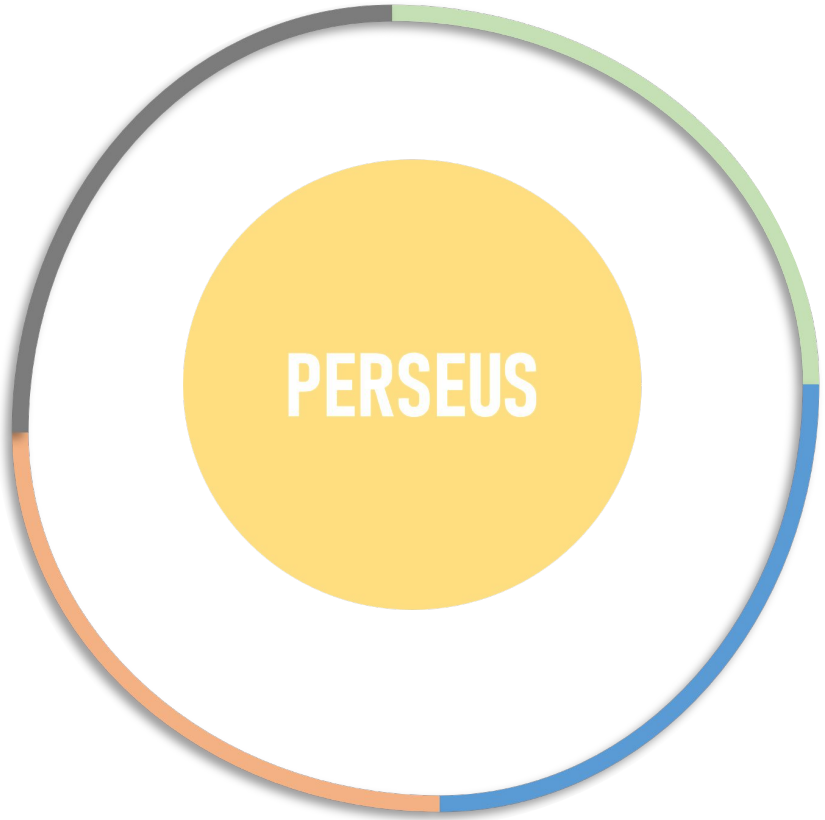


(How) Can Digital Tools Help Build a 15-Minute City?

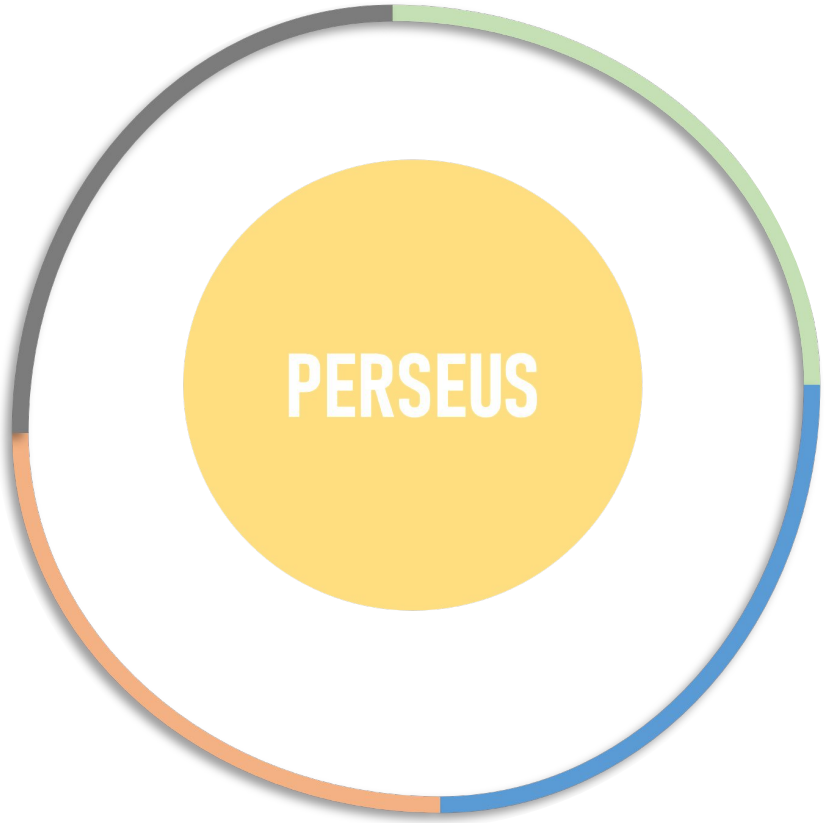
24/09/2026

DUT Driving Urban Transitions

Co-funded by the European Union

Agenda

1. Welcome & Introduction
2. PERSEUS at a Glance
3. What Cities need
4. From Evidence to Action
5. Discussion / Feedback Session



Let’s get to know each other (a bit)

PERSEUS at a glance

✔**Start Date**: 01/01/2025

✔**Duration**: 36 months

✔**Funding**: DUT partnership

✔**Consortium**: 19 partners

(8 co-applicants & 11 co-operational)

✔**Total Budget**: 1.33 million



PERSEUS at a glance

Challenges

1.How to **reduce or eliminate time**- and data-intensive model curation processes, along with bureaucratic procedures within city administrations.
2.How to **advance beyond proximity-based** POI analysis for 15mC planning by incorporating open data and historic traffic data.
3.What **elements** are necessary f**or user-friendly interfaces** enabling municipalities and stakeholders to simulate and compare multiple real-world scenarios.
4.How to **engage diverse stakeholders** with varying expertise in the co-design process.

PERSEUS at a glance

Key Innovation

Rapid modelling approach

- **Fast scenarios** testing
- **Quick assessment** of different intervention scenarios
- **One KPI list for every pilot** and scenario

DSS tool

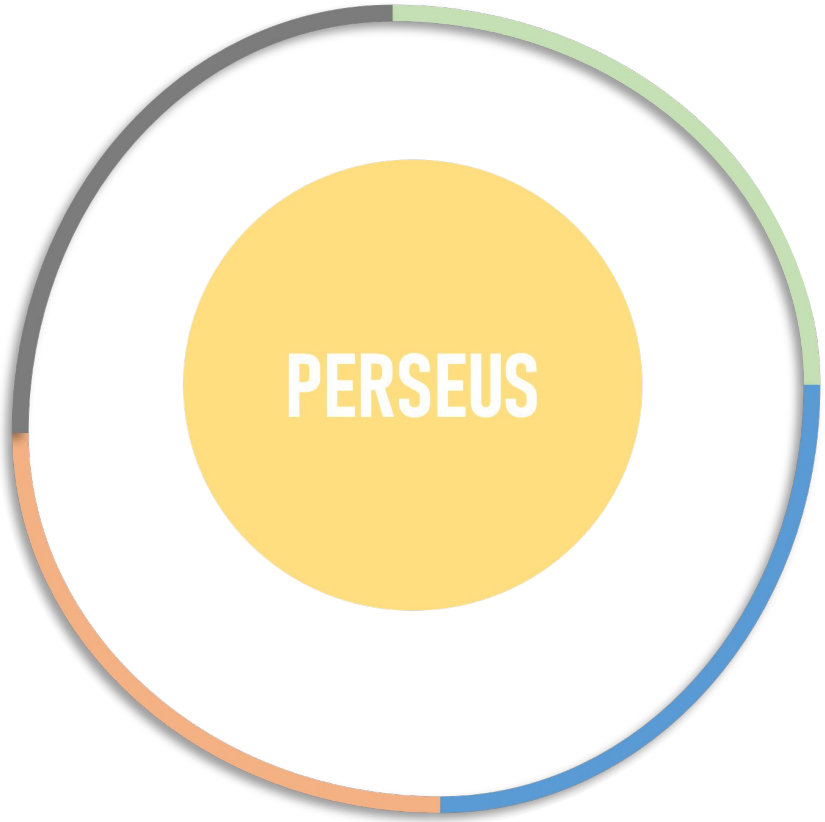
- **Interactive, map-based tool** translating complex modelling results into clear and actionable information
- **Natural language chatbox**

Potentiality Index

- Multiple KPIs translated into one **comprehensive and unified** value
- **Comparative values** between different areas and cities

Scalable & transferable

- Ability to run scenarios for **every city**
- Various areas in same city
- Based on **Open-Source** data



3. What Cities need

Key insights from the pilot city survey

Marlene Doiber,
tbw research (AT, Vienna)

3. Three things we identified

what's behind the data

01

THE CONTROL PARADOX

Cities weighted what they can change.

Infrastructure ranks higher in every city than in the literature - soft factors are systematically underweighted.

02

THE LEGITIMACY GAP

Cities know what works. They need arguments.

Restrictive measures rate as most effective - but only become acceptable when framed as a compromise.

03

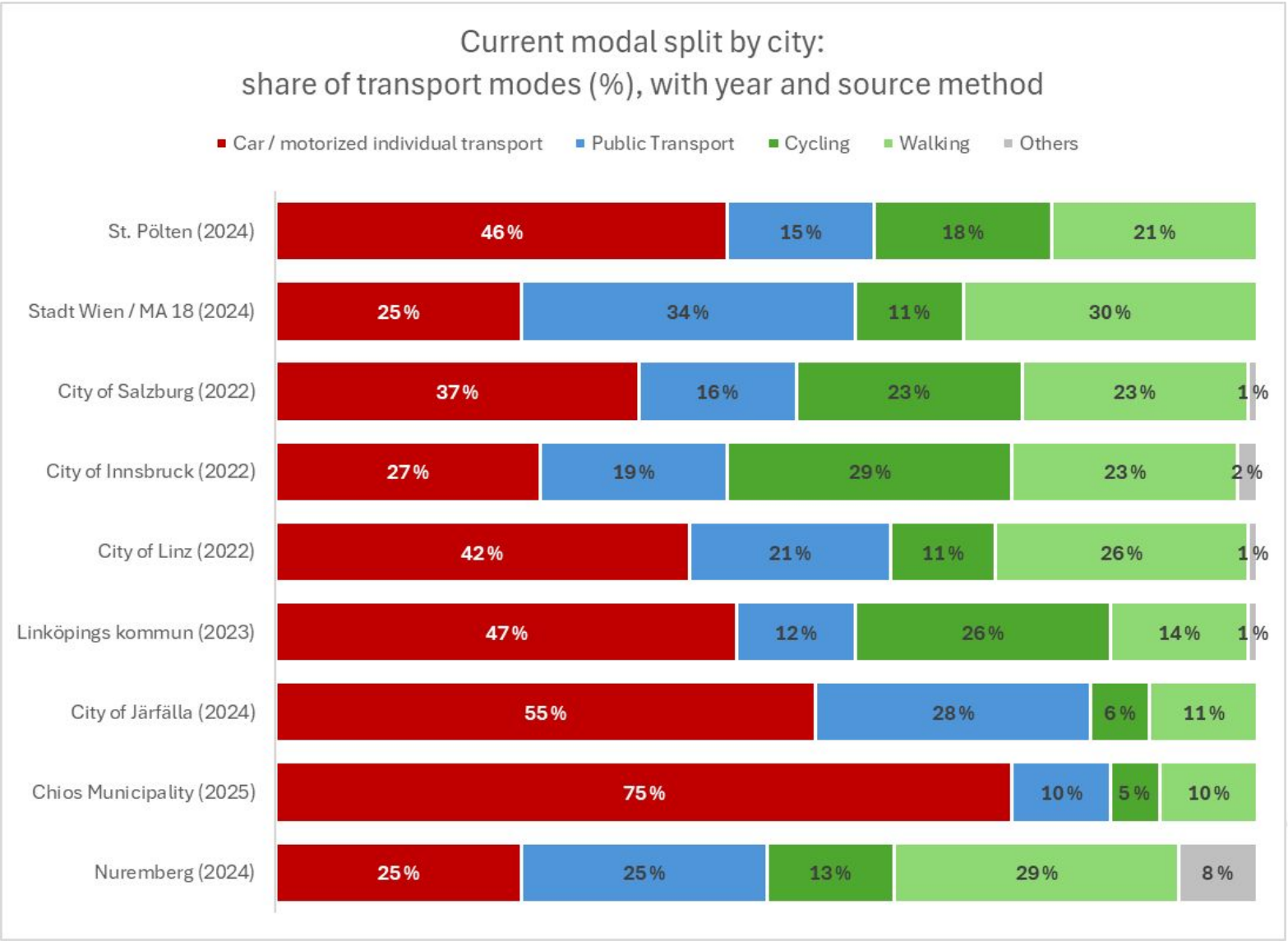
CONTEXT BEATS COUNTRY

The local reality matters more than a label.

Transformation phase, urban form and governance shape priorities more than programme membership or assumed readiness.

→ Together, these findings tell us more about urban transitions than any single indicator on its own.

3. Nine cities, nine starting points



environ-mentally friendly modes
54 %
75 %
62 %
71 %
57%
52 %
45 %
25 %
67 %

Climate-friendly modes:

high range (25 - 75%)

→ Different starting points

→ No “one-solution-fits-all” modelling

FINDING 1: THE CONTROL PARADOX

Cities weighted what they **can change**.

WHAT THEY TOLD US

- All 9 cities weight infrastructure availability higher than the literature reference value (cycling: avg. 27% vs. 20%).
- Vienna & Salzburg push road-category / speed-limit weight to 30-35% for pedestrian comfort (literature: 15%).
- Soft factors - weather, environment, behaviour - are systematically rated lower than the literature suggests.

WHAT'S LIKELY BEHIND IT

These weights aren't a judgement of *what works* – they are a judgement of *what cities can act on*.

Planning is biased toward the supply side: lanes, surfaces, lights - the things cities can build. Demand-side factors that shape real behaviour drift to the edges.

It's not a blind spot planners / city representatives choose. It's the structural one every planning team carries.

> ***Where this matters for the decision support tool:*** *it can surface the demand-side and behavioural factors that fall outside city control - without losing the action-orientation cities need.*

FINDING 2: THE LEGITIMACY GAP

Cities know what works. They need **arguments**.

WHAT THEY TOLD US - TWO SEPARATE QUESTIONS, ONE REVERSAL

- **Most effective measures named**: pedestrian zones / LTNs (4.33), car-lane conversion (4.11) , road re-design for lower speed limits (4.11) - all restrictive.
- Asked which **redesign strategy they would prefer**, cities rank car-lane conversion as highest of five options, but restricted vehicle access in certain areas as last.
- Asked which **compromises are acceptable** to reduce car dependency, the same measure ranks clearly first of five options.

WHAT'S LIKELY BEHIND IT

Cities know the answer. What's missing is permission to say it out loud.

Restriction is rarely a politically attractive opener - but it becomes acceptable when framed as a trade-off against something else (climate & equity or congestion, investment costs, etc.).

This is the implicitly described role for the tool: not analysis alone, but communication, legitimacy, decision support.

> ***Where this matters for the decision support tool:*** *its value is not only what it calculates, but the cover it gives to politically difficult decisions.*

FINDING 3: CONTEXT BEATS COUNTRY

The local reality matters more than the **label**.

WHAT THEY TOLD US

- Sweden, same national programme, opposite priorities: Järfälla rates climate 10/10 (car share 55%, transformation phase), Linköping 7/10 (established active mobility base).
- Salzburg mismatch: "high" 15mC-readiness assumed from structural criteria at on-boarding phase, but lowest average willingness to compromise in the entire sample (3.8 vs. AT avg. 7.4).
- Chios is the only city leaning more on access restriction than infrastructure - a logical answer to island geography without PT-alternatives.

WHAT'S LIKELY BEHIND IT

Readiness assumed from structural criteria doesn't predict the willingness for implementation.

What shapes priorities: **transformation phase**, **historical urban form**, and **local governance** (coalition mix, acceptance dynamics).

Two cities in the same programme can look nothing alike - and both can still be right.

> ***For benchmarking:*** *cities could / should compare to cities at a similar transformation stage - not just cities of similar size or country.*

3. Who the tool output is for

“Considering the PERSEUS tool to visualise the impact of a scenario on your city's 15mC indicators or a 15mC planning strategy, who would be the primary audience for that output?”

- 9/9 cities: internal (City planning department / City council / elected officials)

  → **DSS primarily as a specialized tool**

- 4/9 cities: public (Citizens) → Participation currently secondary
- Chios explicitly mentions communication

  → ***Potential for development into a public-facing tool***

3. What cities need

three needs we identified behind the answers

01

ARGUMENTS, NOT ANSWERS

Support with justification, not just the calculation.

9/9 name planning departments, councils and elected officials as the primary audience for tool output.

02

THE RIGHT PEER GROUP

Benchmarks by transformation phase, not by country or size.

Two cities in the same national programme can hold opposite priorities - and both can be right.

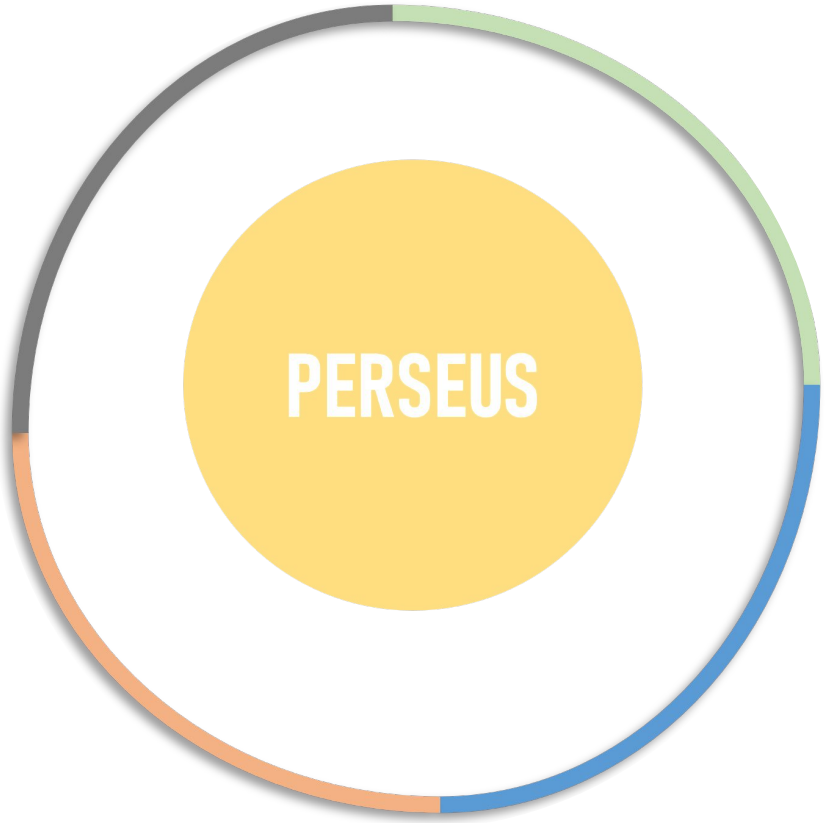
03

NO ABSTRACT MODELS

Model the project that's already on the table.

Cities named concrete local decisions - a new metro station, a street redesign, a SUMP - not generic scenarios.

→ Cities are not asking for a better model. They are asking for a defensible basis for decisions they have already understood.



Indicator Framework Development

Yingwen Deng, Dagmar Lahnsteiner

iSPACE plus GmbH (AT)

Overview of the Six Indicator Domains



ACCESSIBILITY
Access to daily services via walking, cycling, and public transport, including reduced mobility considerations



ENVIRONMENTAL CONDITIONS
Environmental impacts of traffic and conditions that influence liveability in mobility environments



BUILT ENVIRONMENT
Built environment qualities (including physical and infrastructure characteristics) that support active mobility



EQUITY
Fairness and inclusion in accessibility across demographic and transport-mode user groups

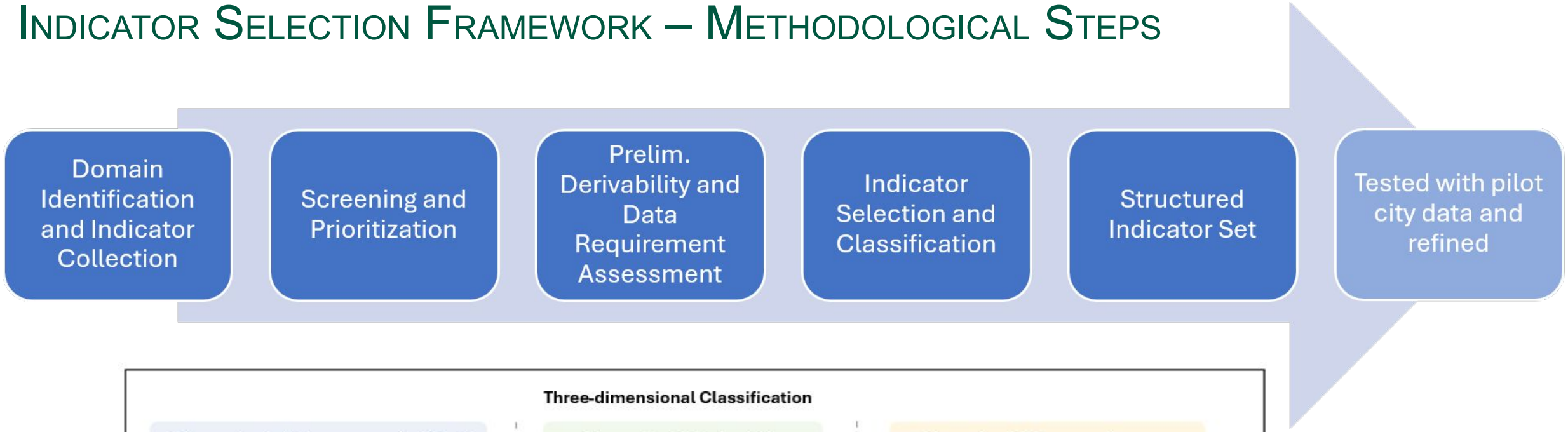


ECONOMY
Resource use and financial costs of sustainable mobility systems



TRAFFIC SYSTEM
Operational performance, efficiency, safety, and user behaviour across modes

Indicator Selection Framework – Methodological Steps



Three-dimensional Classification

Dimension 1: Relevance to the 15mC

- **15mC-primary**
  Captures key dimensions of short-distance accessibility via sustainable modes
- **15mC-contextual**
  Supports broader evaluation of the urban mobility system

Dimension 2: Derivability

- **Derivable**
  Can be derived within the modelling workflow
- **Non-derivable**
  Cannot be derived within the modelling workflow

Dimension 3: Data requirements

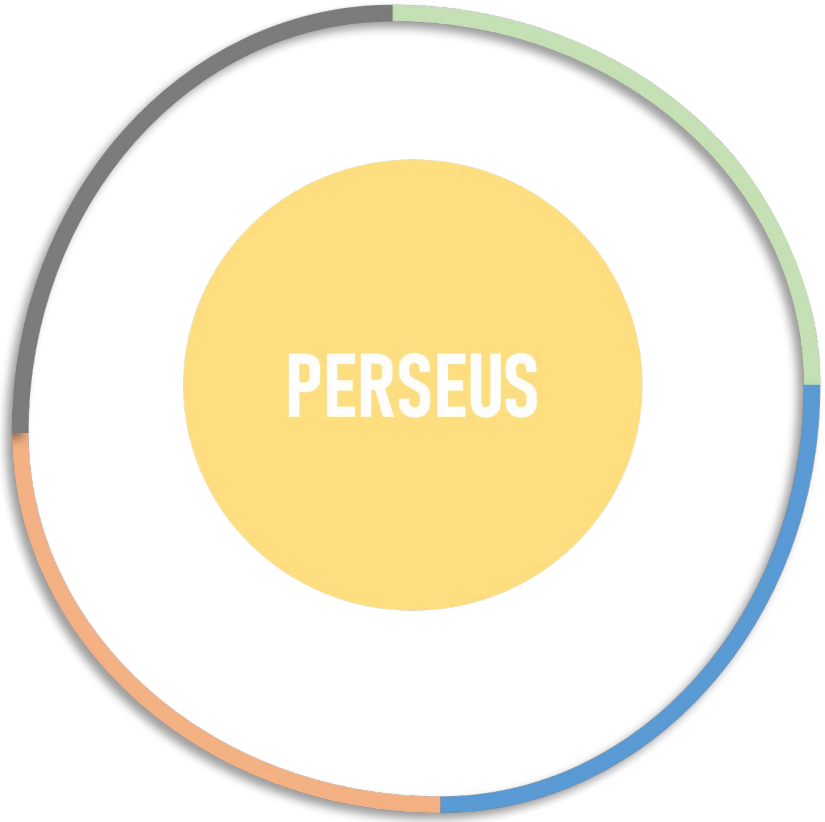
- **Direct modelling outputs**
  Derived directly from network modelling or traffic assignment model outputs
- **Transferable external data**
  Requires additional comparable external data available across cities
- **Case-specific data**
  Requires local case-specific data

Indicators By Thematic Domains

26 Indicators in total

Accessibility (5)	Environmental Conditions (4)	Economy (2)	Equity (3)	Traffic System (7)
• 15-Minute Accessibility • Barrier-free 15-Minute Accessibility • Infrastructure Accessibility Score • Accessibility to Public Transport & Shared Mobility Service • Public Transport Service Quality Class	• Traffic Emission • Traffic Noise • Heat Vulnerability Index • Air Quality	• Traffic Energy and Fuel Consumption • Infrastructure Costs for Active Mobility	• Equity in 15-Minute Accessibility by Mode • Equity in Infrastructure Accessibility • Socio-demographic Profile	• Total System Travel Time • Zone-wise Travel Time • Congestion Index • Modal Split • Motorization Rate • Fatal Vehicle Accident Rate • Pedestrian-Vehicle Collision Risk
	Built Environment (5) • Cycling Quality • Walking Quality • Street Greening Index • Active Mobility Infrastructure Share • Public Parking Supply			

Basis for potentiality index / DSS tool integration



Accessibility Modelling

How many everyday activity destinations can residents reach in 15 minutes considering the perceived travel street conditions?

Moeid Qurashi, Sudipta Chowdhury

Dresden University of Technology (TUD)

Accessibility modelling: what counts

Cumulative opportunities

For an urban neighbourhood, count the destinations reachable within 15 minutes. Work trips are excluded.

Nine distinct services

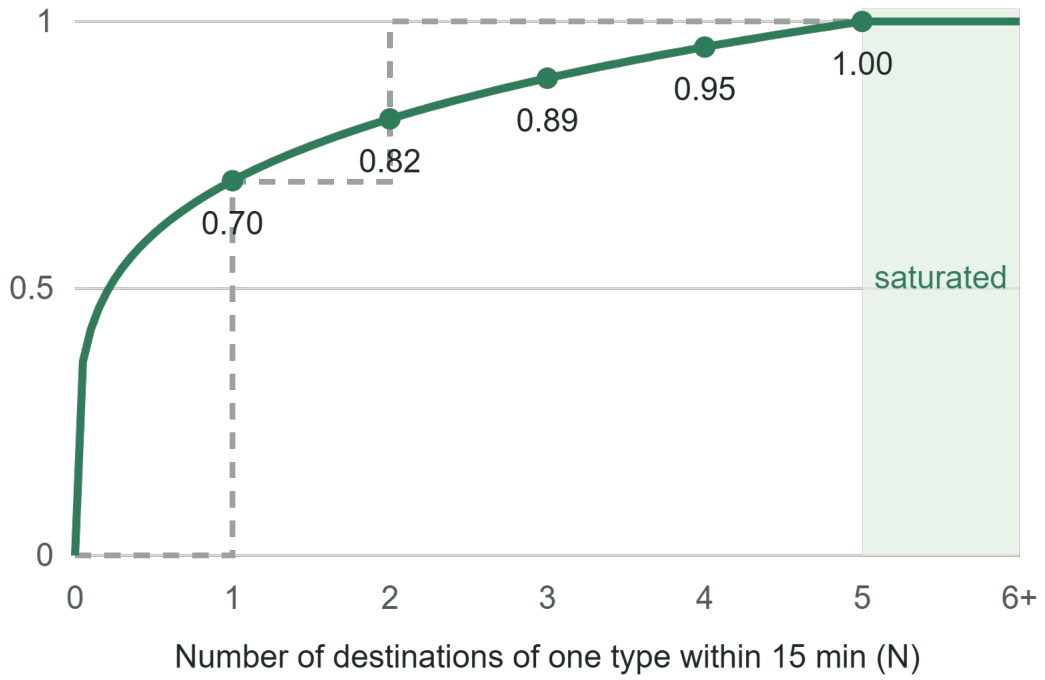
Categories do not substitute for each other: a pharmacy cannot replace a clinic, nor a kindergarten a school.

Weighted by daily routine

Services used most often in weekly household trips weigh most in the score. **Table provides a sample weight settings for household with children**.

Service	Includes	Weekly trips	Weight
Kindergarten	Kindergarten, prep school	5	3
School	School	5	3
Basic retail	Chemist, food, supermarket	3	3
Sport	Gym, sports centre	2–3	2
Playground	Playground	2–3	2
Leisure	Park, Open space	2–3	2
Pharmacy	Pharmacy	1	1
Logistics	Post office, parcel locker	<1	0.5
Banking	Bank, ATM	<1	0.3
Total			16.8

The first destination matters most



— Continuous curve (now) - - Step rule 0 / 0.7 / 1

Utility per service

$$FU(N) = (N / 5)^{\gamma}$$

γ = 0.22: one destination gives about 70%, more choice adds the rest, five or more is full.

Cell score

$$A = \Sigma\, w \cdot f \cdot FU \div \Sigma\, w \cdot f$$

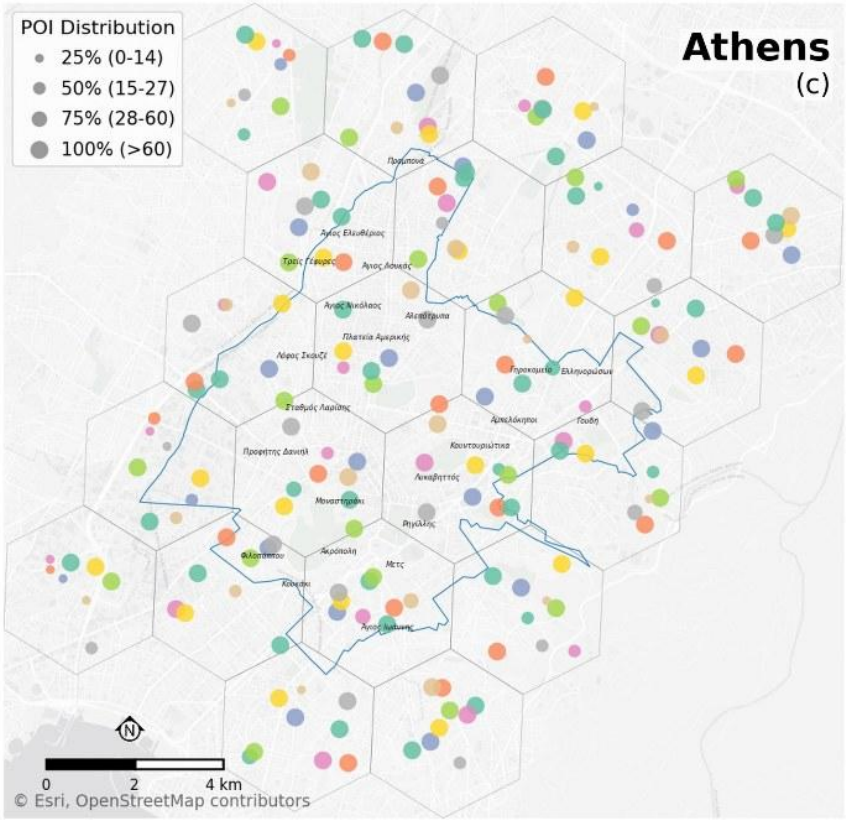
Weighted by importance (w) and weekly trip frequency (f); from 0 to 1.

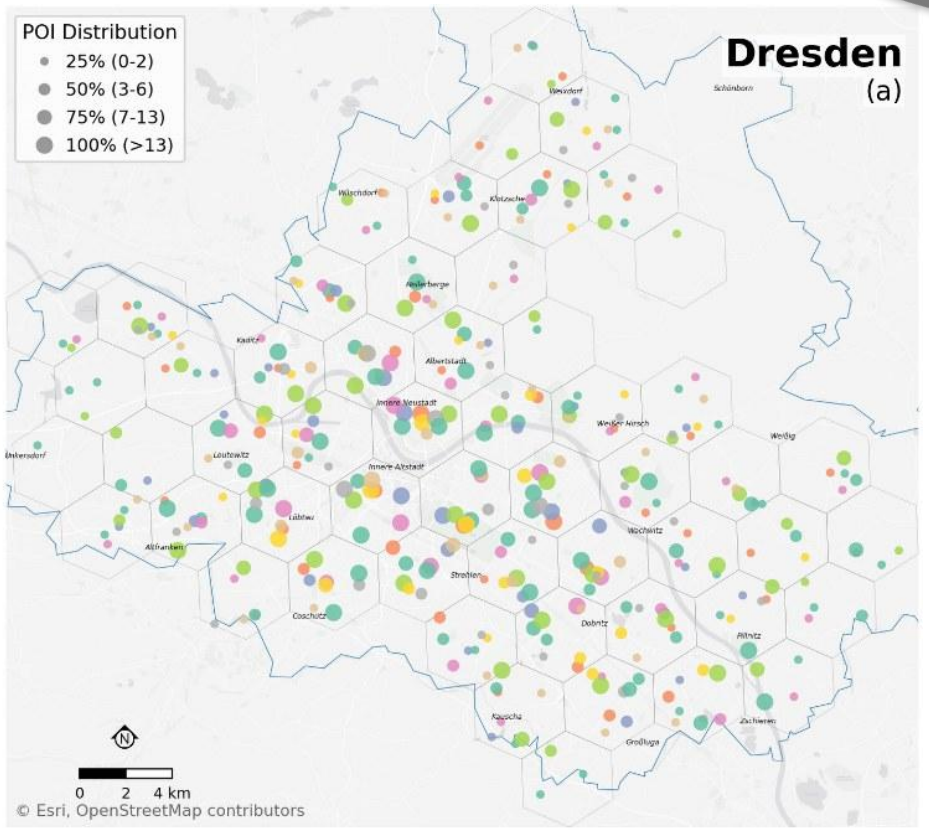
Travel time with slope

Base speeds of 18, 15, 13 and 11 km/h (protected track, bike lane, mixed traffic, path) slow uphill; the longer of the trips there and back counts.

Case study: where daily destinations are

Points of interest in Athens and Dresden, from kindergartens and schools to pharmacies and leisure.

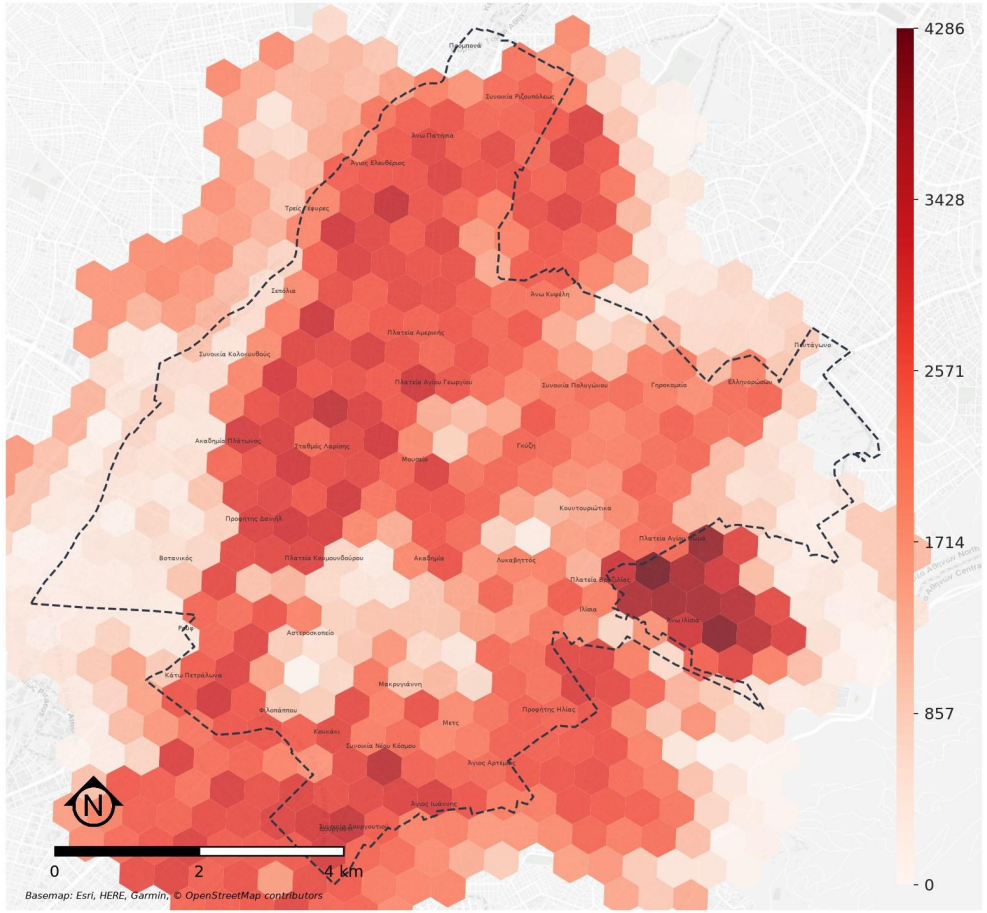




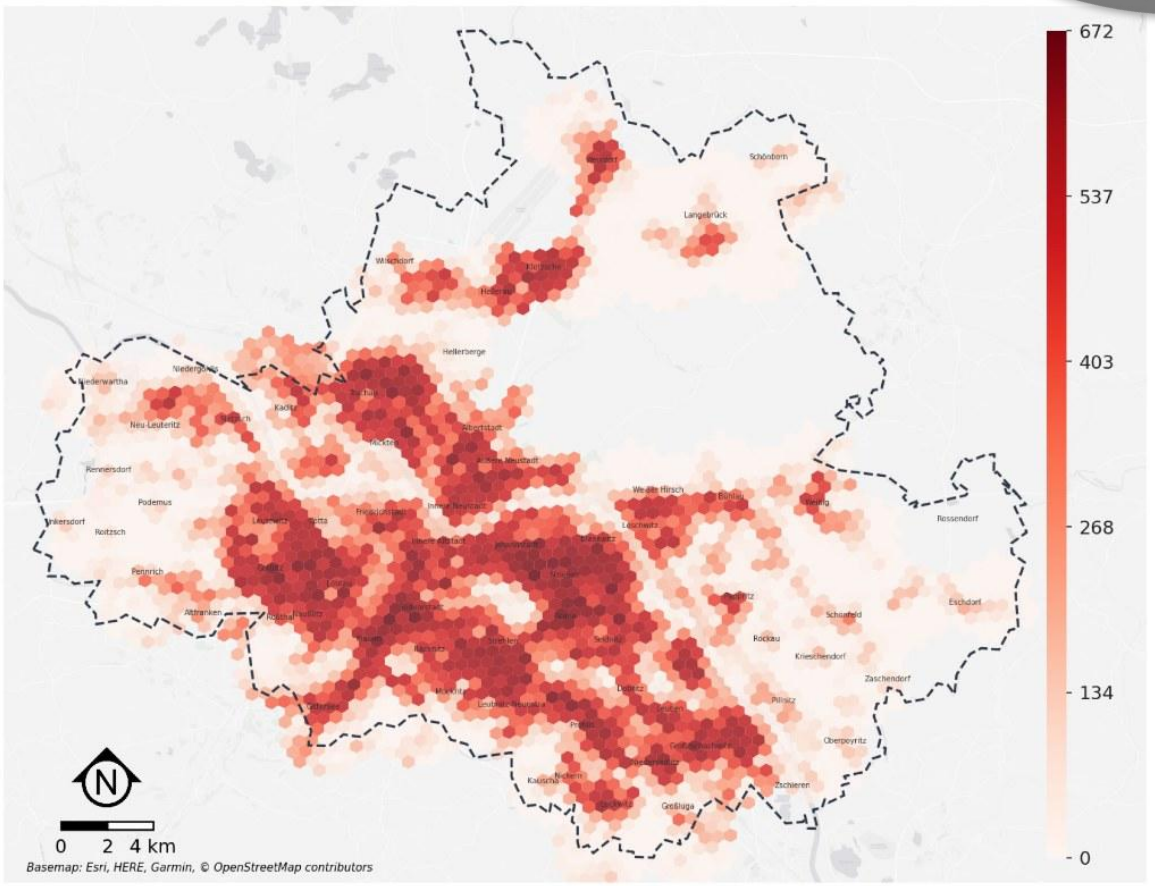
Kindergarten School Basic Retail Sport Playground Pharmacy Logistics Banking Service Leisure

Case study: where people live

Residents per hexagon cell. Population weights the accessibility gain in the population-based index.



Athens

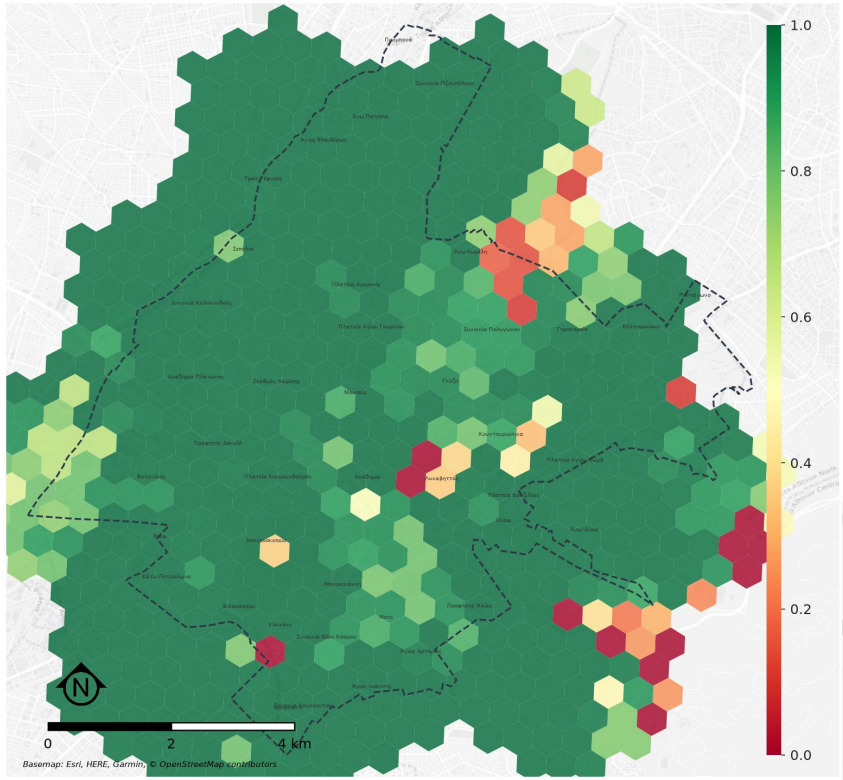


Dresden

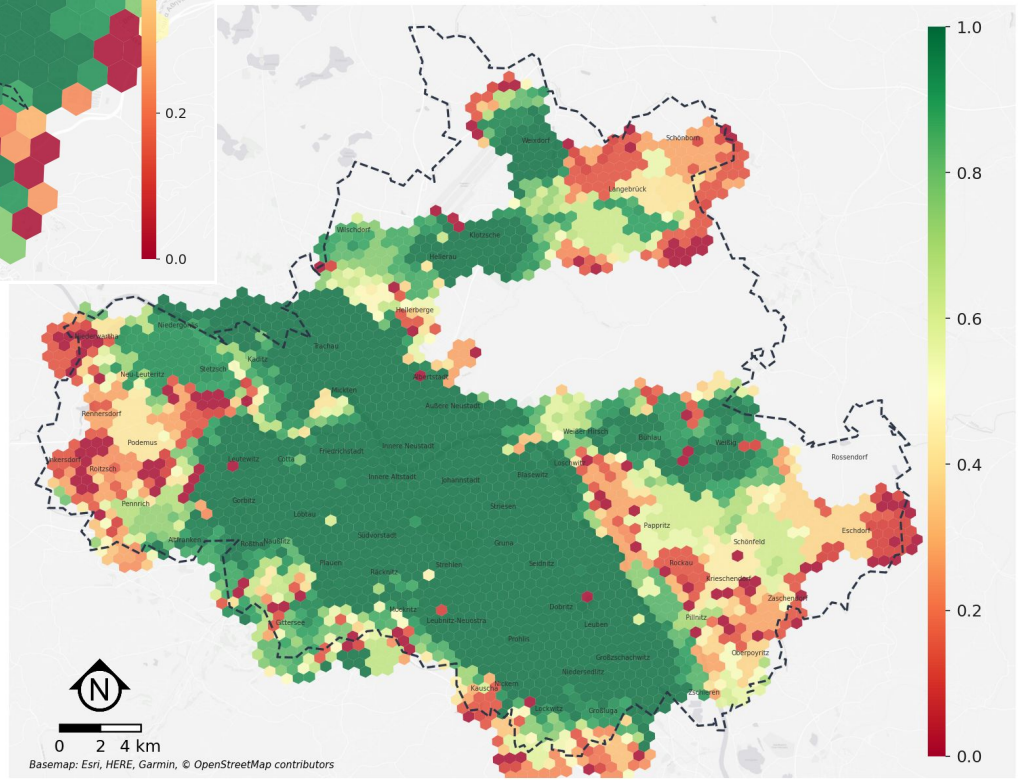
PROXIMITY ONLY

By distance alone, the city looks well served

Counting only destinations within 15 minutes of travel time distance at fixed speeds, accessibility is high almost everywhere.



Athens



Dresden

Accessibility as it feels, not as the clock says

Each hexagon counts the destinations reachable by bike within 15 minutes of **perceived** travel time. Street conditions stretches or shrinks that time.

Safety

+600%

Heavy traffic with no protected lane can add more than this.

Gradient

+1100%

Slopes steeper than 6% can add more than this.

Noise

+54%

A very loud street at 75 dB.

Greenery

−46%

A street with 60% greenery makes the ride feel shorter.

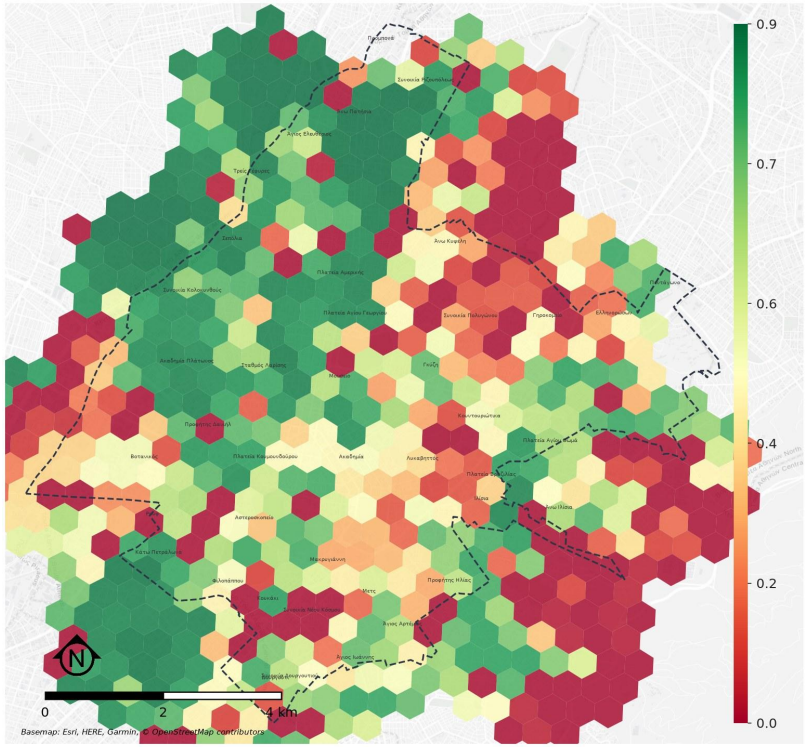
Perceived time = real time × (1 + safety + slope + noise + greenery + surface quality)

Better streets conditions bring destinations within 15 minutes, without anything moving closer.

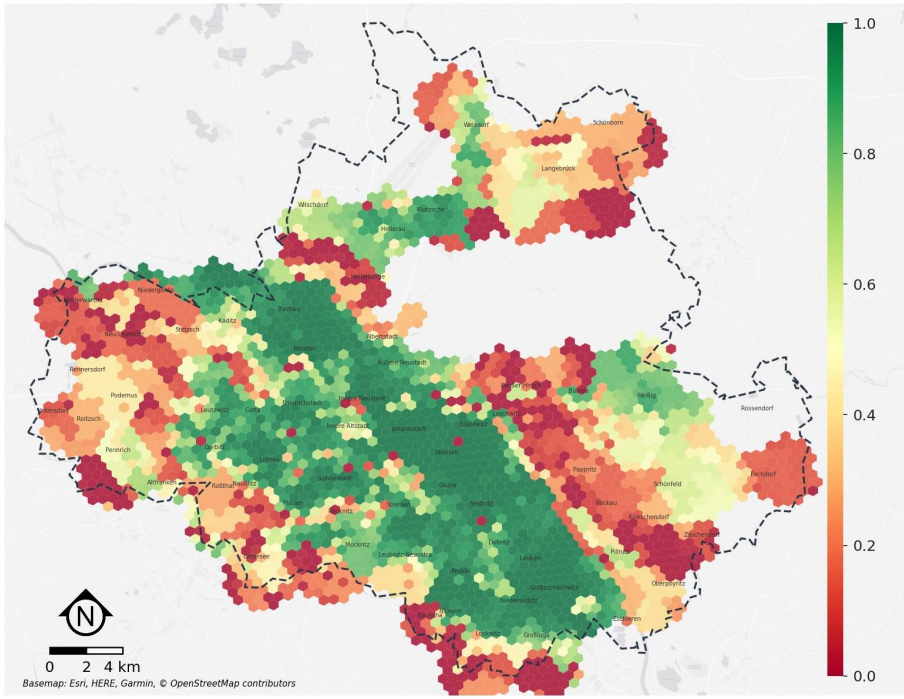
ALL FACTORS

Add street conditions, and access drops

Safety, slope, noise and greenery stretch perceived travel time. Many destinations fall outside 15 minutes, even though nothing moved.

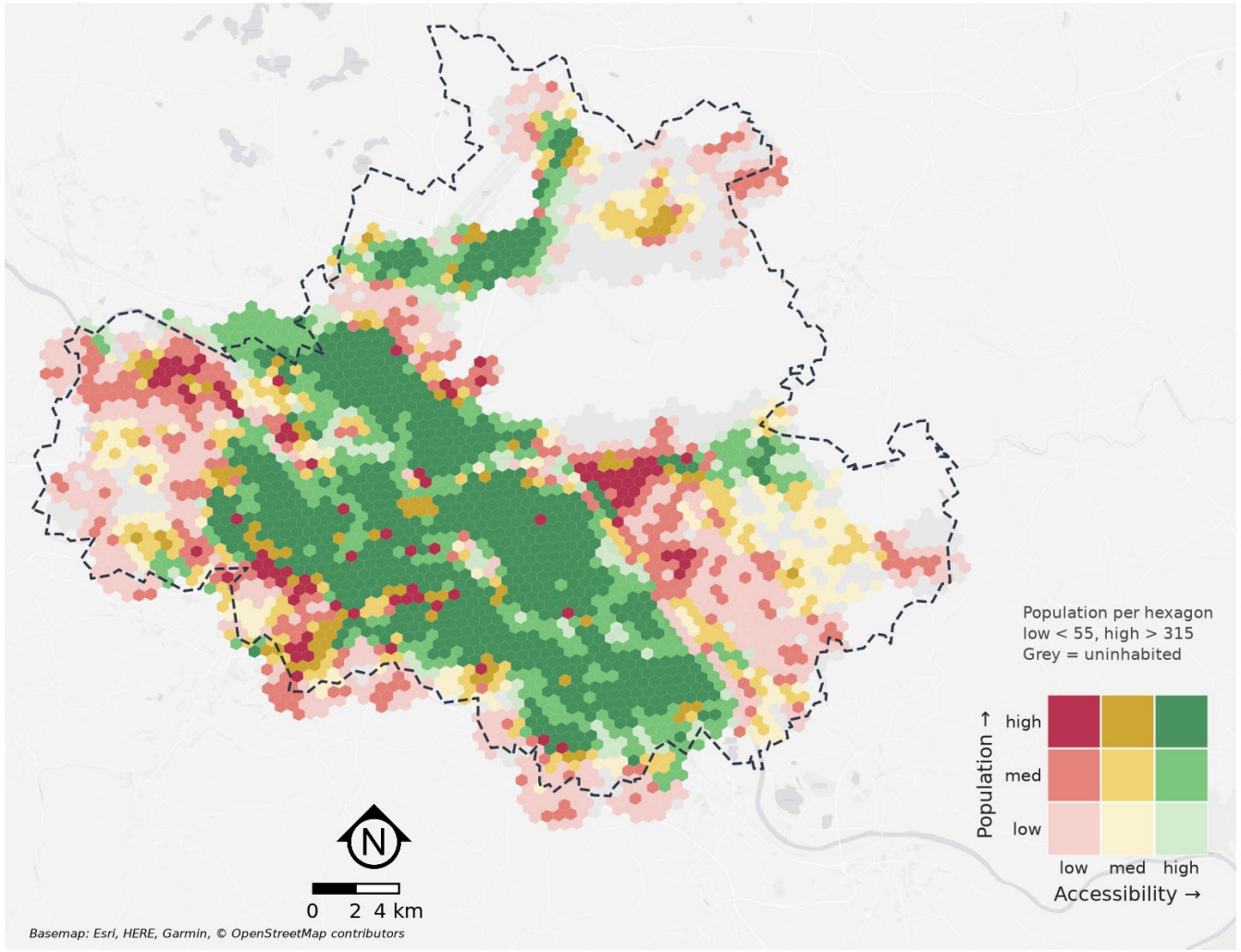


Athens

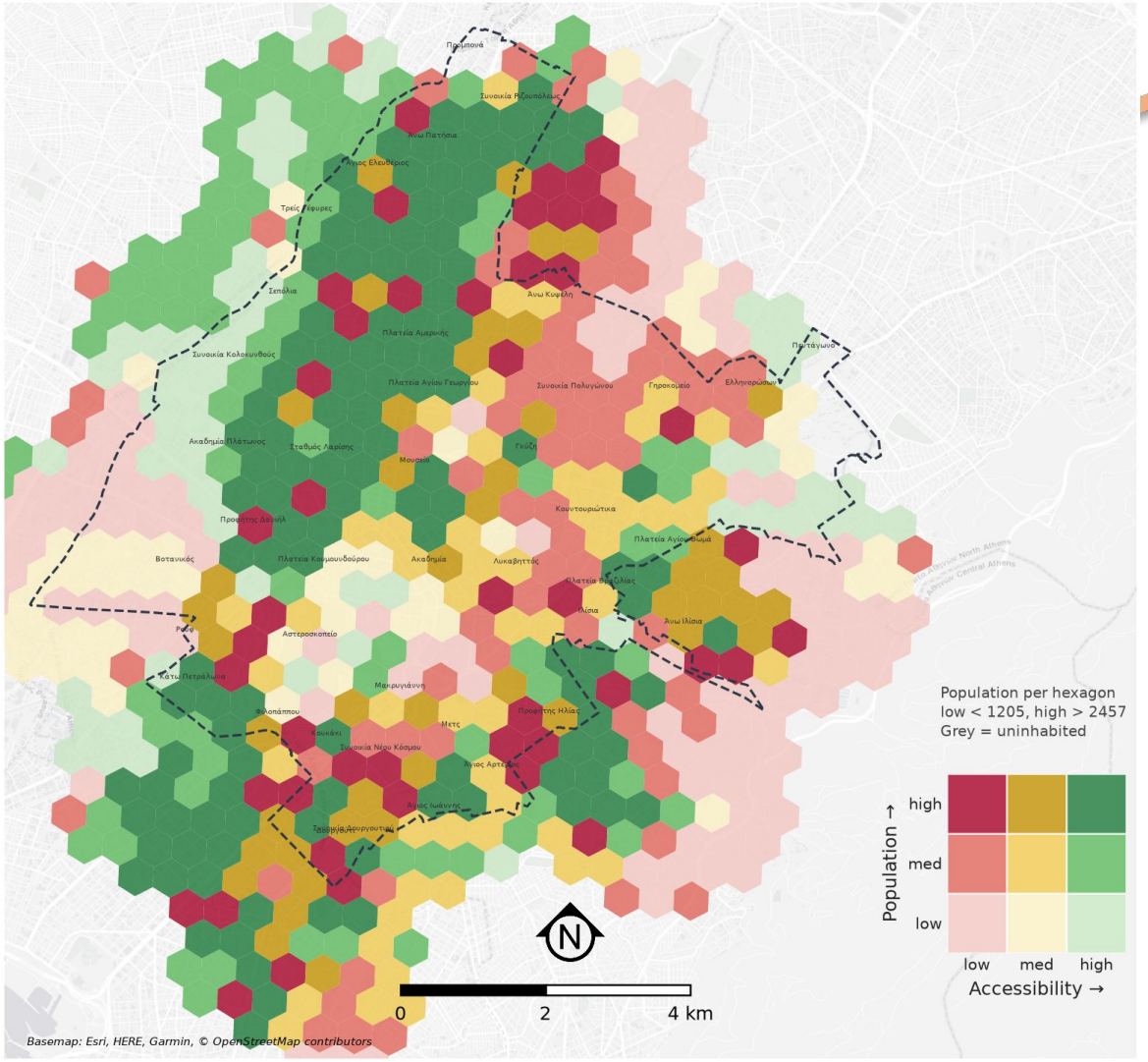


Dresden

Accessibility score vs. Population

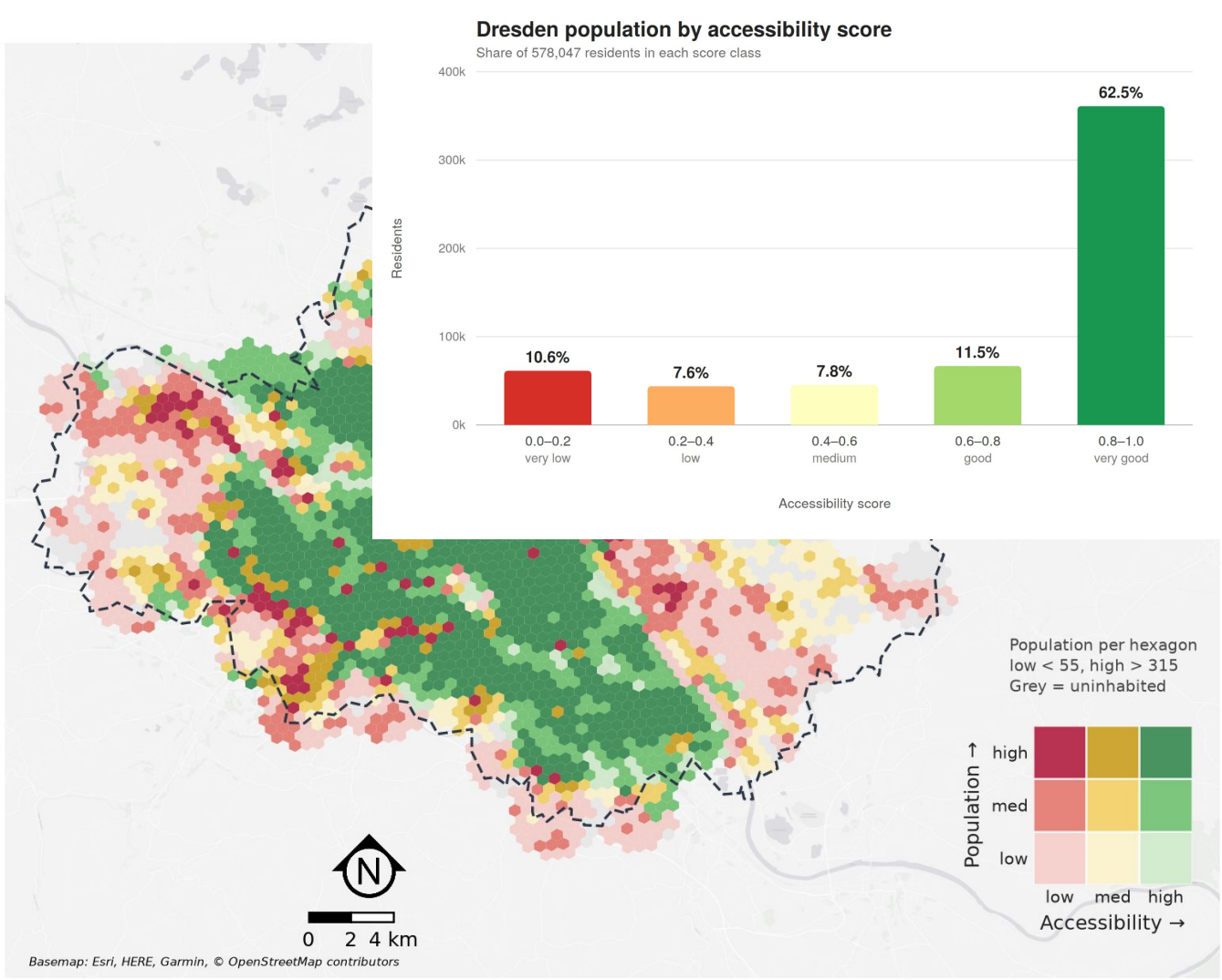


Dresden

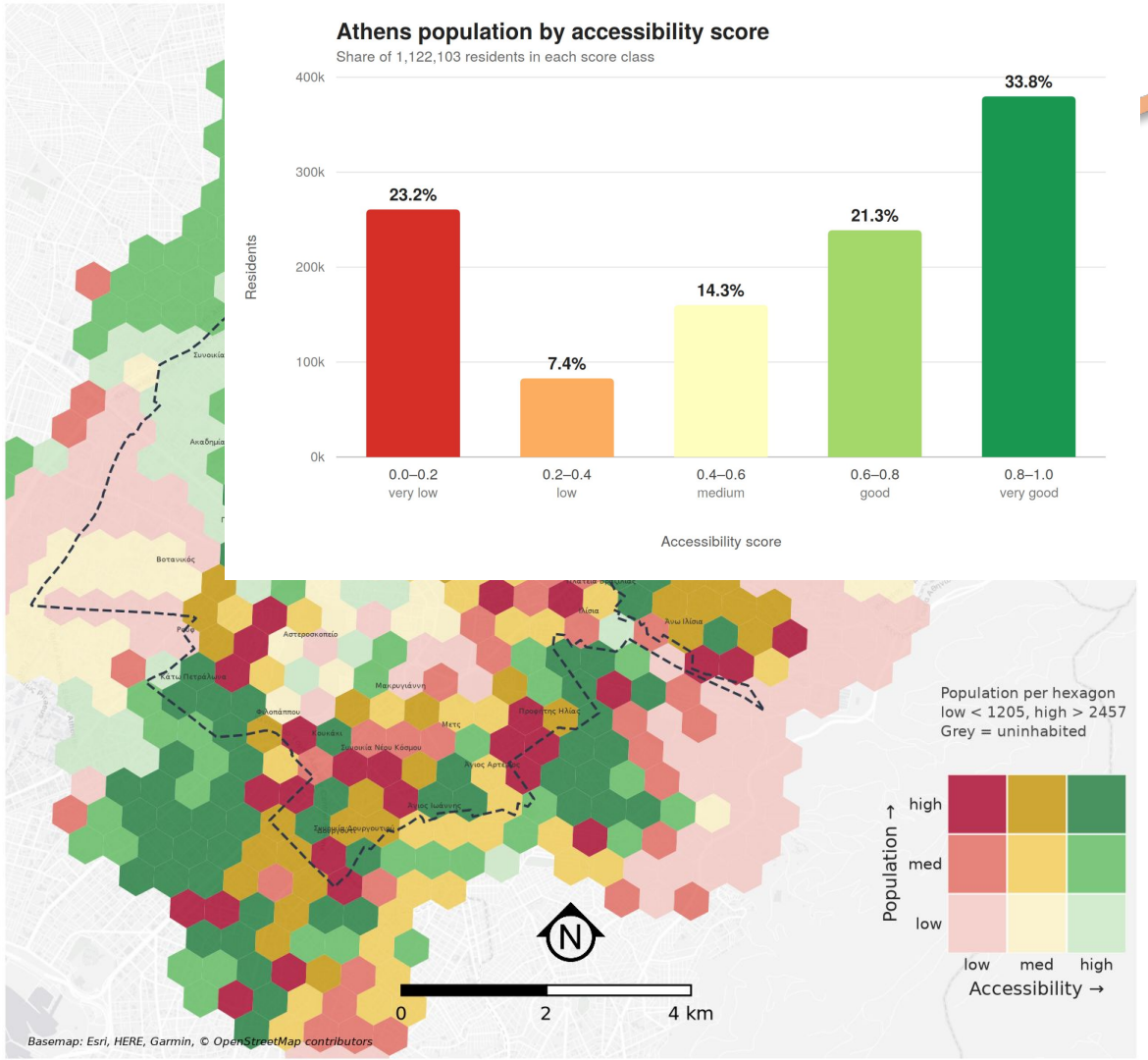


Athens

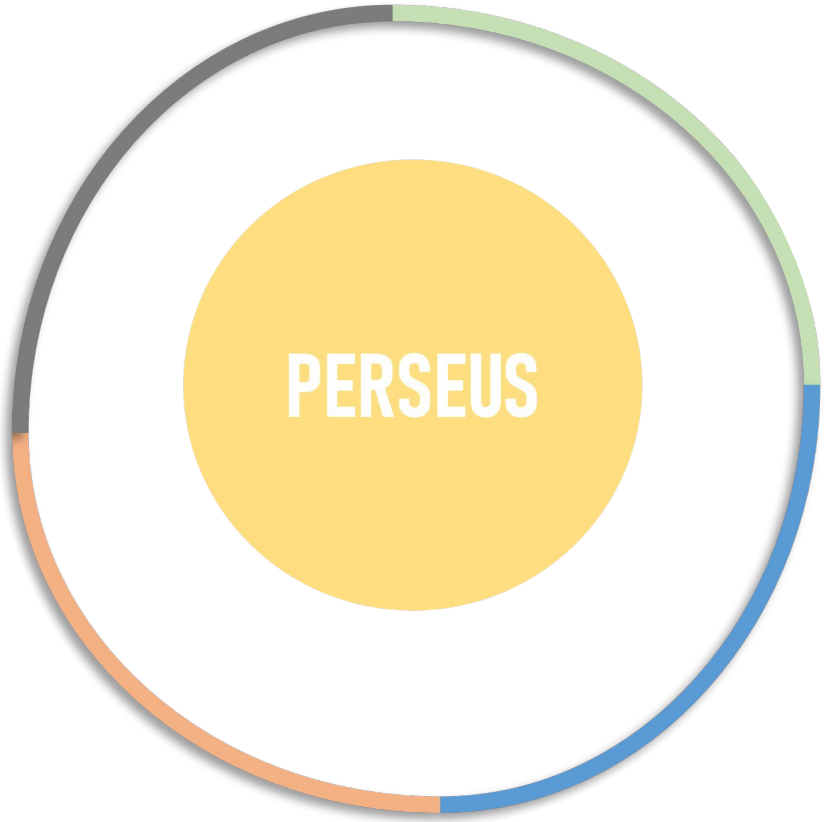
Accessibility score vs. Population



Dresden



Athens



METHODOLOGY OVERVIEW · CYCLING · 15-MINUTE CITY

The Potentiality Index

Ranking neighbourhoods' potential for accessibility improvement to bring everyday activity destinations by street redesign considering network impacts?

What is the Potentiality Index?

A ranking tool for neighbourhoods to rank accessibility improvements by infrastructure interventions at least impact costs.

01

The goal

A 15-minute city: shops, schools, medical care and green space within a 15-minute travel, without needing a car.

02

The constraint

The street network cannot be rebuilt all at once. The same redesign helps some zones a lot and others barely, at very different costs.

03

The index

For every zone, the accessibility gained is set against the cost of achieving it, giving one comparable score per zone.

Where does the street redesigning budget bring the most destinations within reach?

One number per zone

$$\text{Potentiality} = \frac{\textbf{Benefit}}{\textbf{Cost}}$$

Perceived accessibility (benefit)

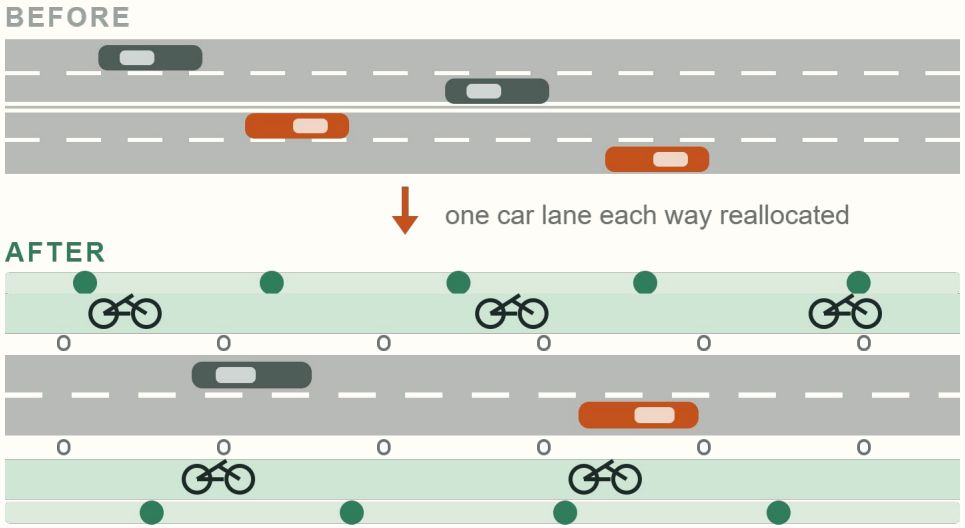
- Proximity
- Safety (Traffic exposure)
- Slope
- Greenness
- Noise
- Surface Quality

Generalised system & capital cost

- Traffic total system travel time
- Traffic CO_2 emissions
- Traffic Fuel consumption
- Street redesign cost

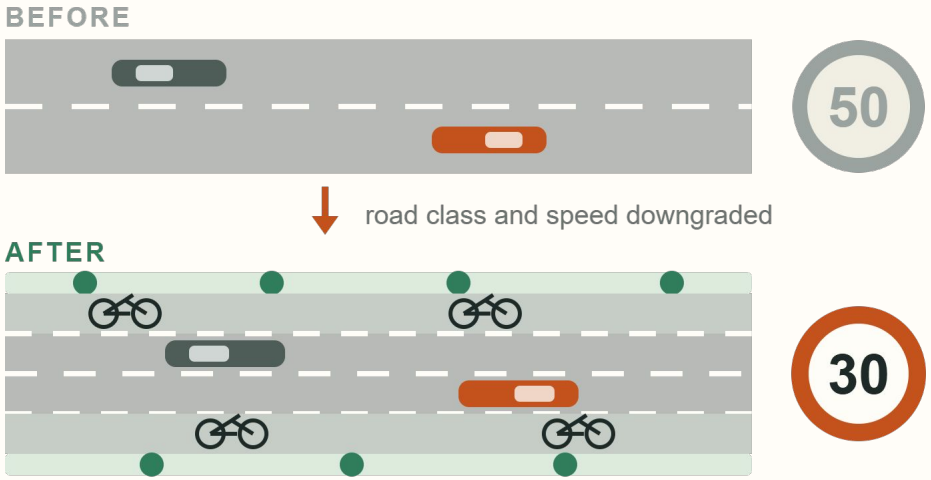
Scenario: reclaim road space

Each zone is redesigned on its own, then the whole city is re-run to see how accessibility and traffic change.



Multi-lane roads

A car lane in each direction becomes a protected bike track on both sides, with trees along the route.



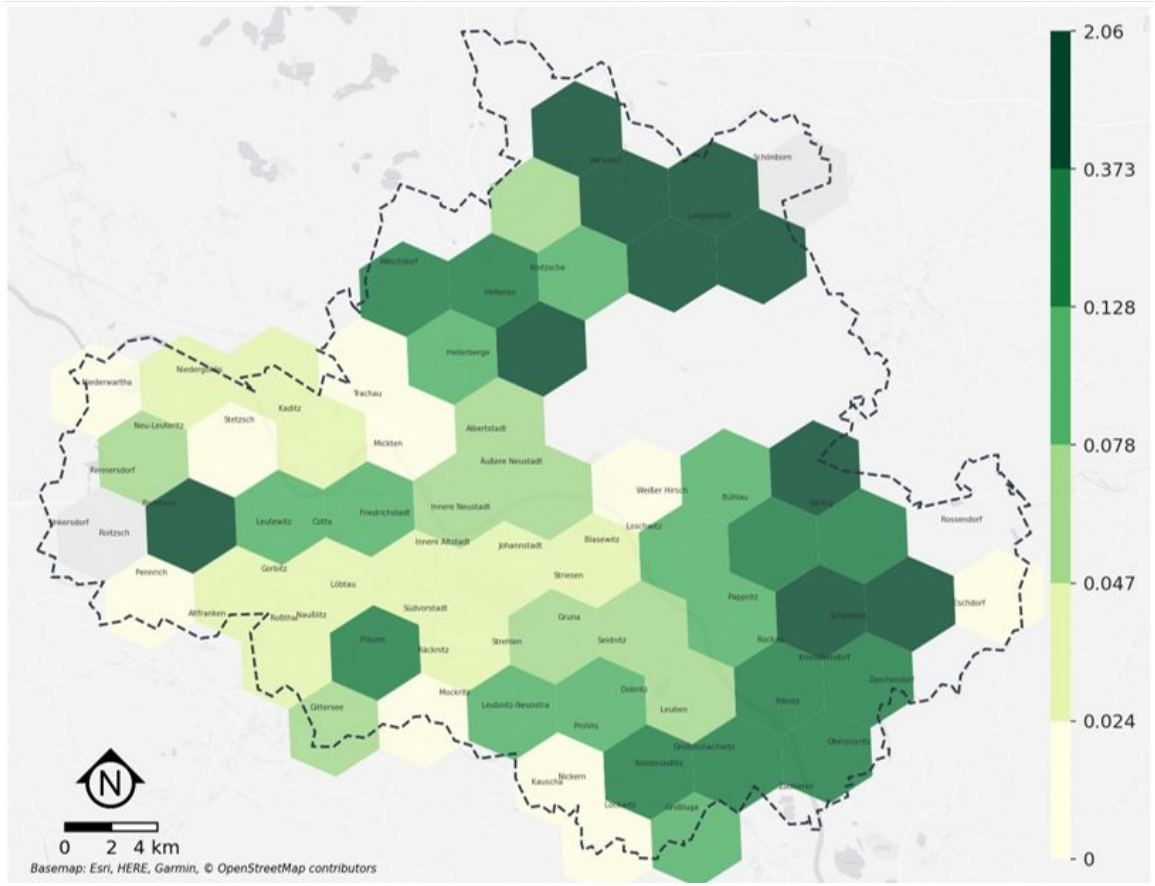
Single-lane roads

The road drops a class, speed and capacity fall, and on-road bike lanes on both sides and trees are added.

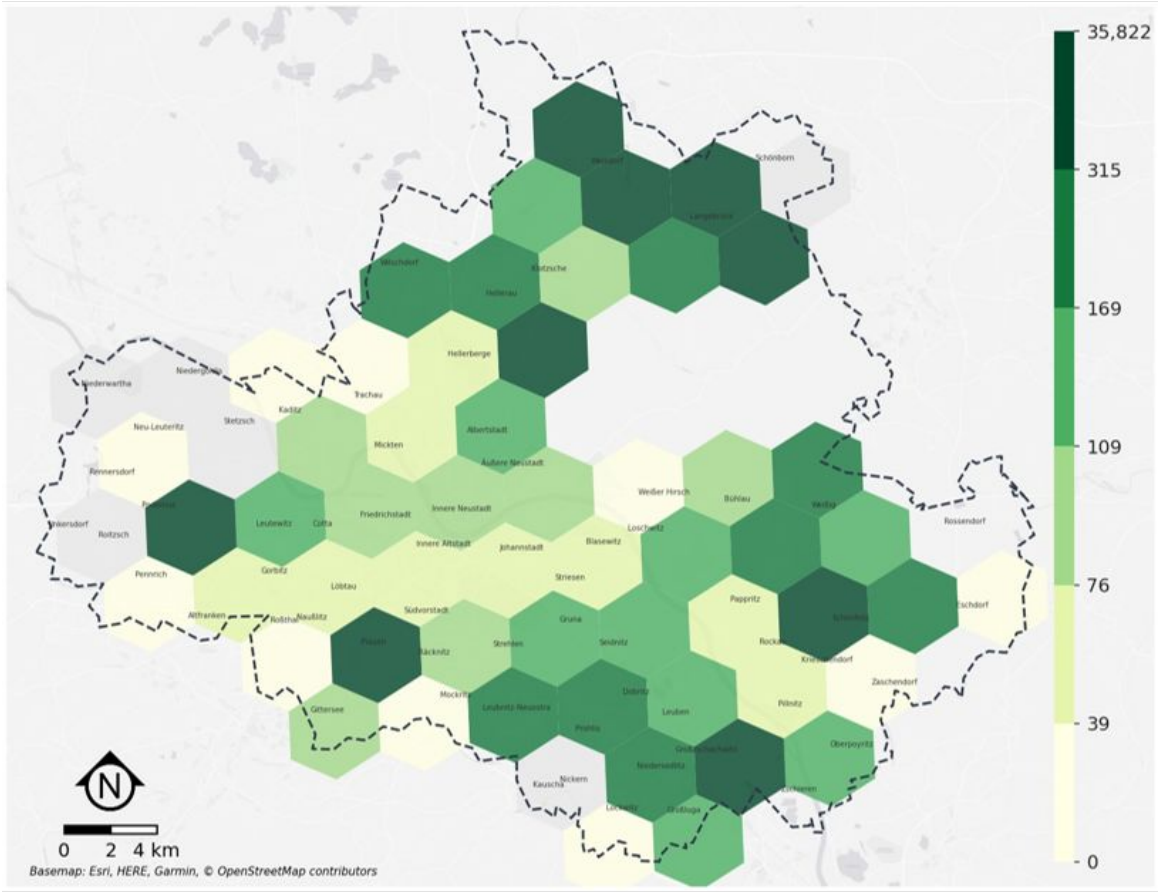
Better for cycling, but slower for cars: the index weighs both sides.

Potentiality Index: Dresden

Darker zones deliver the most accessibility gain per euro. Comparing both maps shows whether gains reach people or just ground.

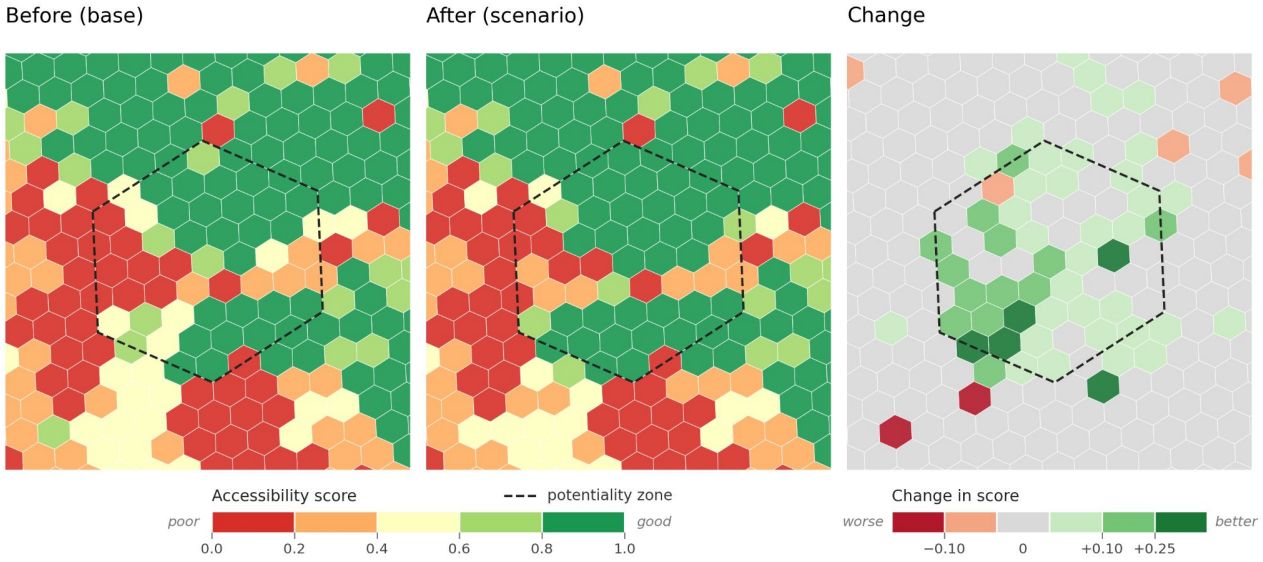


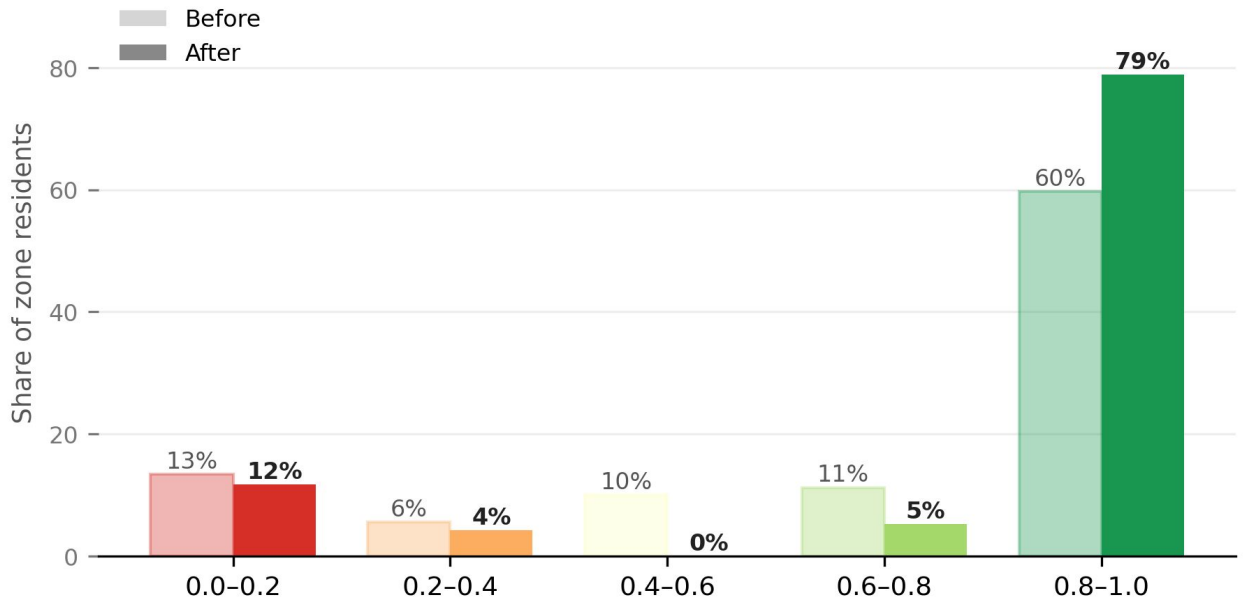
Area-weighted

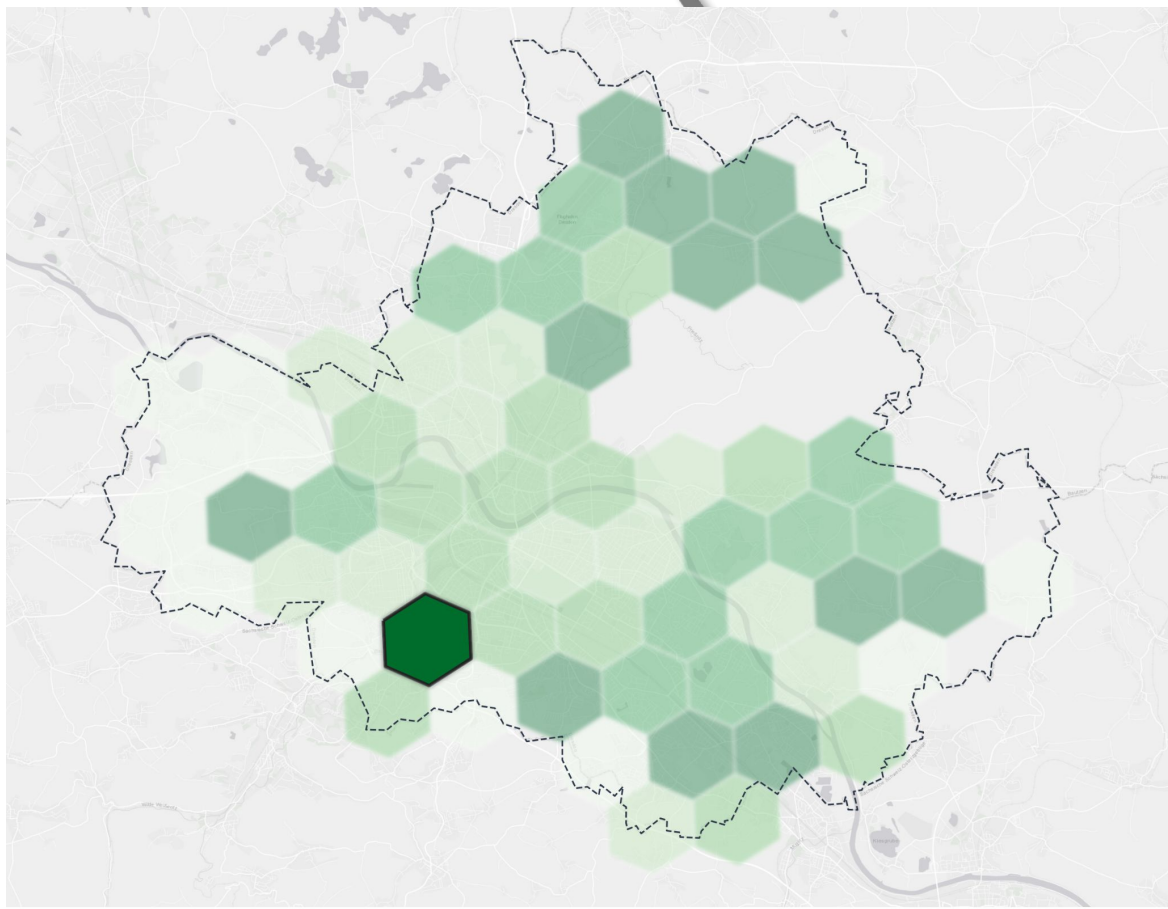


Population-weighted

Potentiality Index: Dresden

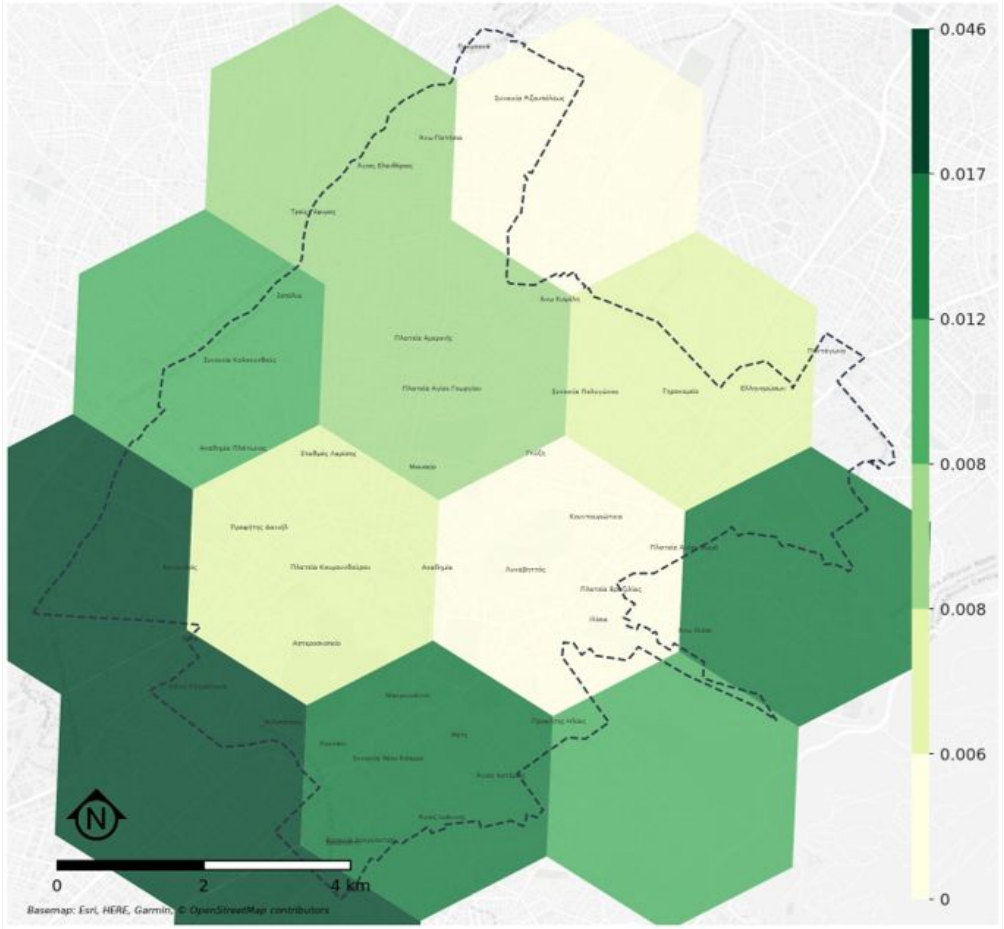




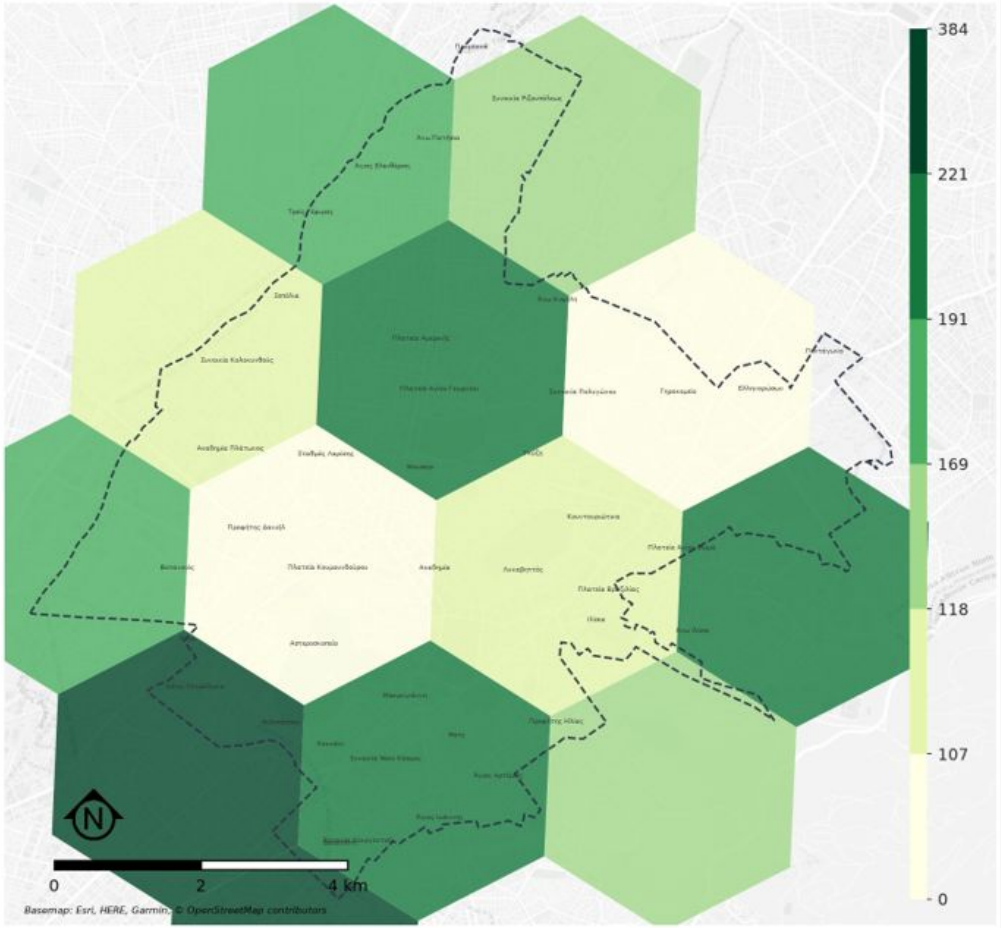


Potentiality Index: Athens

Darker zones deliver the most accessibility gain per euro. Comparing both maps shows whether gains reach people or just ground.



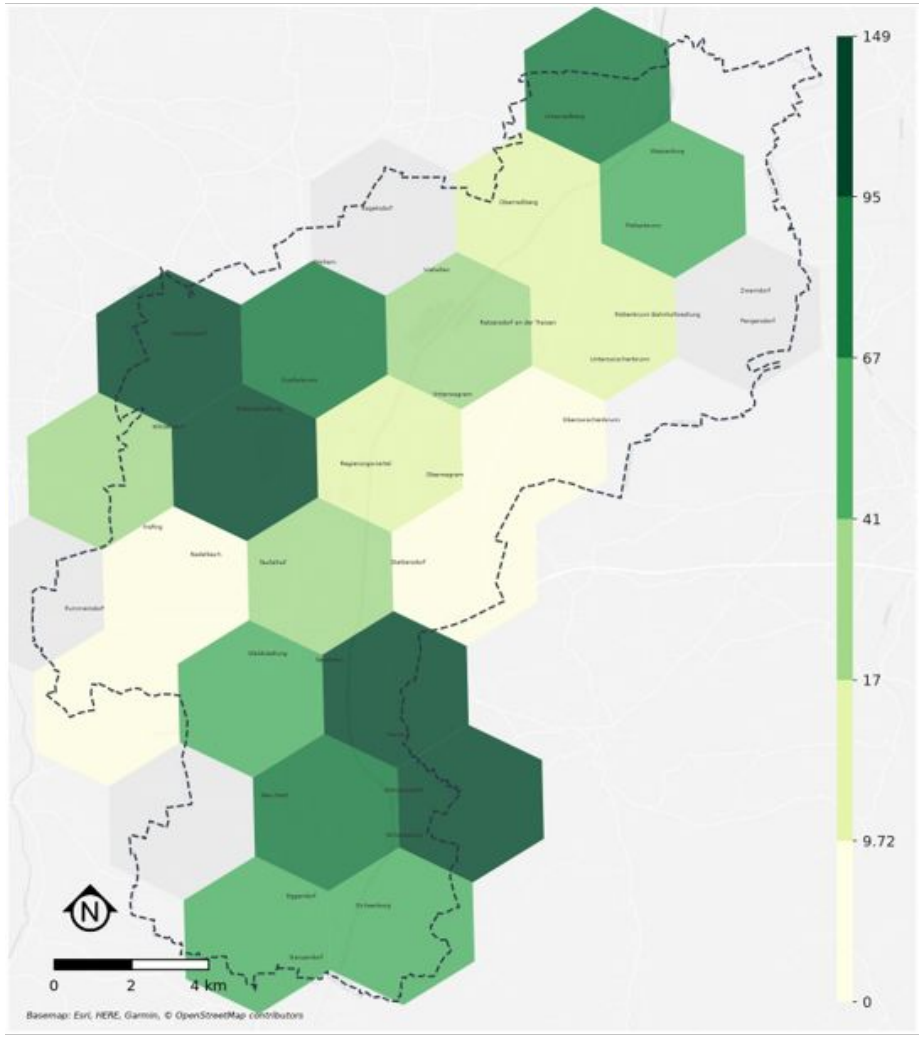
Area-weighted



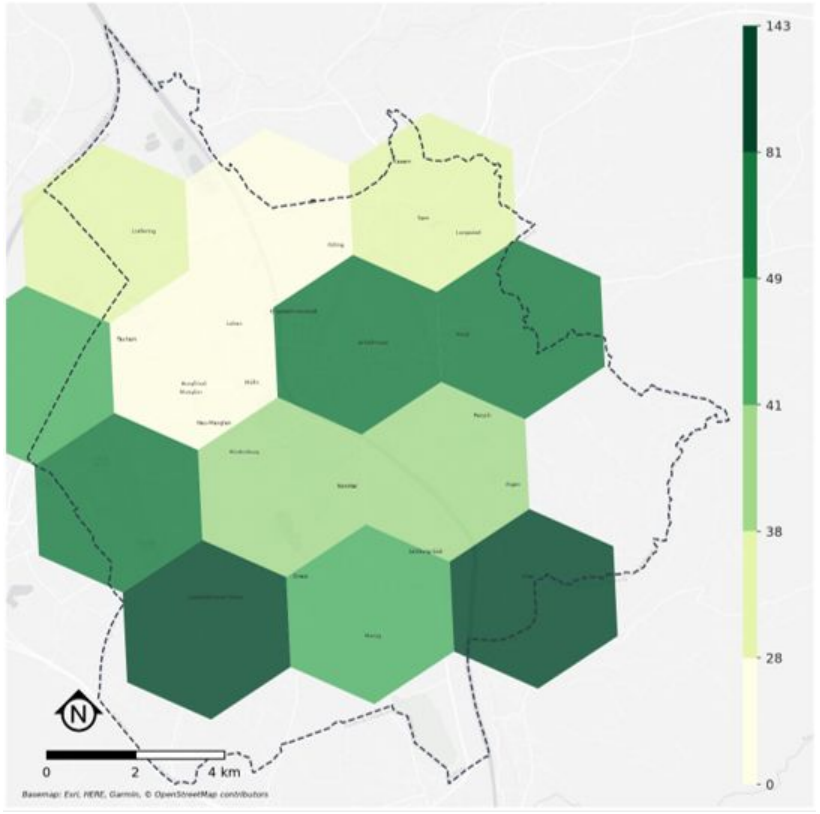
Population-weighted

Replicable in other cities

The same workflow runs on any city with open network, POI and population data.



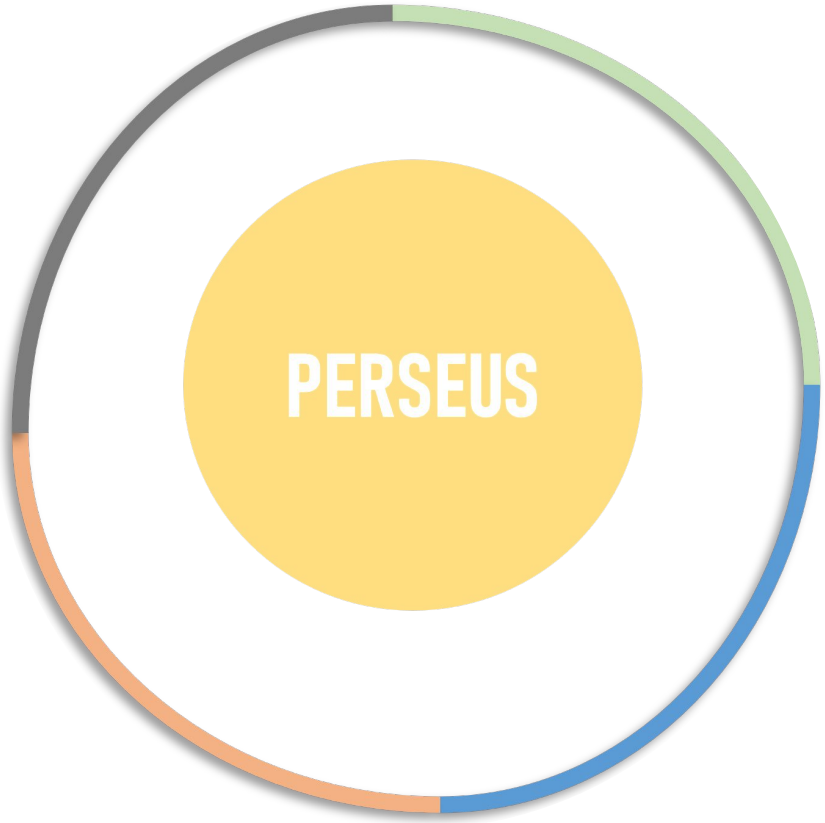
St. Pölten



Salzburg



Linköping



The DSS-Tool

A first glimpse of the PERSEUS tool frontend

Ilyas Oulbacha, Bingyu Zhao

TU Wien (AT)

DSS Aims and Objectives

Aim

Make 15mC evidence usable as an **interactive, map-based tool** that turns technical indicators into **insights experts and non-experts can act on**.

Objectives

- Translate modelling requirements into tool functions through co-creation
- Visualise 15mC indicators and *“15mC potentiality”* on interactive maps
- Enable scenario testing of POI and infrastructure changes
- Explain results in plain language for non-expert users through LLM integration
- Refine tool and logic iteratively via pilot-city feedback
- Release as open-source, web-accessible, and transferable

Components of DSS tool

Control Panel:

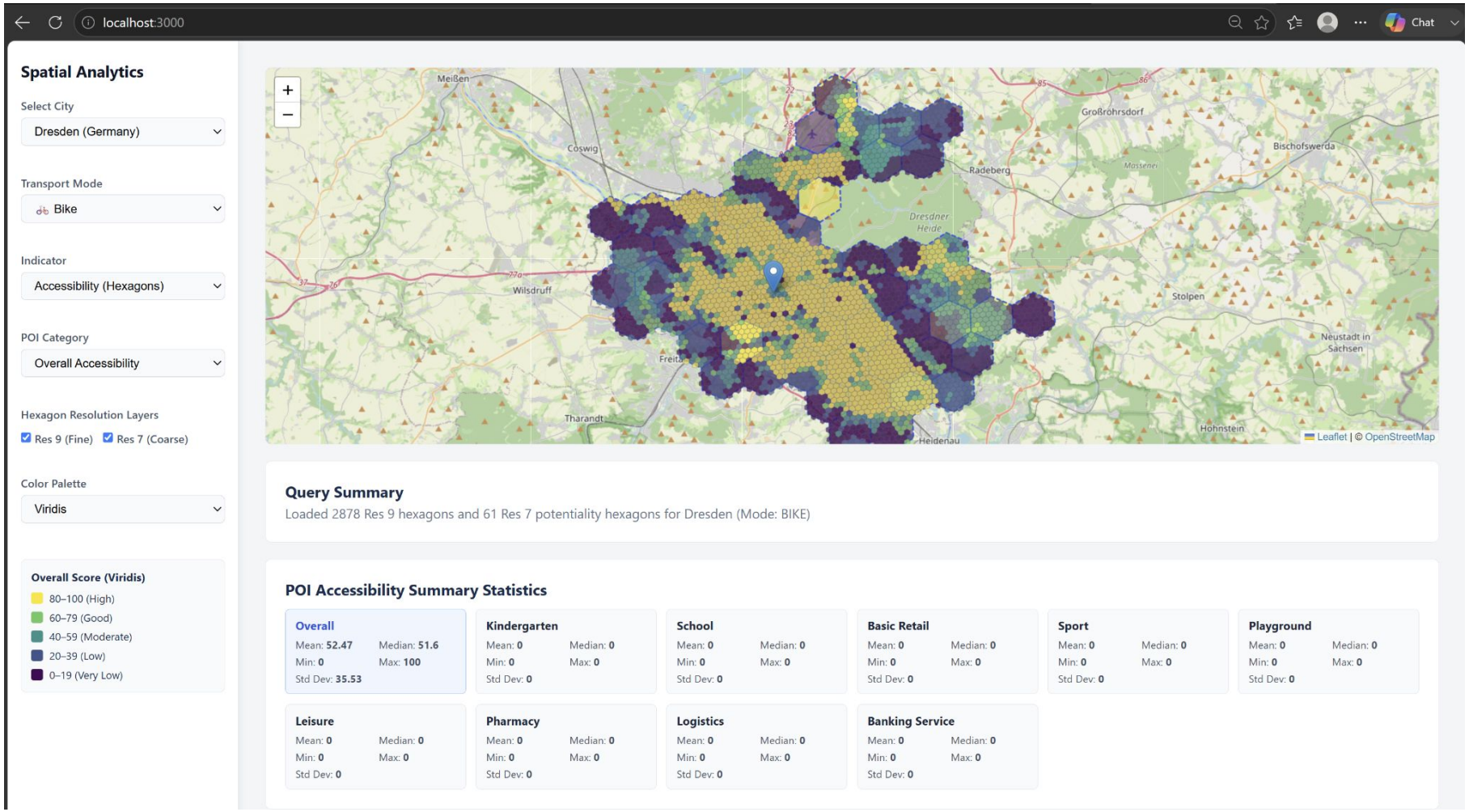
Left side section the dashboard,allows users to select city,transport mode,indicator,target POI, hexagone resolution and palette colours.

Visualisation Area:

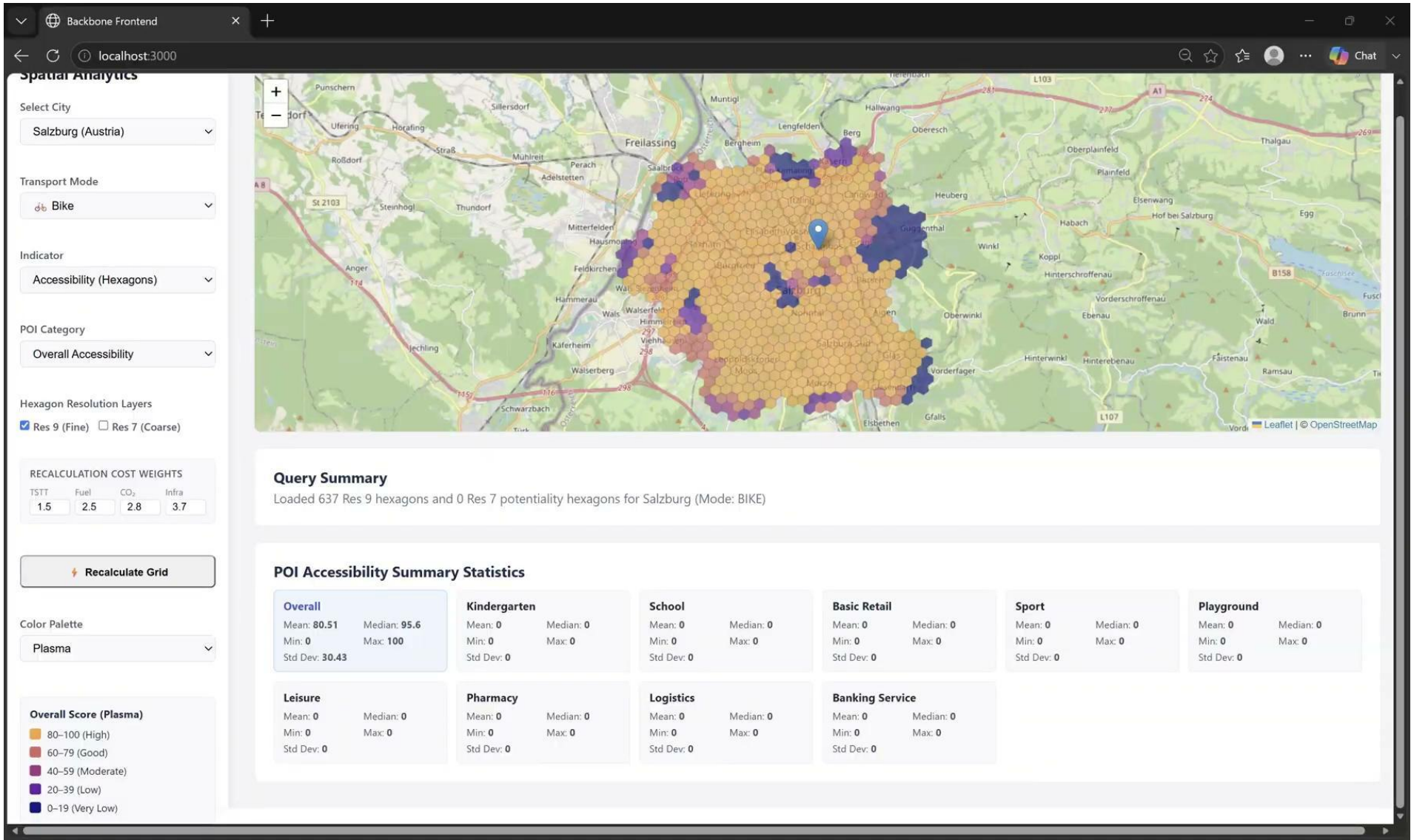
2 layers of hexagons over the map of the chosen city. Users can select one or both layers.

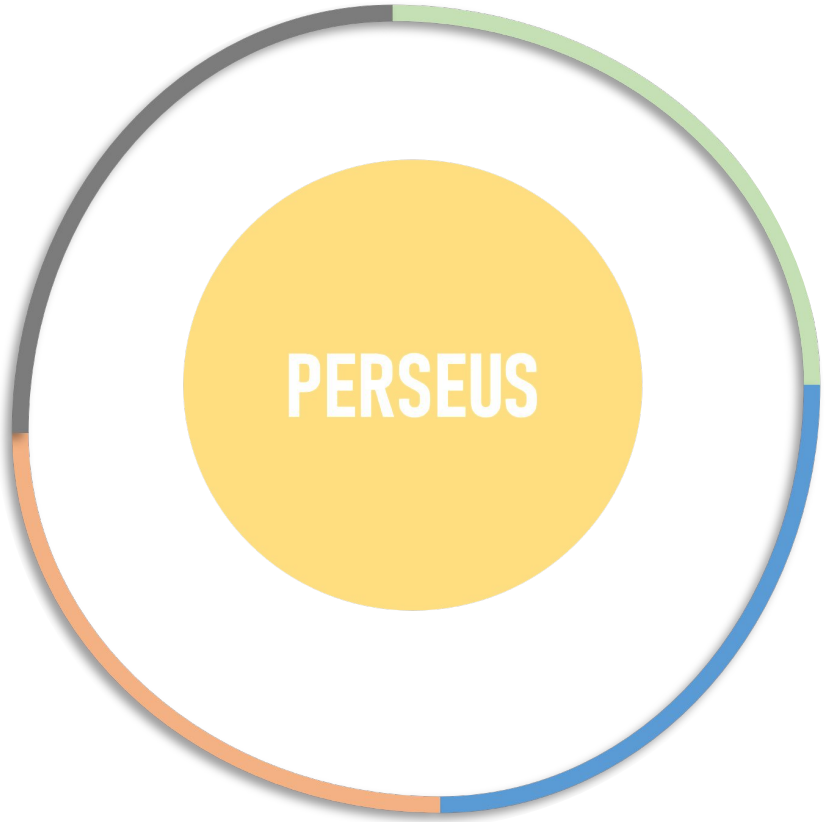
Statistics:

Based on the chosen indicators,different metrics are displayed: mean,min,max and standard deviation of the specific POI.



The DSS-Tool


Backbone Frontend
localhost:3000
Chat
Spatial Analytics
Select City
Salzburg (Austria)
Transport Mode
Bike
Indicator
Accessibility (Hexagons)
POI Category
Overall Accessibility
Hexagon Resolution Layers
Res 9 (Fine)
Res 7 (Coarse)
RECALCULATION COST WEIGHTS
TSTT
Fuel
CO₂
Infra
1.5
2.5
2.8
3.7
Recalculate Grid
Color Palette
Plasma
Overall Score (Plasma)
80–100 (High)
60–79 (Good)
40–59 (Moderate)
20–39 (Low)
0–19 (Very Low)
Leaflet | © OpenStreetMap
Query Summary
Loaded 637 Res 9 hexagons and 0 Res 7 potentiality hexagons for Salzburg (Mode: BIKE)
POI Accessibility Summary Statistics
Overall
Mean: 80.51
Median: 95.6
Min: 0
Max: 100
Std Dev: 30.43
Kindergarten
School
Basic Retail
Sport
Playground
Leisure
Pharmacy
Logistics
Banking Service



What do you think about the PERSEUS tool?

PERSEUS

Thank you

Follow us for project updates and infos on:

LinkedIn

Website