

Bicycle Network Planning

Geospatial Data Science for evaluating and improving
cycling conditions

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What can Data Science do for bicycle network planning?

Go to www.menti.com and use the code 23 19 18 6

DATA SCIENCE TEAM

Where do I fit?

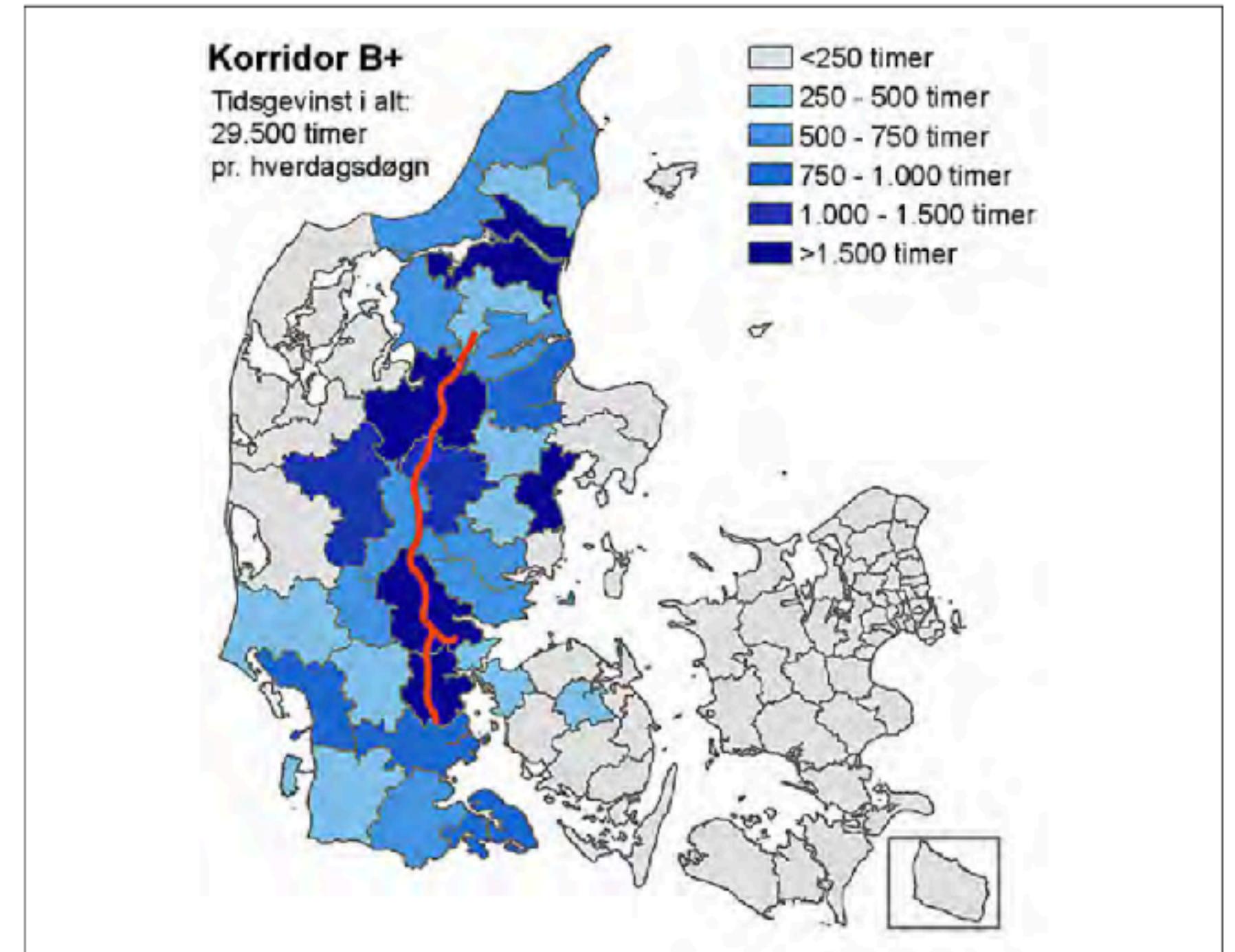
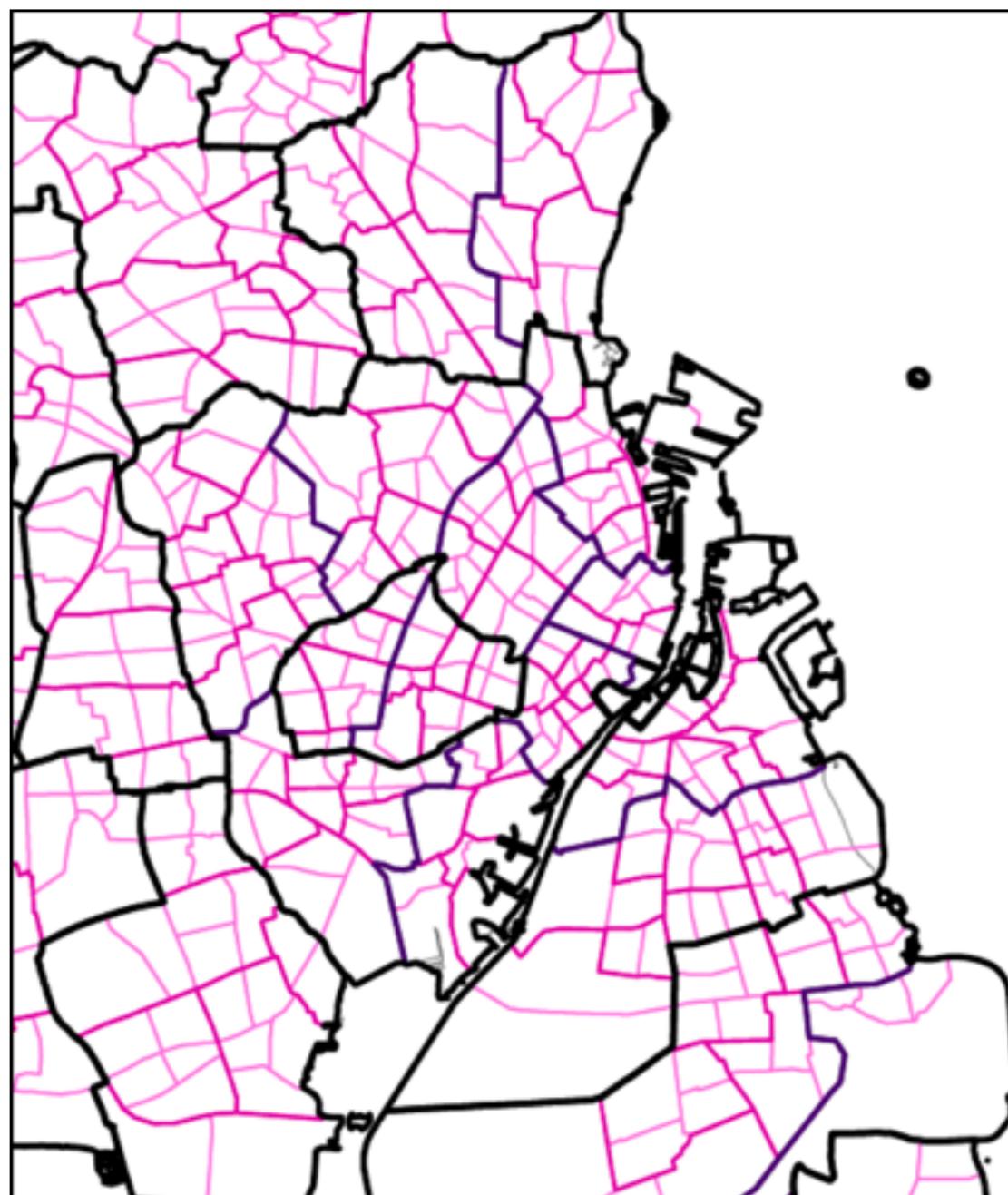


Data ninjas

Bicycle planning in ‘real life’

Traditional transport planning:

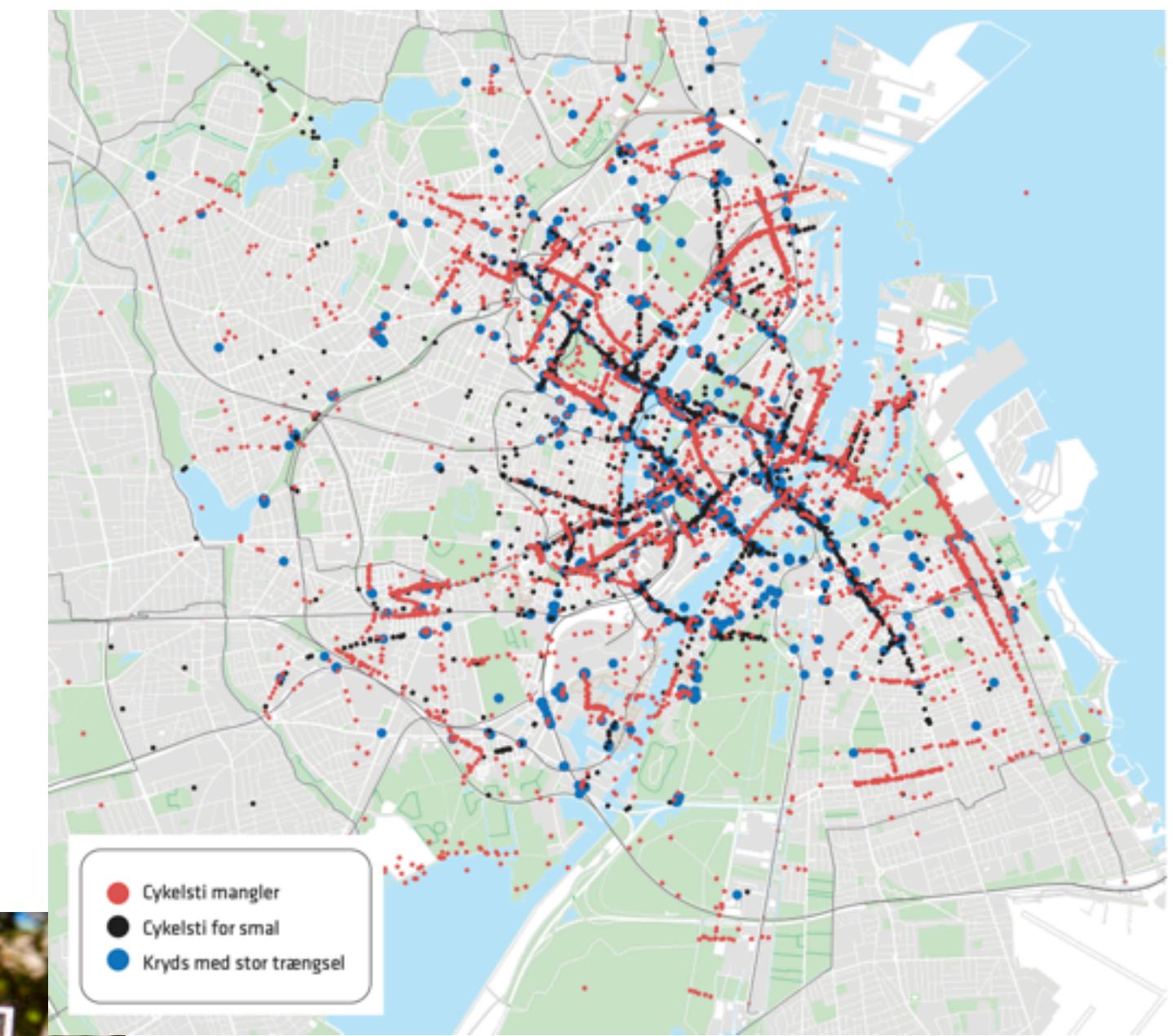
- Transport models
- Modelled or real data
- Coarse scale
- Expressed as hours spent/saved (time as monetary value)



Bicycle planning in ‘real life’

Bicycle planning:

- Very little data
- No/few models
- Ad hoc + piece-by-piece
- Based on local knowledge + requests + maybe some modelling/ measurement of cycling flow



GDS applied to Bicycle Planning

● CROW

● BLOS

● LTS

● TRANSPORT MODELS

● NETWORKS

● EQUITY

1987

1997

2004

2006

2012

2015

2017

2017

2020

2021

2022

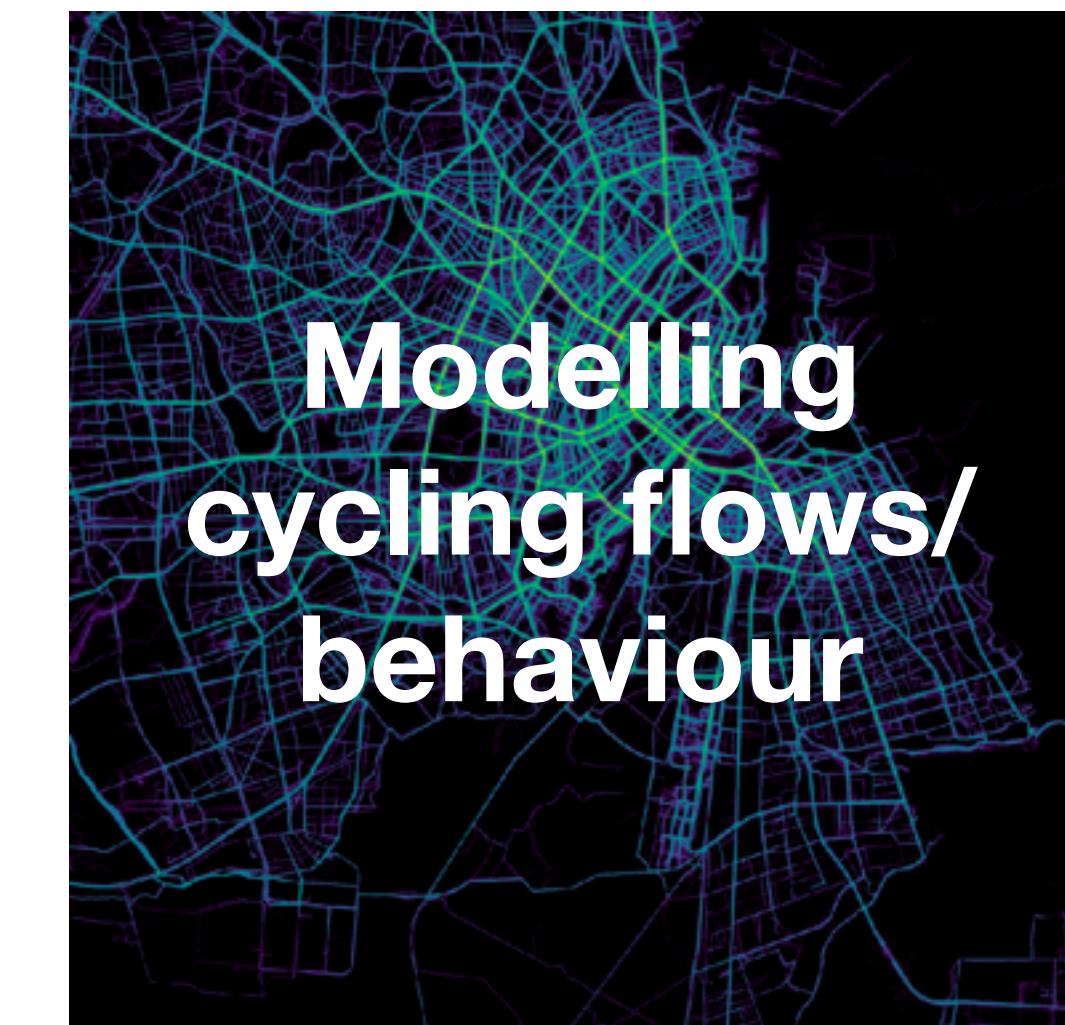
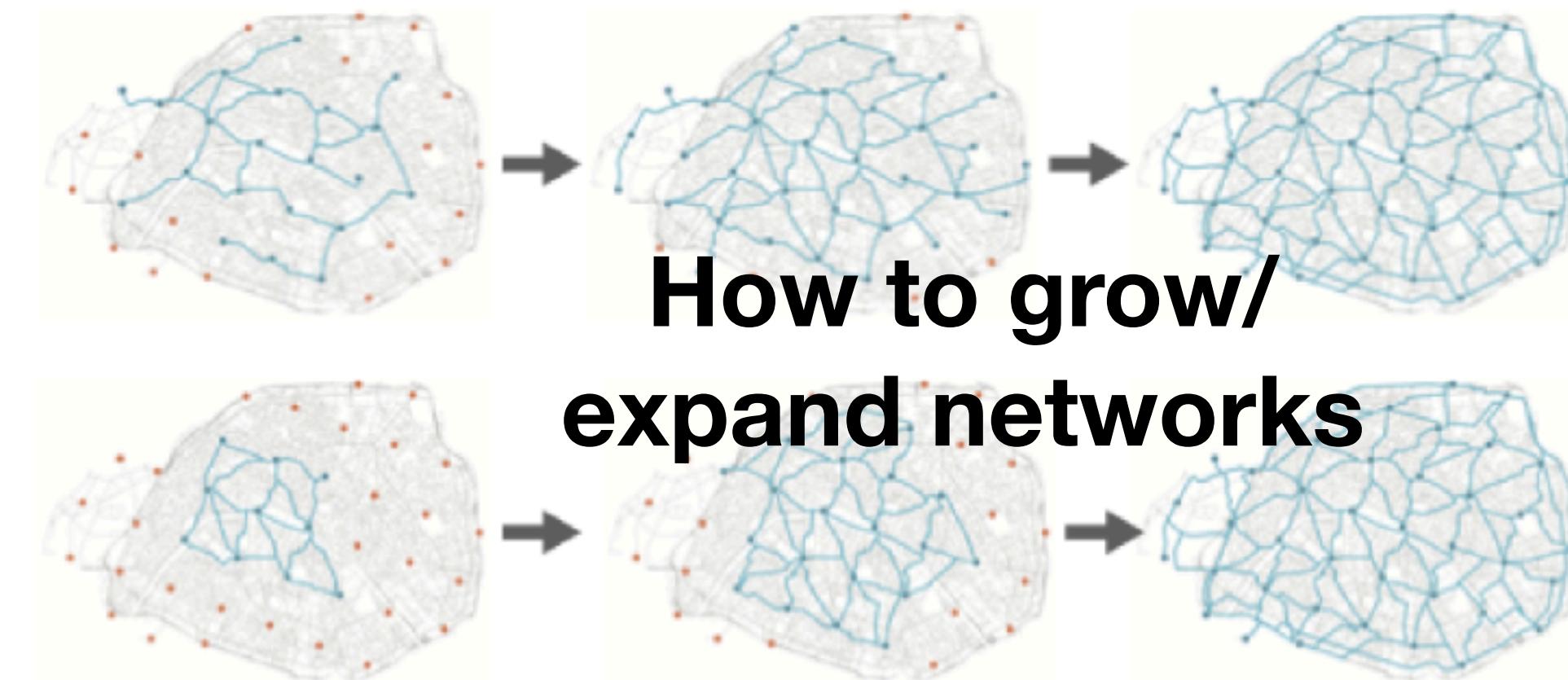
2021

?



Current approaches

How are cycling networks researched?



Is Copenhagen the most bikeable city in the world?

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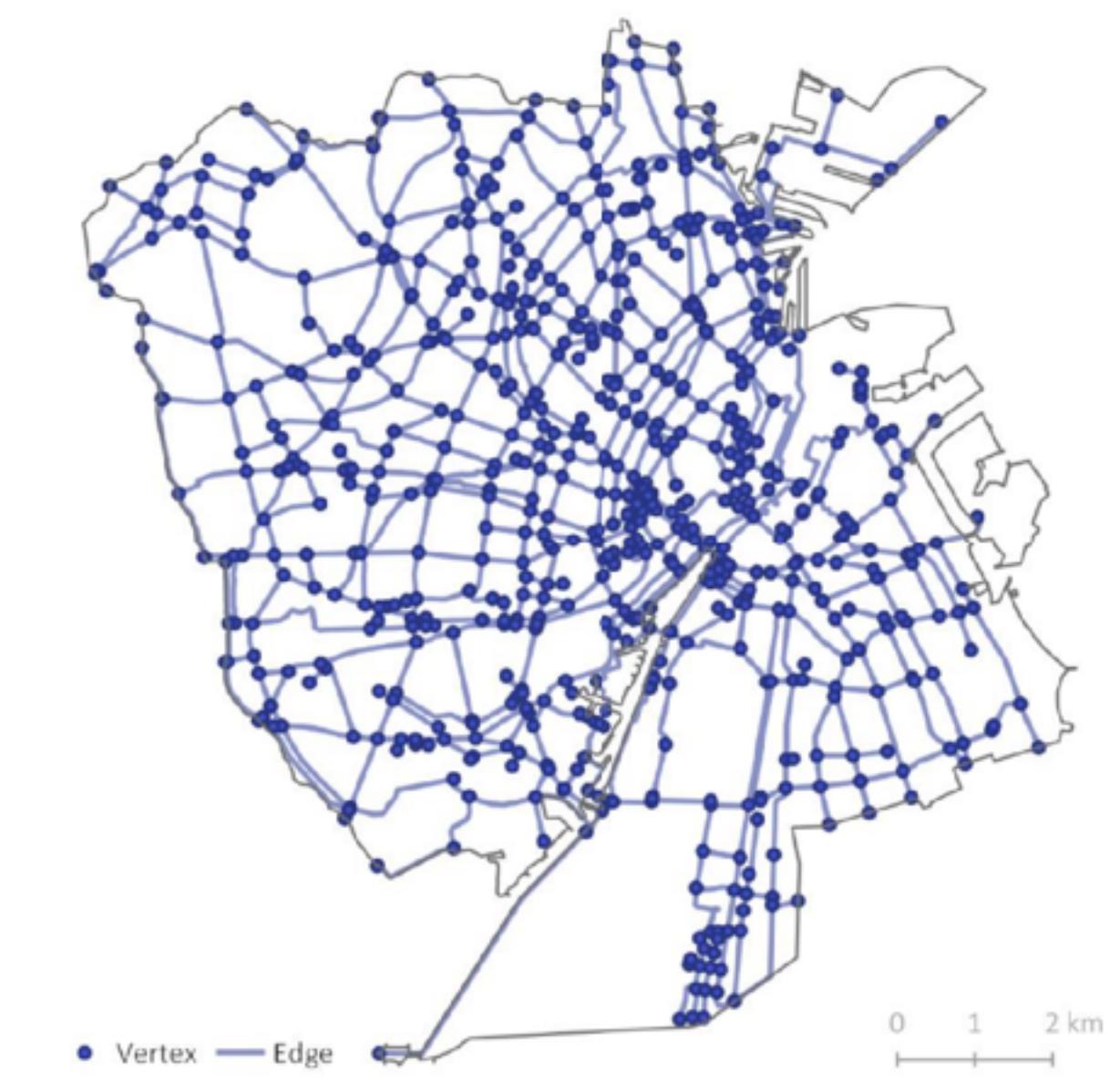
My Research

Spatial Data Quality + Mapping of Infrastructure

Are open source data good enough for cycling research and planning?

How can data quality be defined?

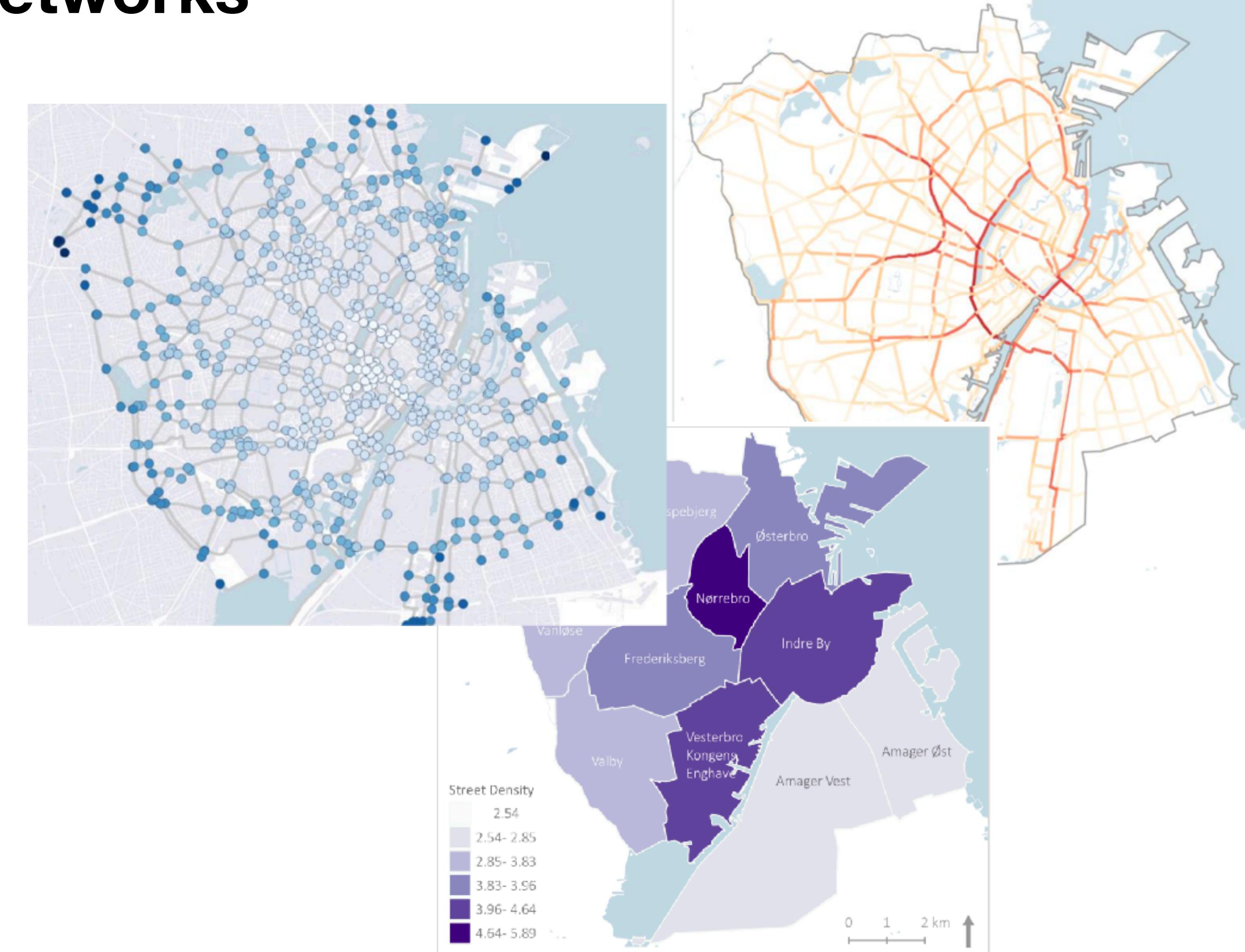
Can missing data be interpolated?



My Research

Quality Metrics for Cycling Networks

How to quantify and benchmark quality of cycling networks?



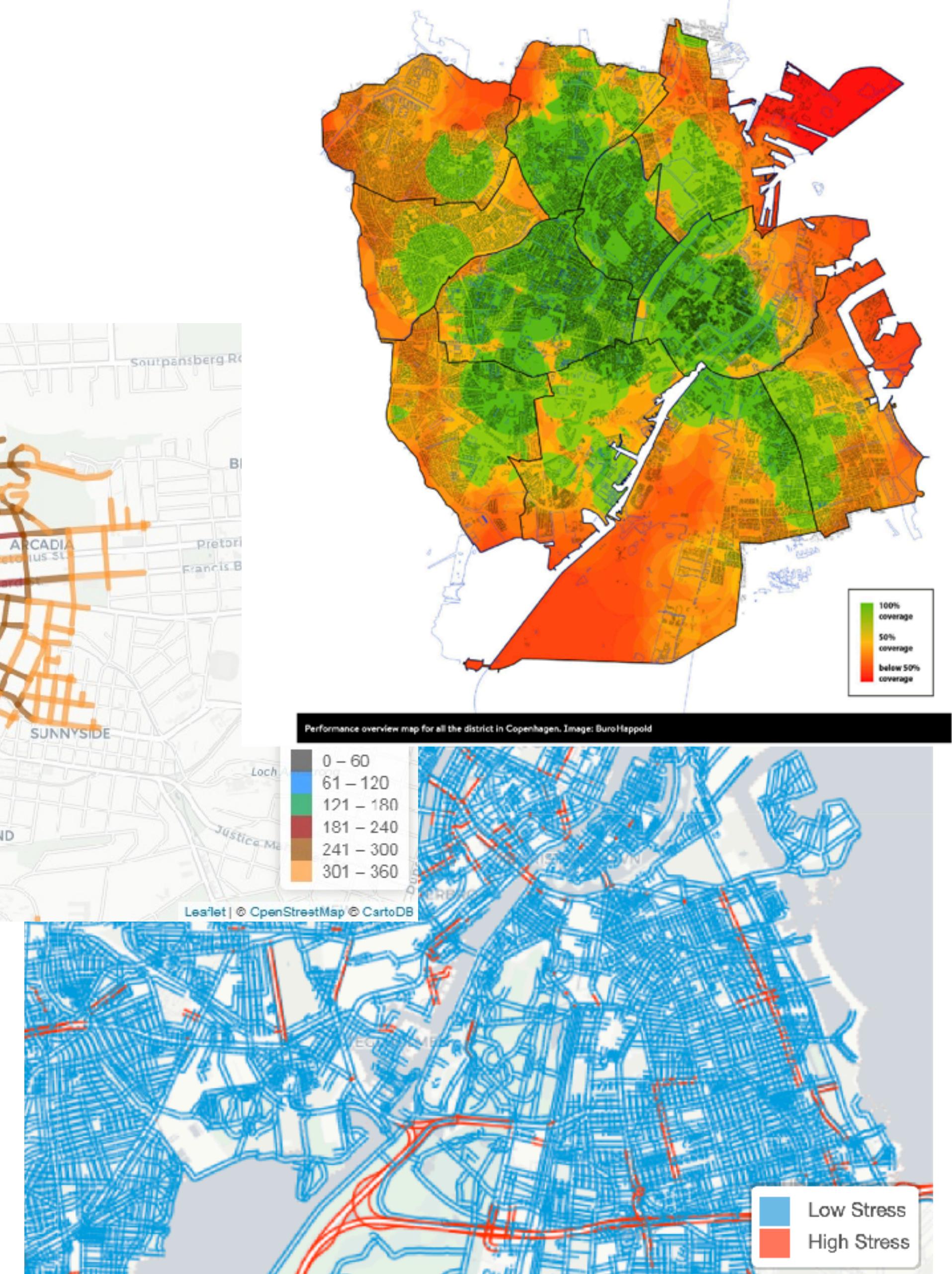
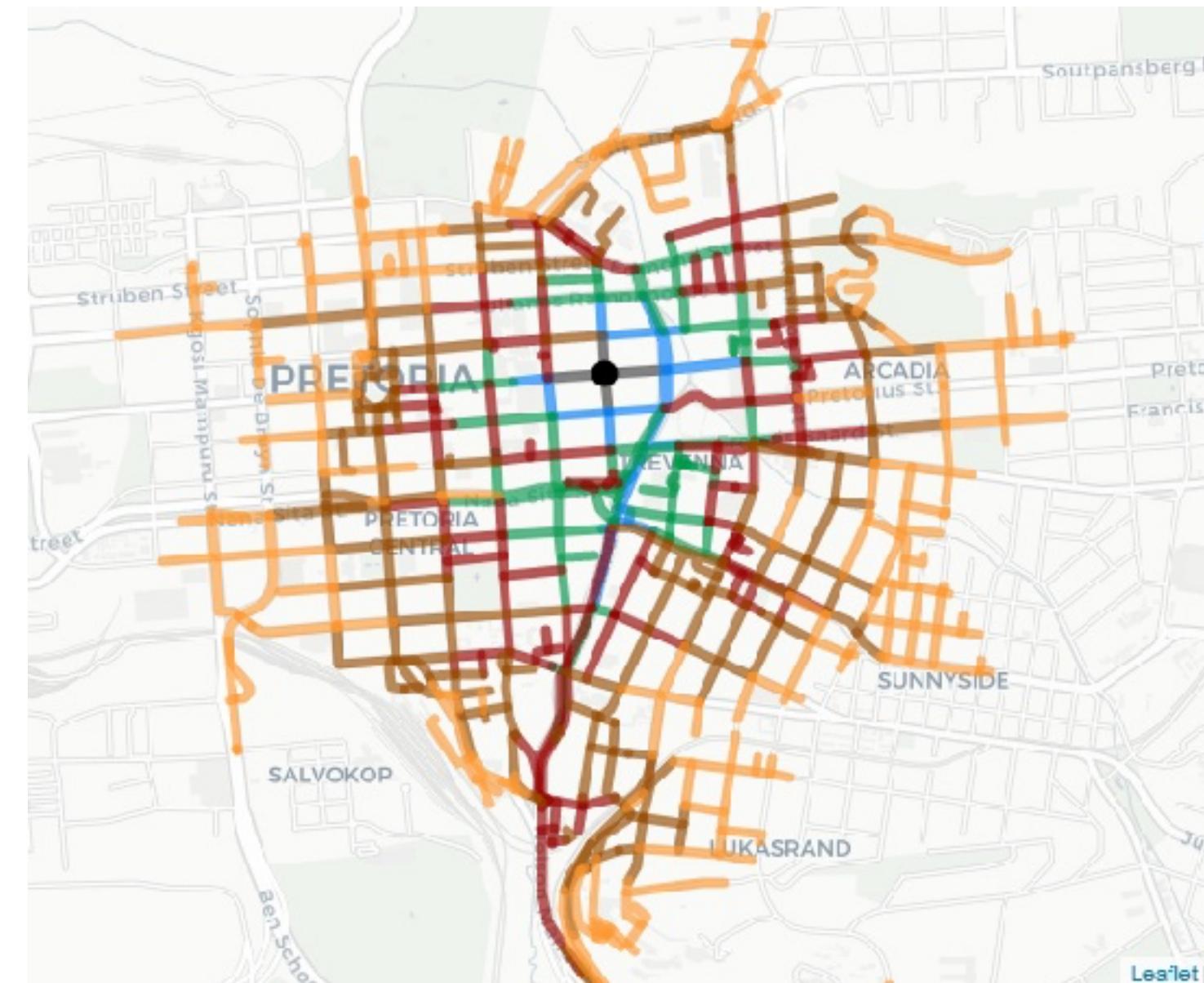
My Research

Bikeability & Cycling Accessibility

Accessibility: “*...the ease of reaching goods, services, activities and destinations*”

(Litman, 2022)

Bikeability: “*...the extent to which an environment is convenient and safe for cycling*” (Reggiani et al, 2022)



Research project: Missing Links



Research project: Missing Links

Gap ranking

$$c_B(l) = \sum_{i,j} \frac{\sigma_l(i,j)}{\sigma(i,j)}$$

edge betweenness centrality

$$\tilde{c}_B(l) = \sum_{|i,j| < r_{\max}} \frac{\sigma_l(i,j)}{\sigma(i,j)}$$

modified edge betweenness
centrality (accounting for network
edge effects)

$$m_c(g) = \sum_{l \in g} \tilde{c}_B(l) \cdot x(l)$$

meters cycled on a gap

$$\bar{m}_c(g) = \frac{\sum_{l \in g} \tilde{c}_B(l) \cdot x(l)}{\sum_{l \in g} x(l)}$$

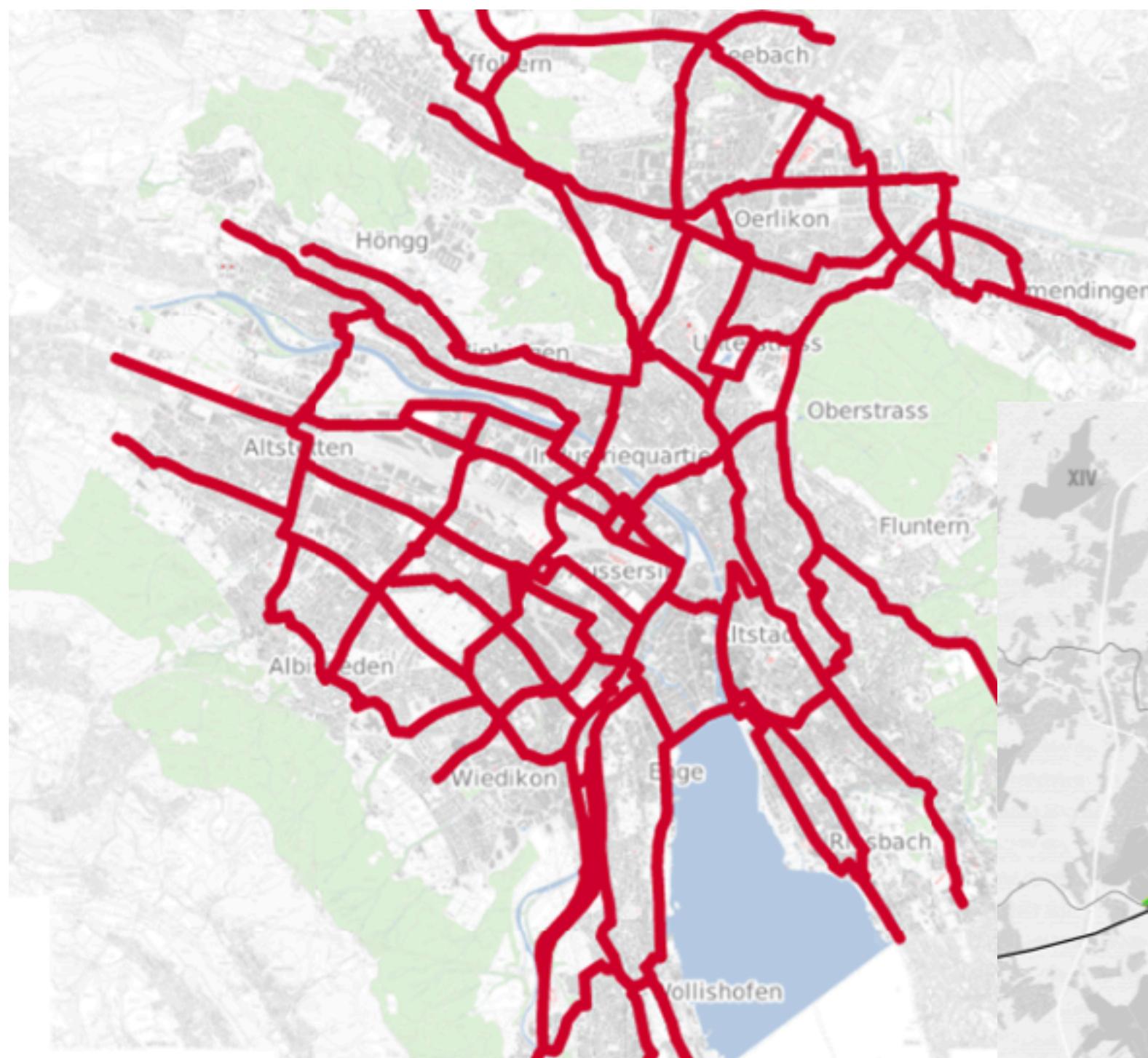
meters cycled on a gap
per investment unit



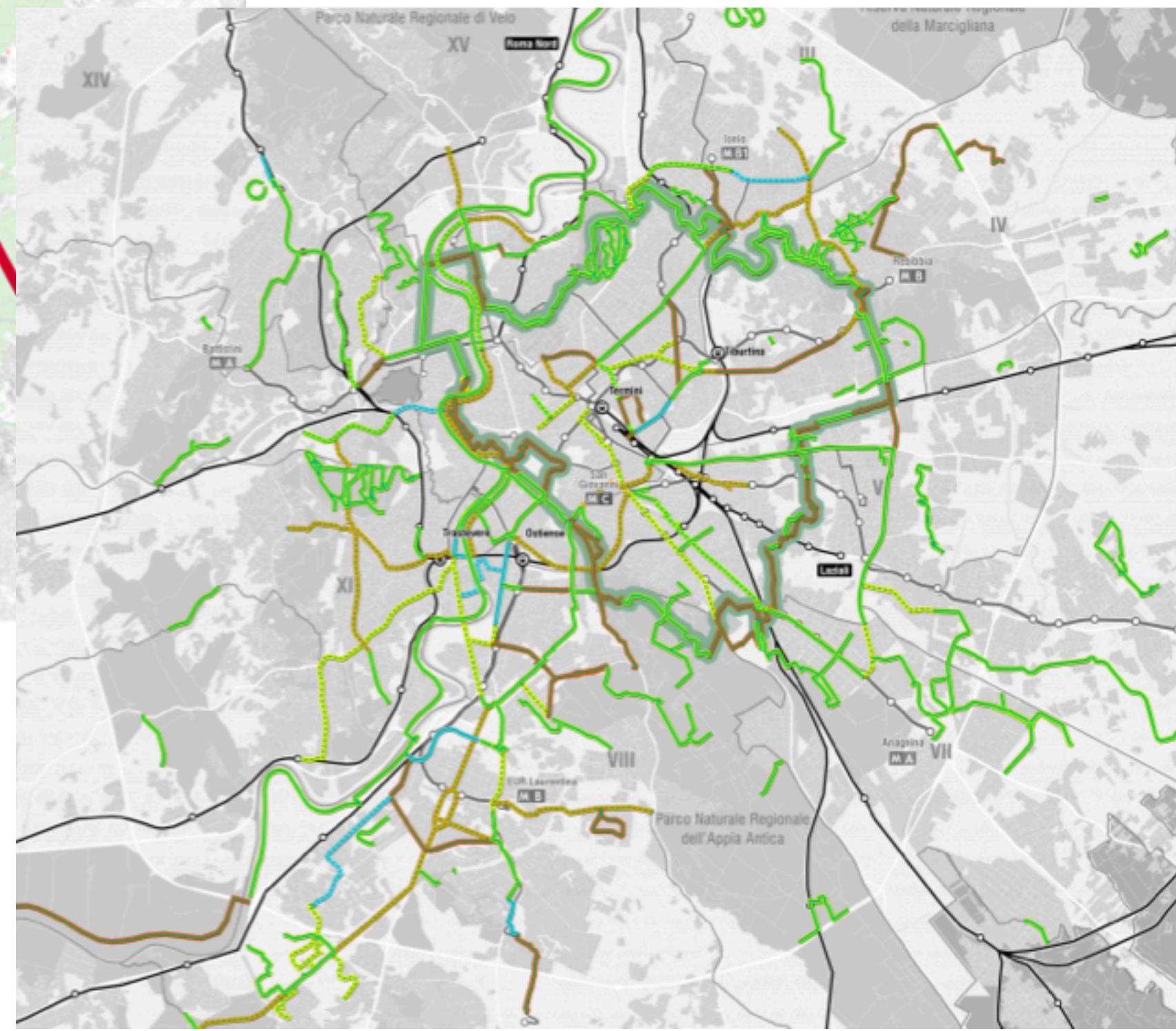
**“If this gap was closed, how
many meters cycled in mixed
traffic would be avoided per
investment unit?”**

Research project: Development Plans

Berlin



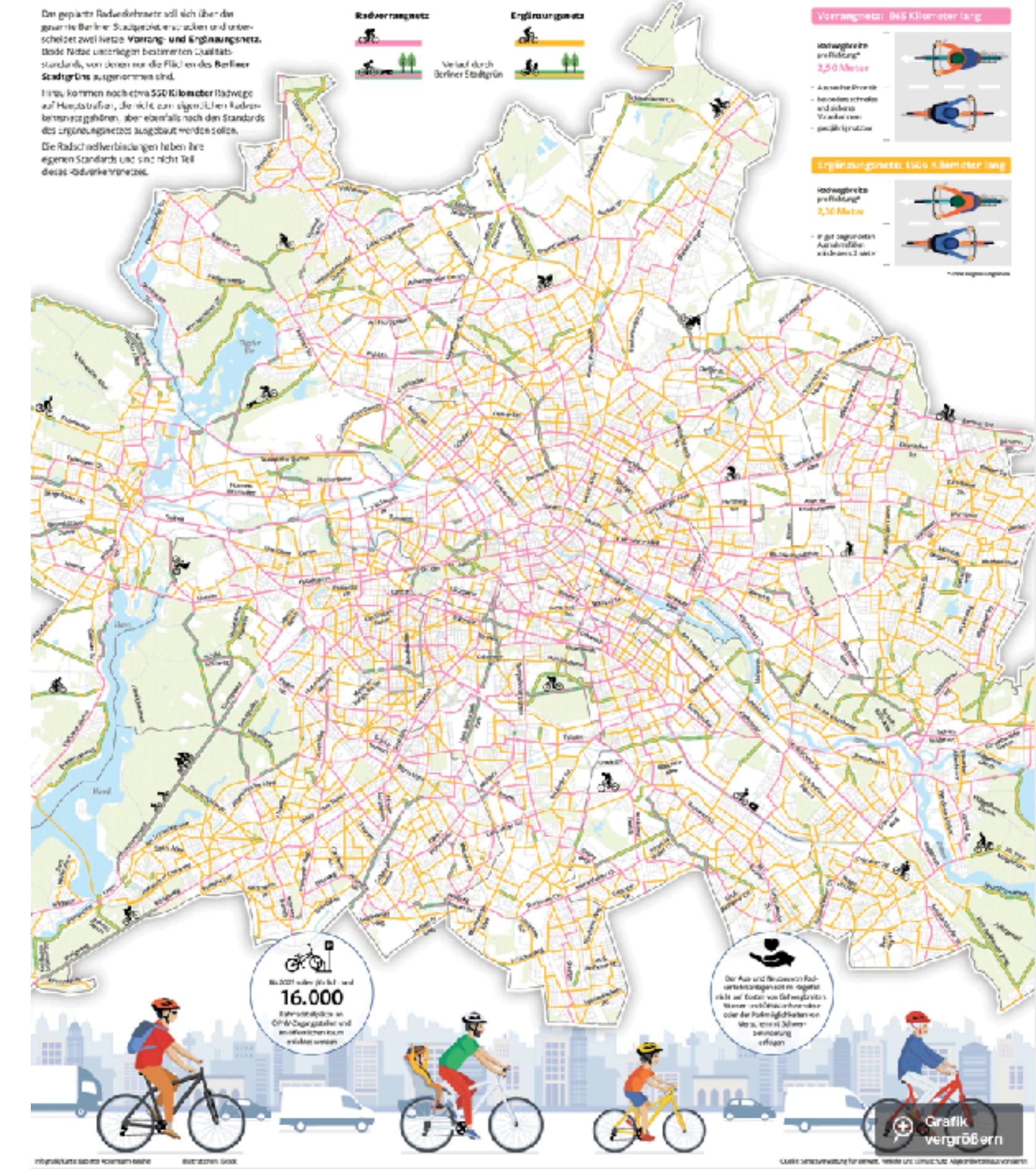
Zürich



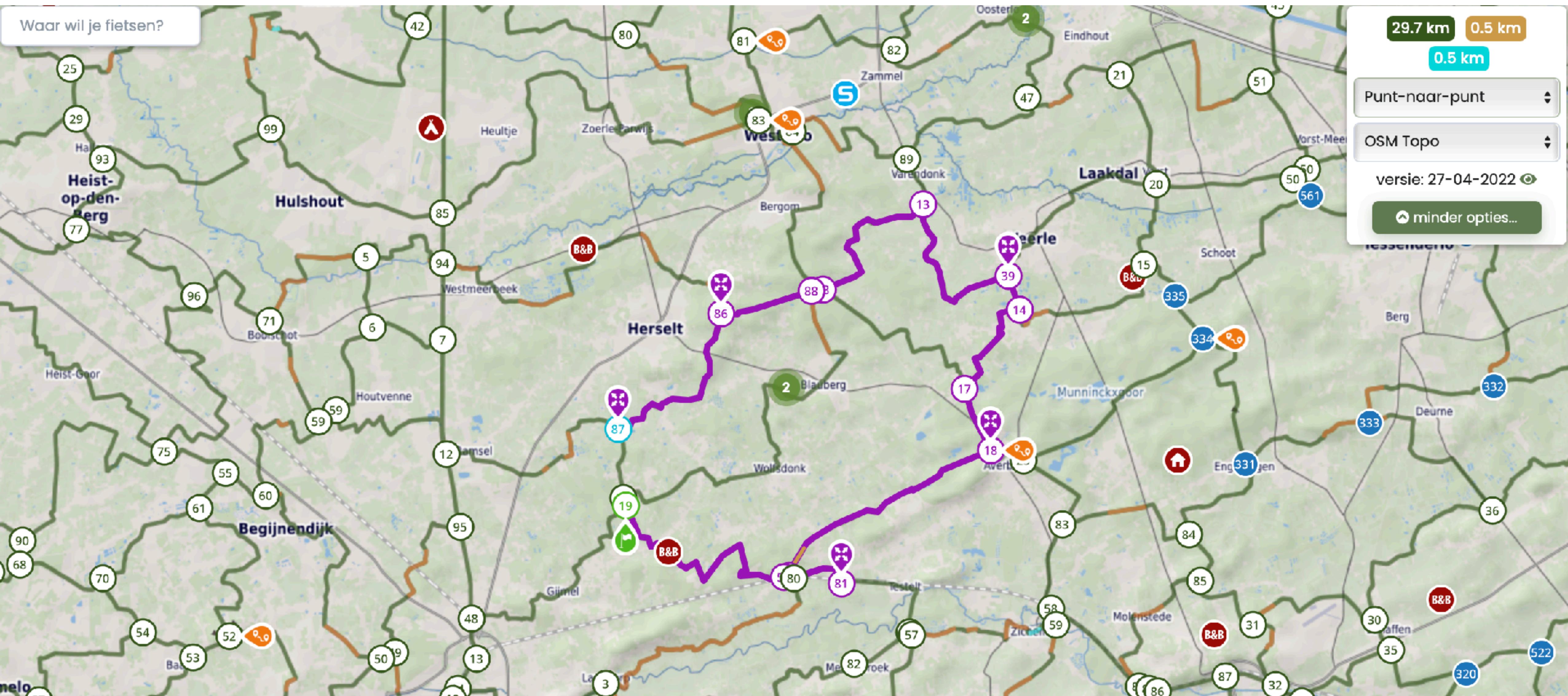
Rome

Radverkehrsnetz der Zukunft

Da der Fahrradverkehr in Berlin steig zuminimmt, sollen Radwege stark ausgebaut und verbessert werden. Laut Senatsverwaltung für Verkehr soll so bis 2030 ein Netz von Radverkehrsverbindungen mit einer Gesamtlänge von rund 3000 Kilometern entstehen. Ein erster Entwurf zeigt, welche Straßen an die Anforderungen des Fahrradverkehrs angepasst und baulich verändert werden müssen

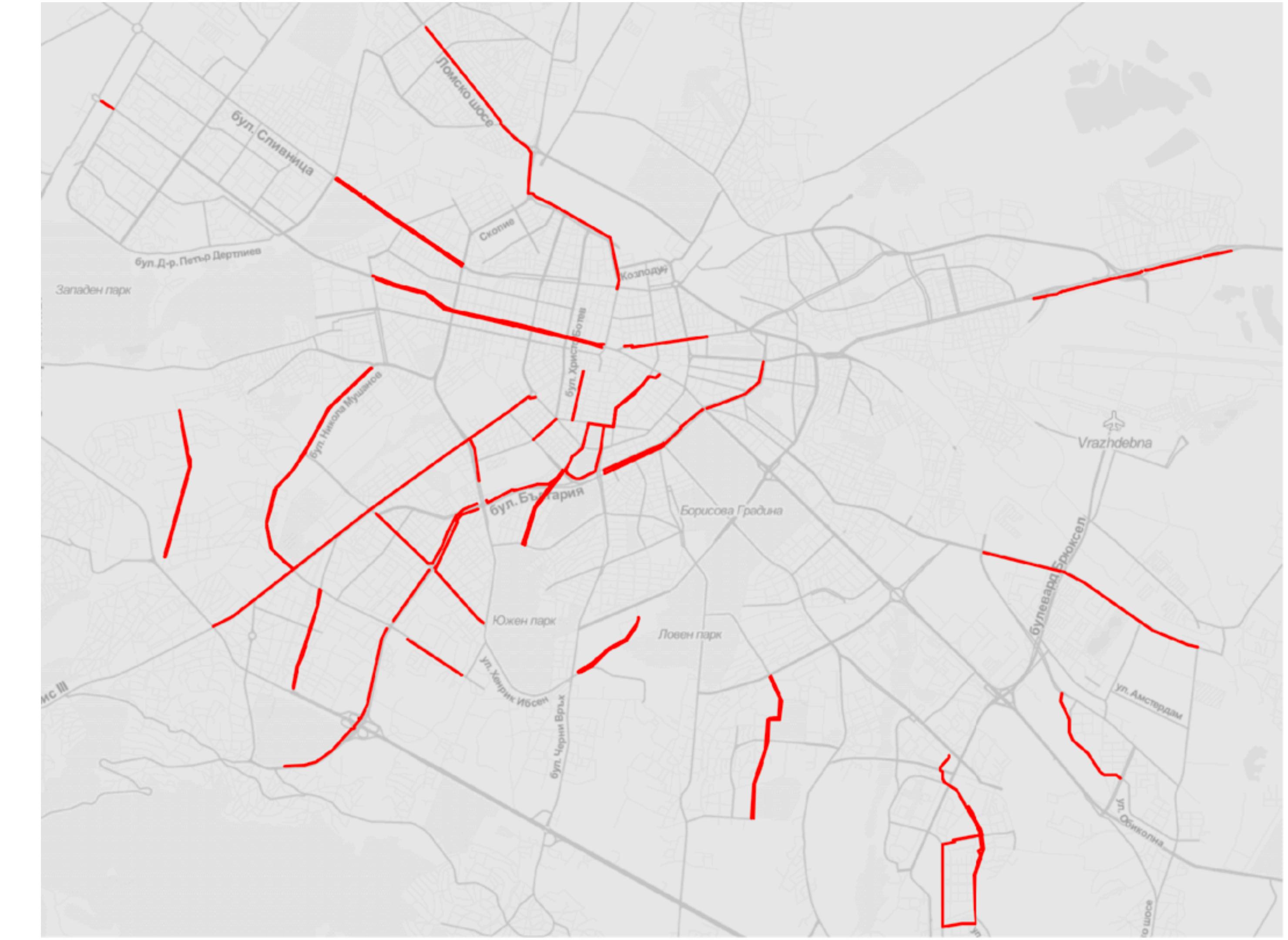


Research project: Cycle Node Networks



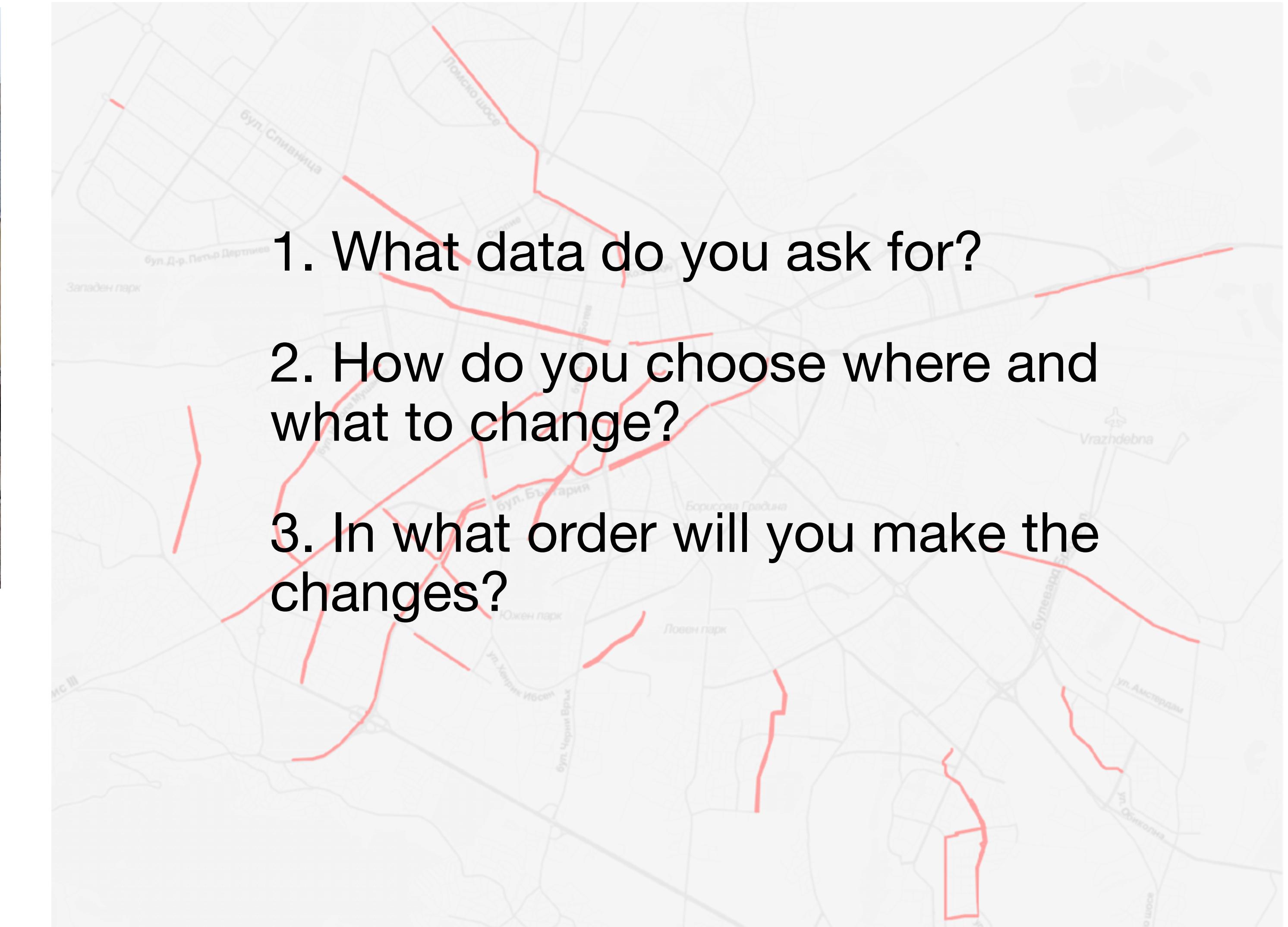


Case Study: Sofia





Case Study: Sofia

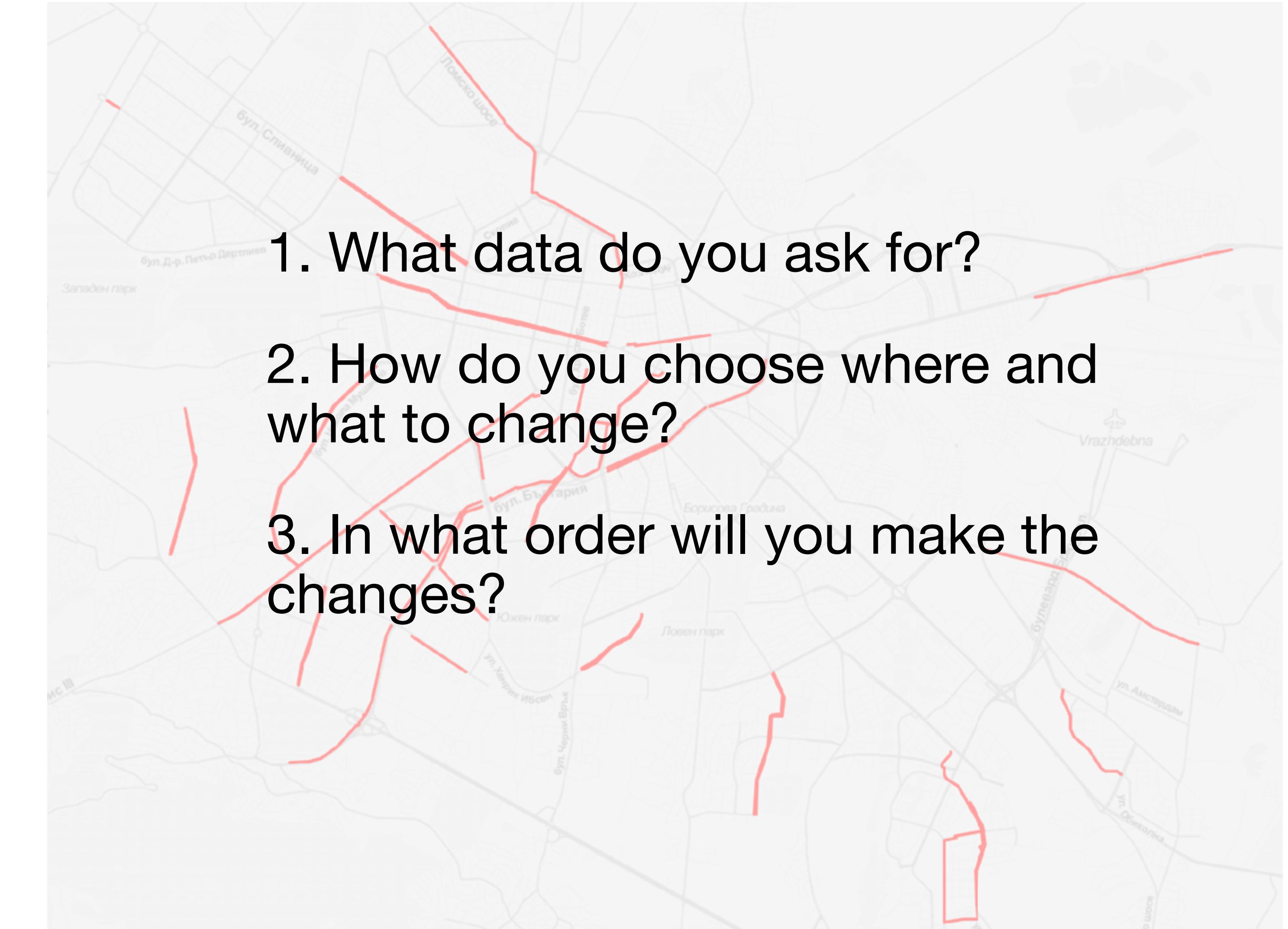


Digital version of the map (with satellite layer etc.) in the GitHub repository: [tutorials/folium/sofia_task](https://github.com/tutorials/folium/sofia_task)

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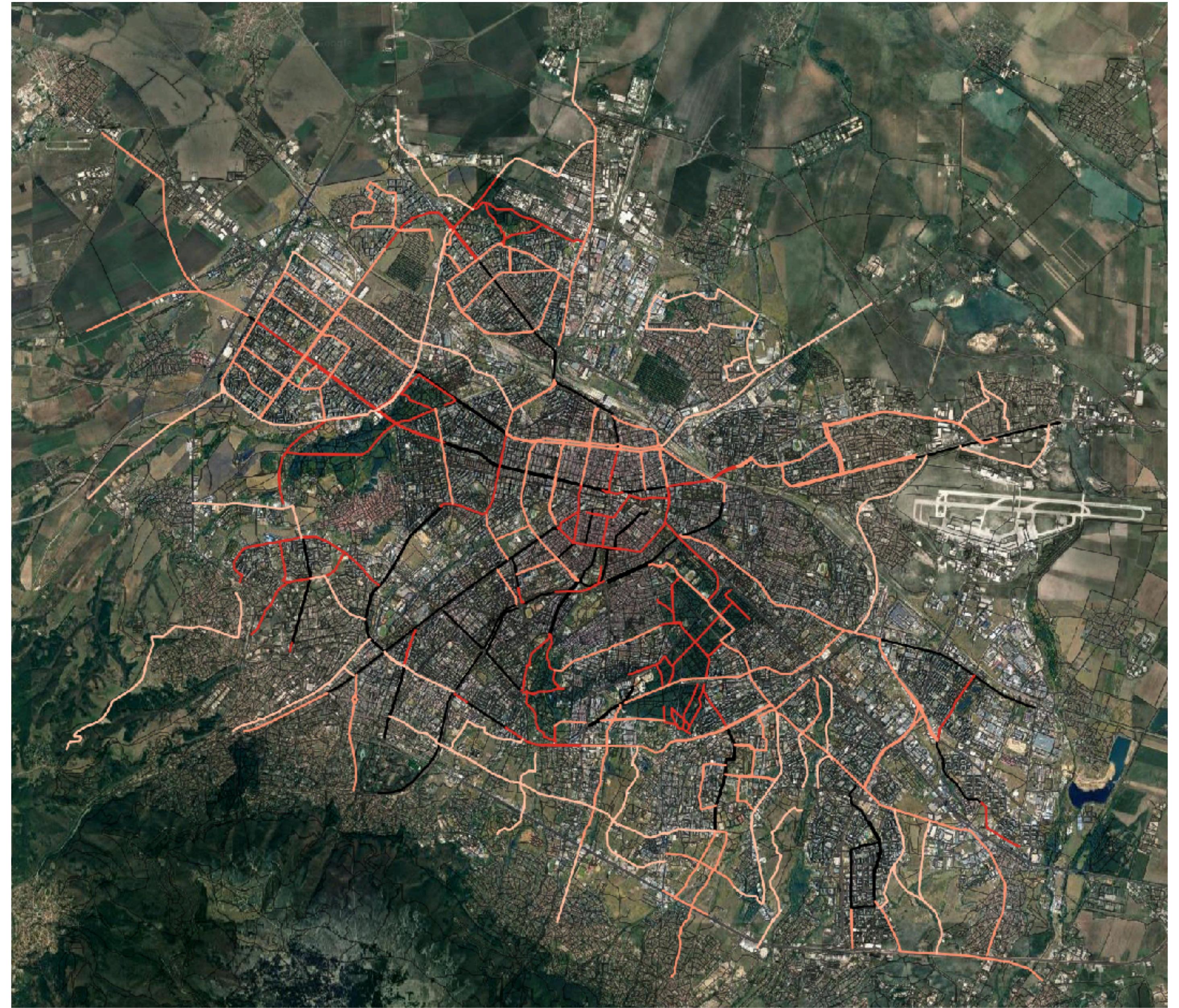


Case Study: Sofia



- 1. What data do you ask for?**
- 2. How do you choose where and what to change?**
- 3. In what order will you make the changes?**

Case Study: Sofia



What's next?

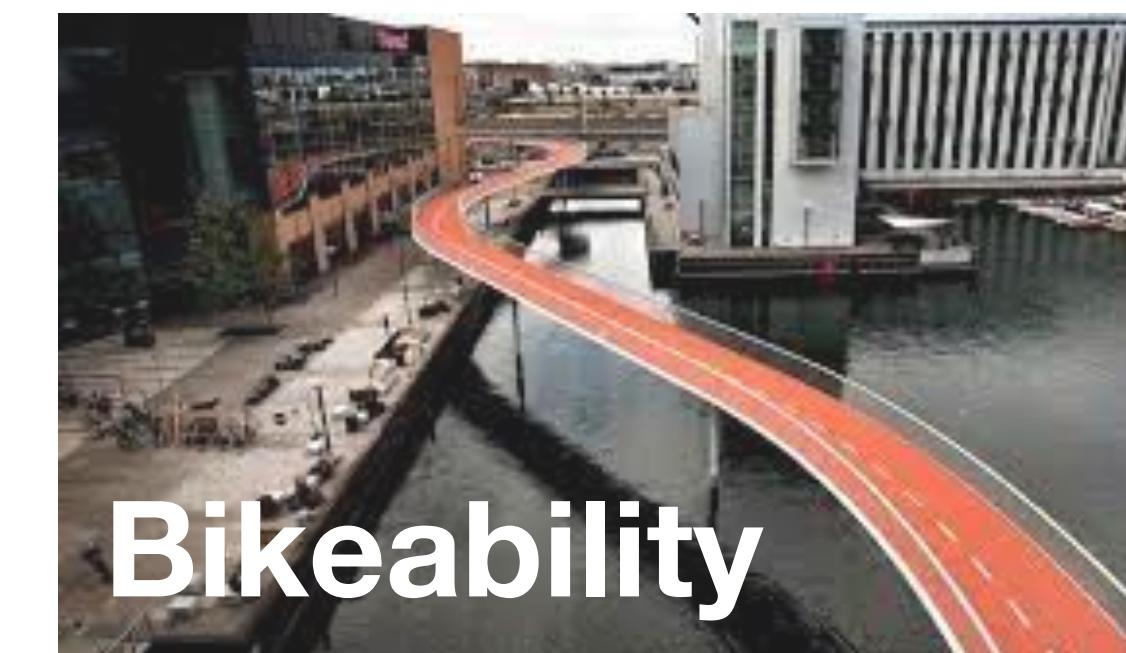
Research questions & unsolved problems



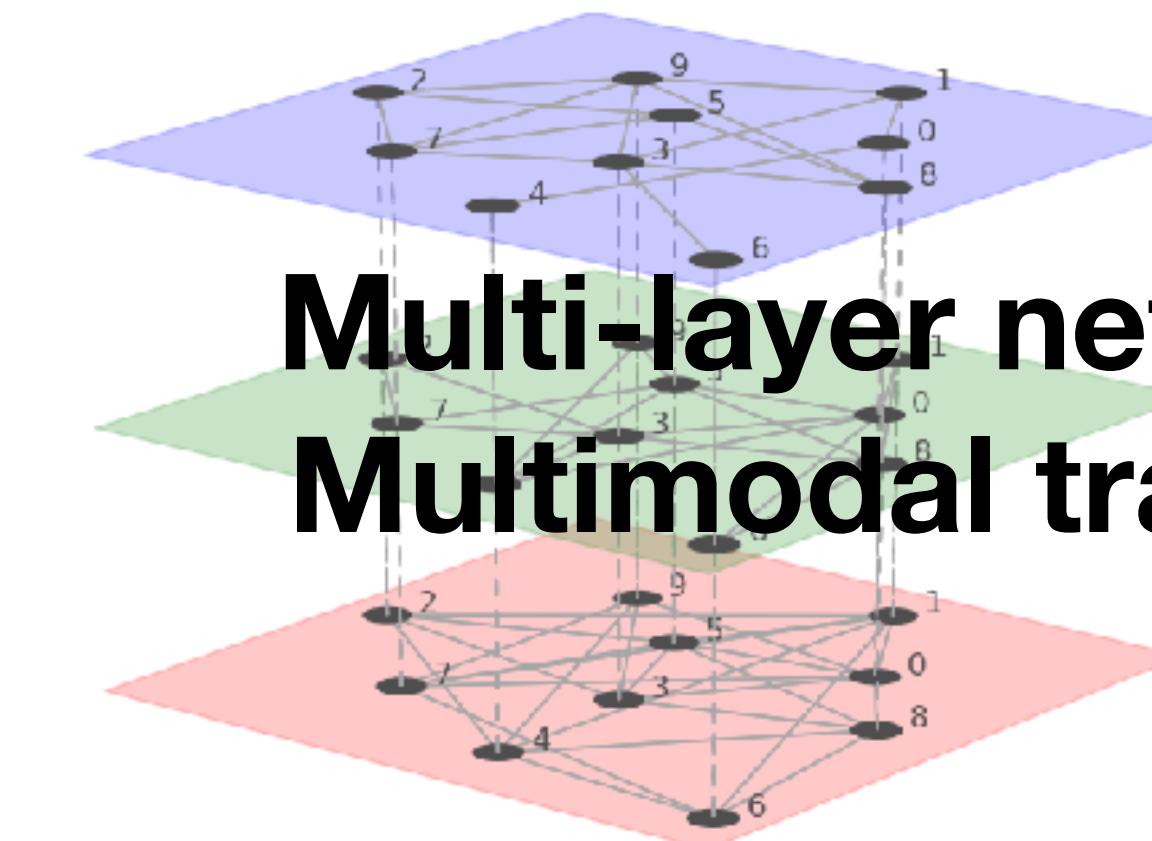
What's next?

Research questions & unsolved problems

Prioritisation of investments



How to identify missing links?



References & tipps

If you still haven't had enough of it.

- Concept of BLOS - Bicycle Level of Service: recent study by [Pritchard et al. \(2017\)](#)
- Concept of LTS - Level of Traffic Stress: report by [Mekuria et al. \(2012\)](#); recently revised e.g. by [Cabral & Kim \(2022\)](#)
- Bike Lanes Are White Lanes: book by [Hoffmann \(2016\)](#)
- Transport modelling including cycling: [Liu et al. \(2020\)](#); recent CBA on e-bikes and supercykelstier by colleague from DTU - [Rich et al. \(2021\)](#)
- Networks: Early study - overview of network connectivity measures from urban planning: [Dill \(2004\)](#); **Michael's work**; bikeability study by [Reggiani et al. \(2021\)](#)
- Accessibility: the 20-minute city - [Calafiore et al. \(2021\)](#)