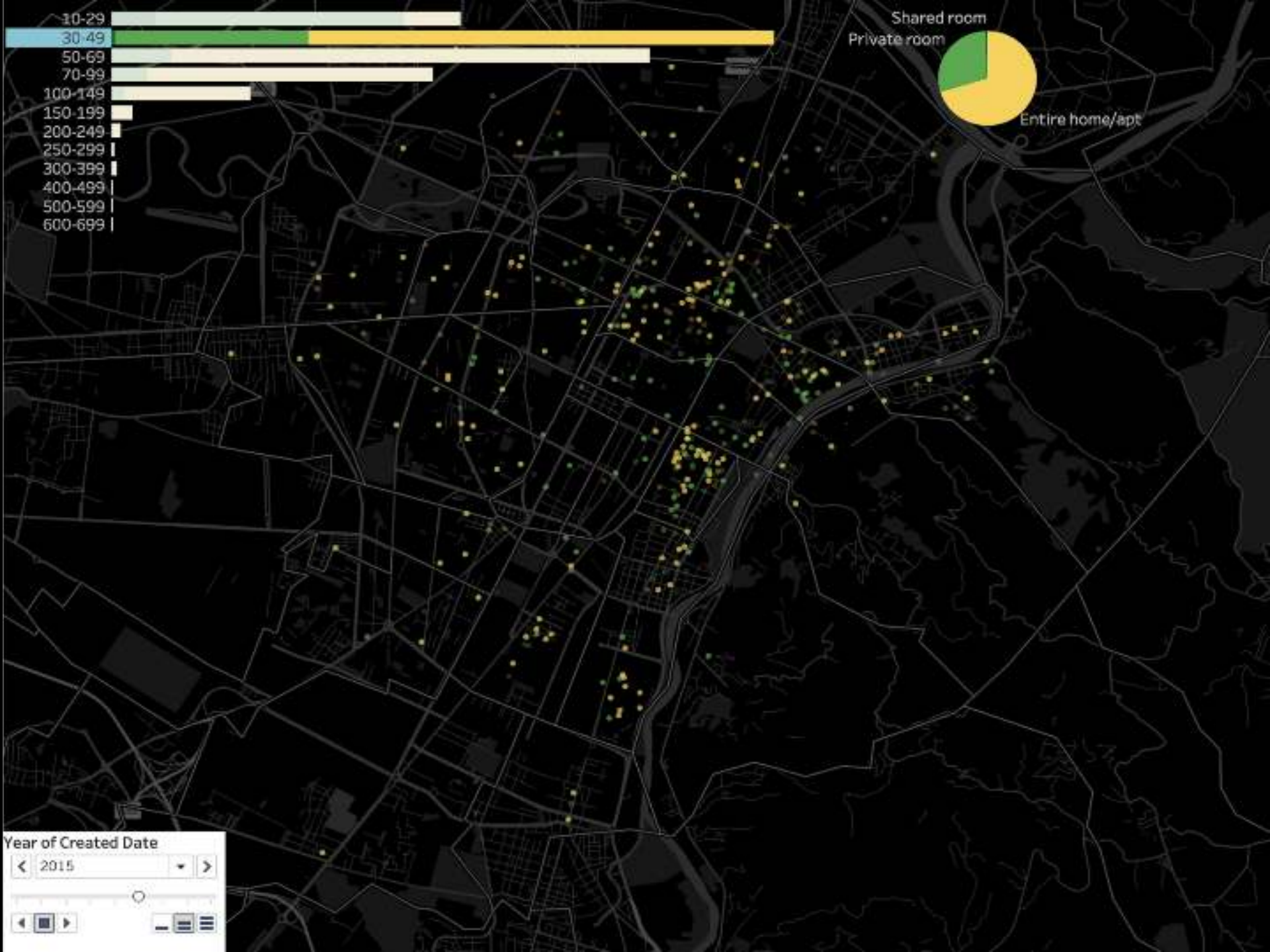












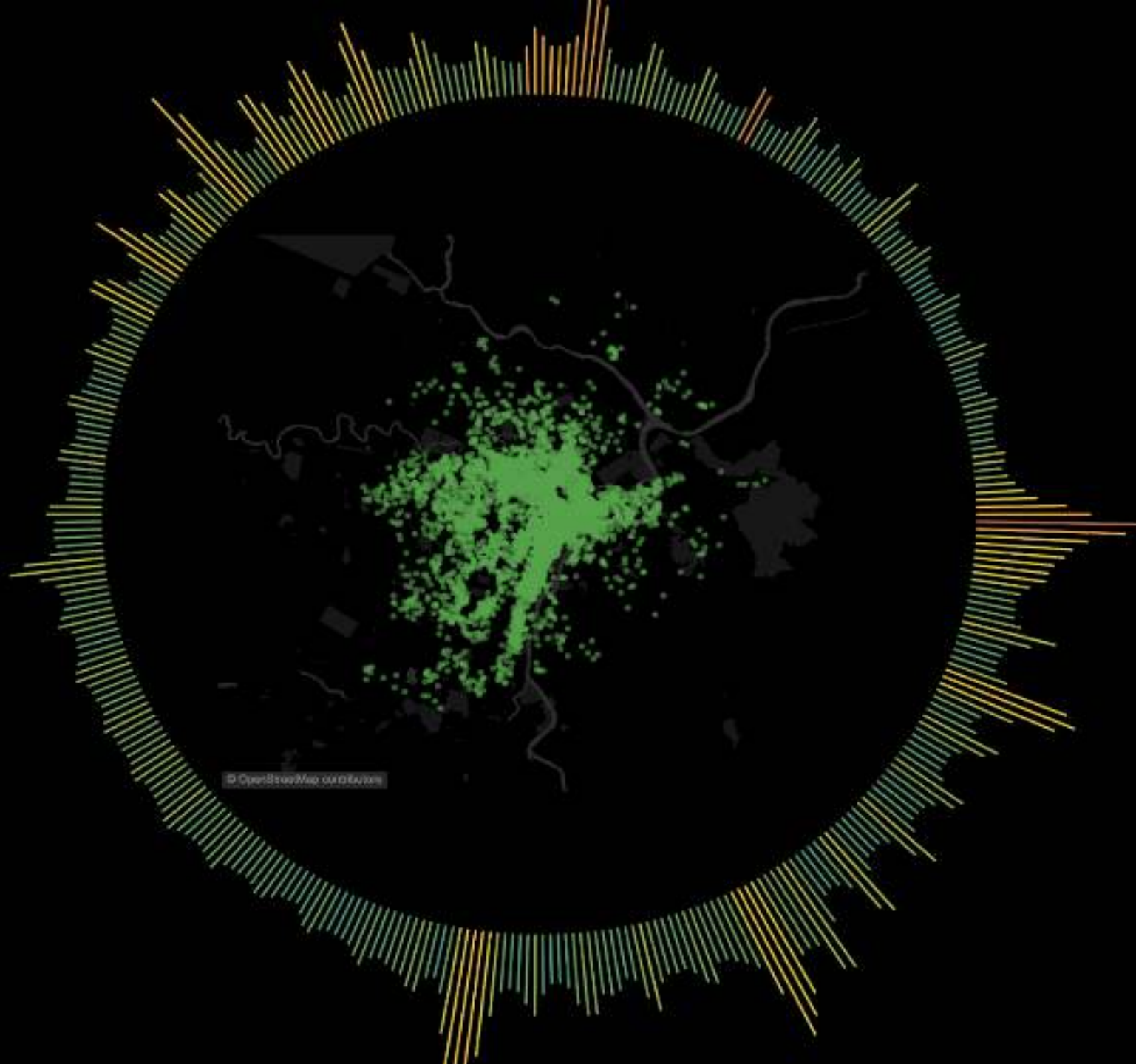














✓ Keep Only ✕ Exclude 🔍 ↺ ↻ 📄

Day of Date: 29 luglio 2016

Number of Records: 572

Avg. Price (Native): 50,63

# Matching maps

# Energy consumption + Retail Pattern

overall  
**41.928 MWh/year**  
(selected area)

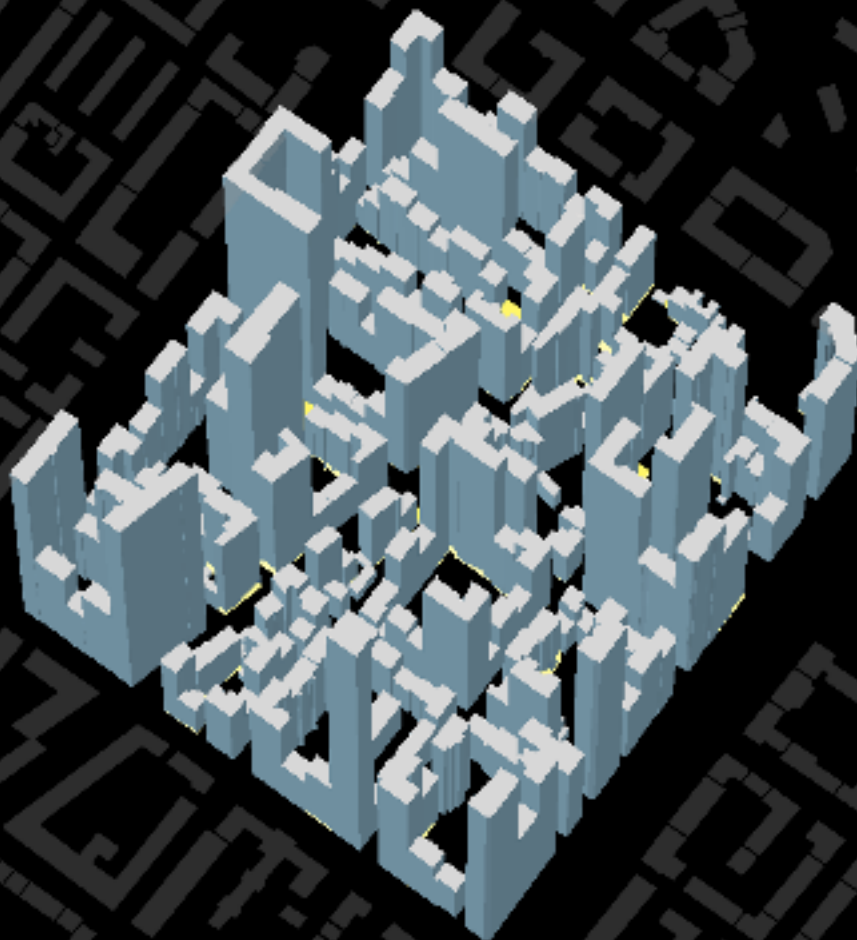
commercial  
**179 MWh/year**

0.4%



892 MWh/year

2.0%



## **Critical maps**





# "Ogni anno 900 morti in più a Torino a causa dell'inquinamento da polveri sottili"

I dati dell'Arpa in base a uno studio del 2010

di GABRIELE GUCCIONE

10 febbraio 2017



"Novecento morti fanno a Torino sono attribuibili all'inquinamento causato dalle polveri sottili". A sostenerlo è il direttore del centro regionale per l'epidemiologia e la salute ambientale dell'Arpa, Ennio Cadum. "Gli studi condotti sinora - afferma il medico - dimostrano che ad ogni picco di emissioni nocive corrisponde nei giorni immediatamente successivi un aumento del numero di decessi".

Fonte: La Repubblica  
10.02.2017

## Emergenza smog, Torino la peggiore in Italia secondo Legambiente: inchiesta della procura

Il capoluogo piemontese maglia nera, Piemonte in ritardo sulle misure anti-inquinamento



CONVEGNI

LEGGI ANCHE

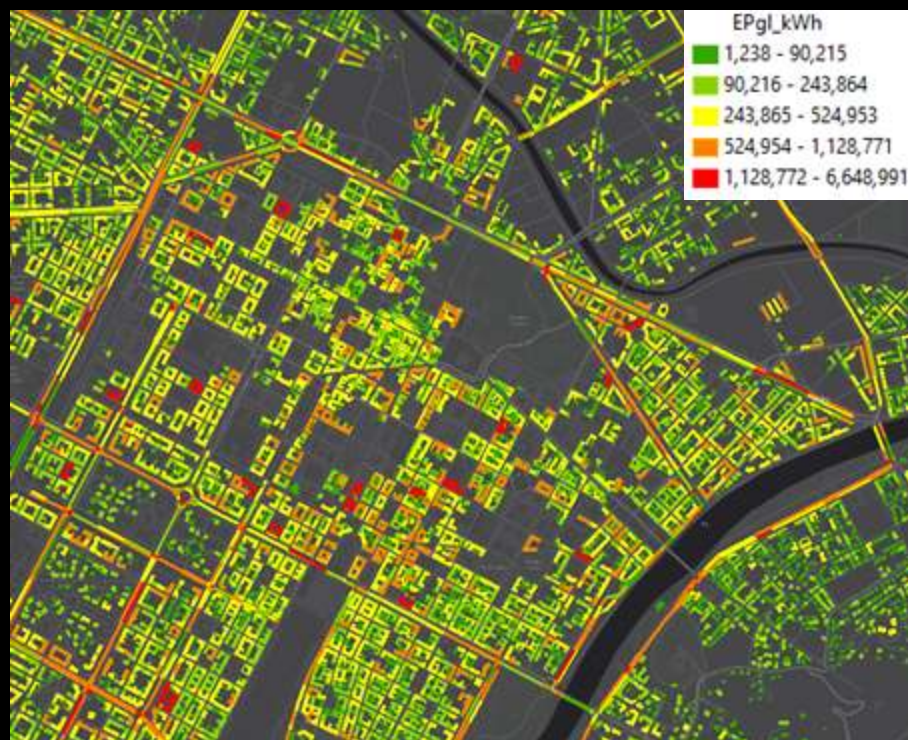


Smog oltre i limiti, Torino anticipa i divieti da mercoledì sereni i diesel fino all'Euro 4



Emergenza smog a Torino, il Comune: "Noi aprite porte e finestre"

Fonte: La Stampa  
16.10.2017



Application of GIS-based Model:  
distribution of **thermal energy consumptions** for  
different types of users at building scale [kWh/year]  
+ Traffic Model (7-8 a.m.)



Application of GIS-based Model:  
distribution of **daily GHG emissions** for the  
residential sector due to the thermal consumption  
[tCO<sub>2</sub>/day] at building scale + Traffic Model (7-8  
a.m.)

**Traffic Model + Energy Model**



**CO<sub>2</sub> GHG EMISSIONS** (daily value)  
5% traffic (ZTL)  
95% residential buildings (ZTL)

# Experiments





The commercial structure and its development in Parisian districts - APUR, Paris

[http://carto.apur.org:8080/ibdppc\\_hist/client/client.jsp#](http://carto.apur.org:8080/ibdppc_hist/client/client.jsp#)



# CARTA HISTÒRICA DE BARCELONA

## 1936. Barcelona before the Civil War

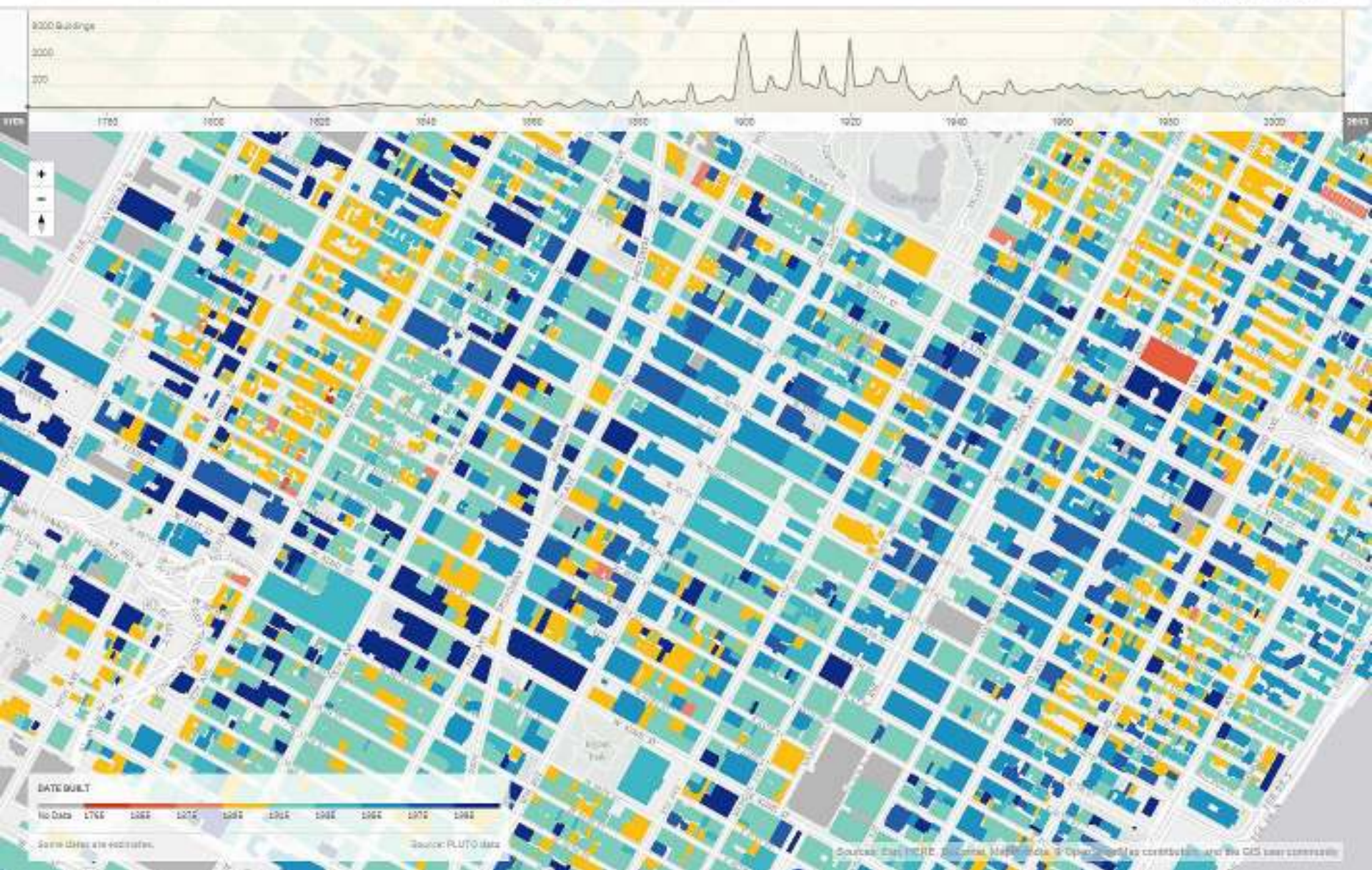
From 1800 to 1890 Barcelona's population had grown from half a million inhabitants to a million, as a result of immigration attracted by industrial growth and the large-scale urban developments. The first subway line had opened in 1924 and the World's Fair, held in 1929, had transformed Plaça Espanya and the slopes of Montjuïc. This rapid growth, under conditions of intense social inequality, led to the spread of slum housing and shanty towns, only somewhat relieved by the construction of the first low-cost housing developments (casas barates): Eixdorf, Can Peguera, Baró de Viver and Bon Pastor. In 1920 Barcelona had incorporated la Marina d'Hoportlet to build the free zone (Zona Franca).

500 m

150 a.C. 100 a.C. 10 a.C. 200 250 550 1000 1100 1200 1250 1300 1400 1500 1600 1700 1750 1800 1850 1900 1936 1956 1976 1992 2004 2010

1936





New York Urban Layers - Morphocode

<http://io.morphocode.com/urban-layers/>







## WALKABILITY THE 5-MINUTE WALK

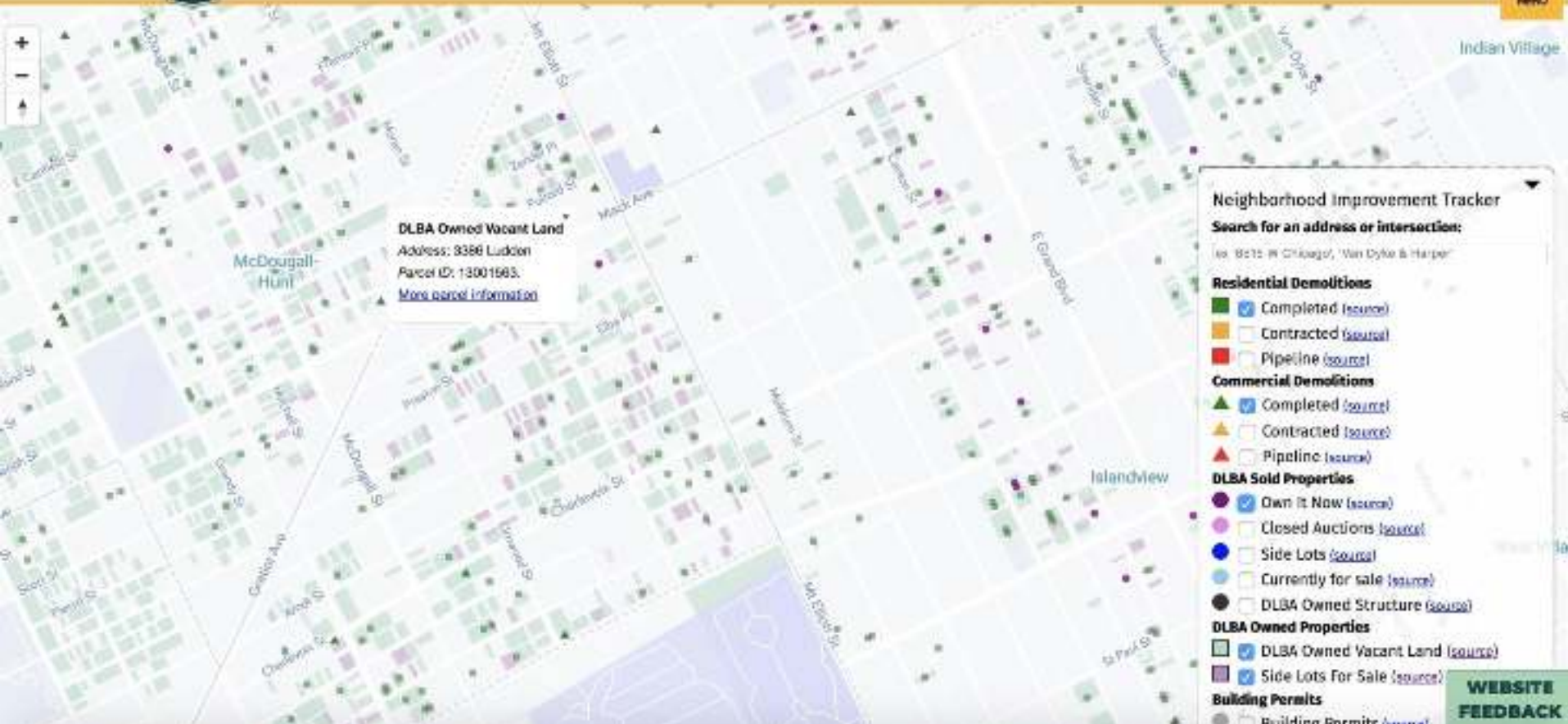


The Pulse of Melbourne - Morphocode

<https://morphocode.com/visualizing-pedestrian-activity-city-melbourne/>



## Detroit Neighborhood Improvement Tracker



Detroit Neighborhood Improvement Tracker

<https://detroitmi.gov/webapp/detroit-neighborhood-improvement-tracker>



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**Valeria Todeschi - DENERG**  
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