Evidence-based design and planning: Space Syntax

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the theoretical background

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Cities are big, complicated and slow to build.

Governments change over years

Economies change over months

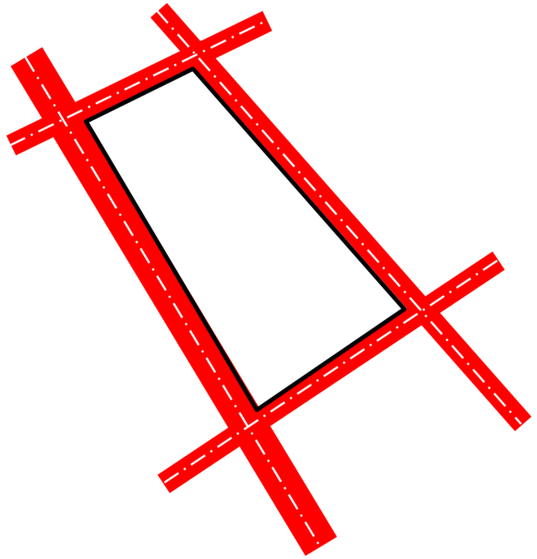
Streets change over centuries

Activities change over minutes

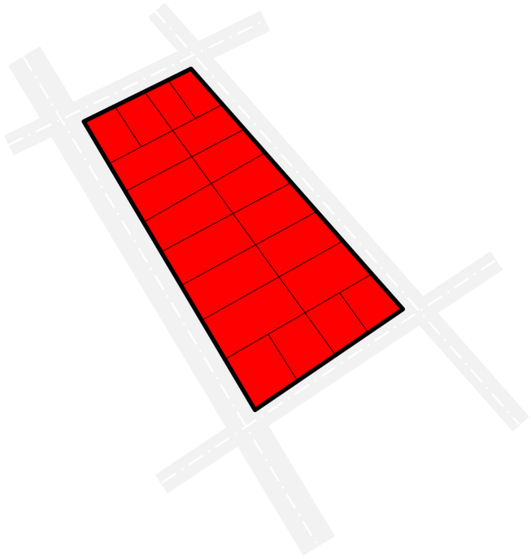
Buildings change over decades

Space Syntax

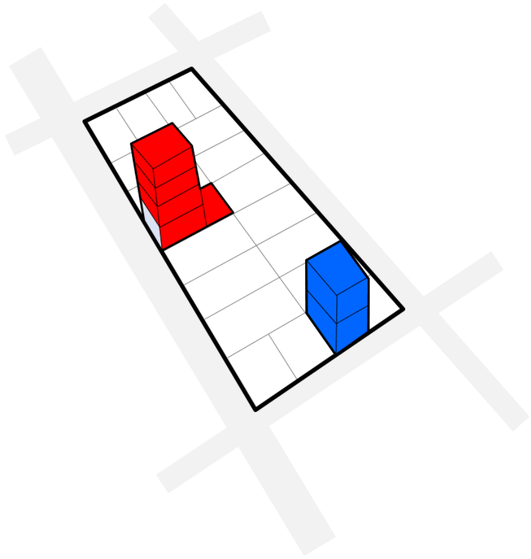
We should therefore design the fewest, most influential elements:



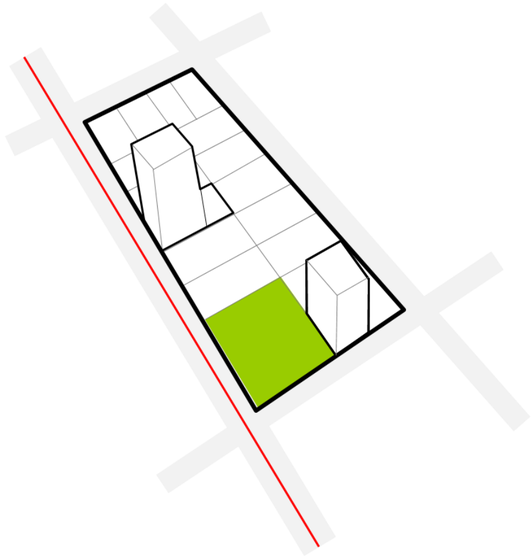
Spatial network
Hierarchies
Street typologies
Infrastructure



Plots
Ownerships
Security
Finance



Plot Typologies
Activities
Densities
Interfaces



Services
Public Transport
Schools
GPs
Parks

Space Syntax

Space syntax

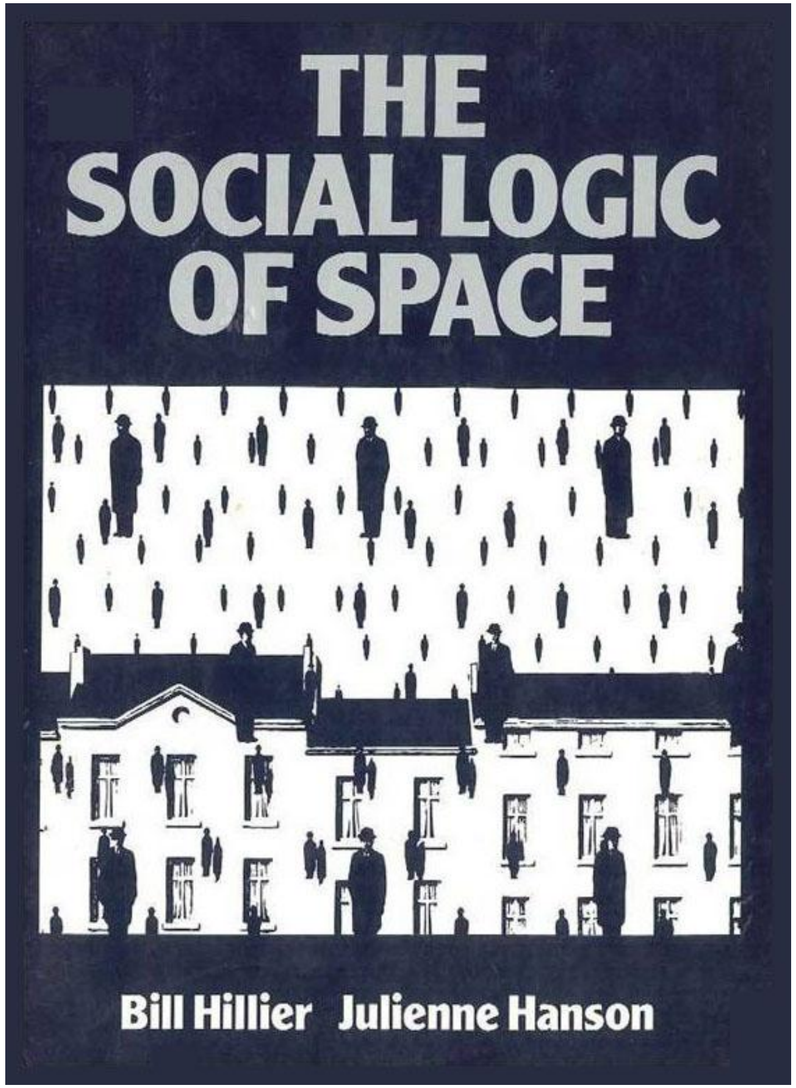
Space is not a background to human activity but is **intrinsic** to it.

Space syntax is a theory and a method for quantitatively describing patterns of spatial layout and relating these patterns to social activities such as movement, behaviour, and even social meaning and interpretation

- to understand and simulate the social effects of design.

Space is first and foremost **configurational**

- what happens in any individual space is fundamentally influenced by the relationships between that space and the network of spaces to which it is connected.



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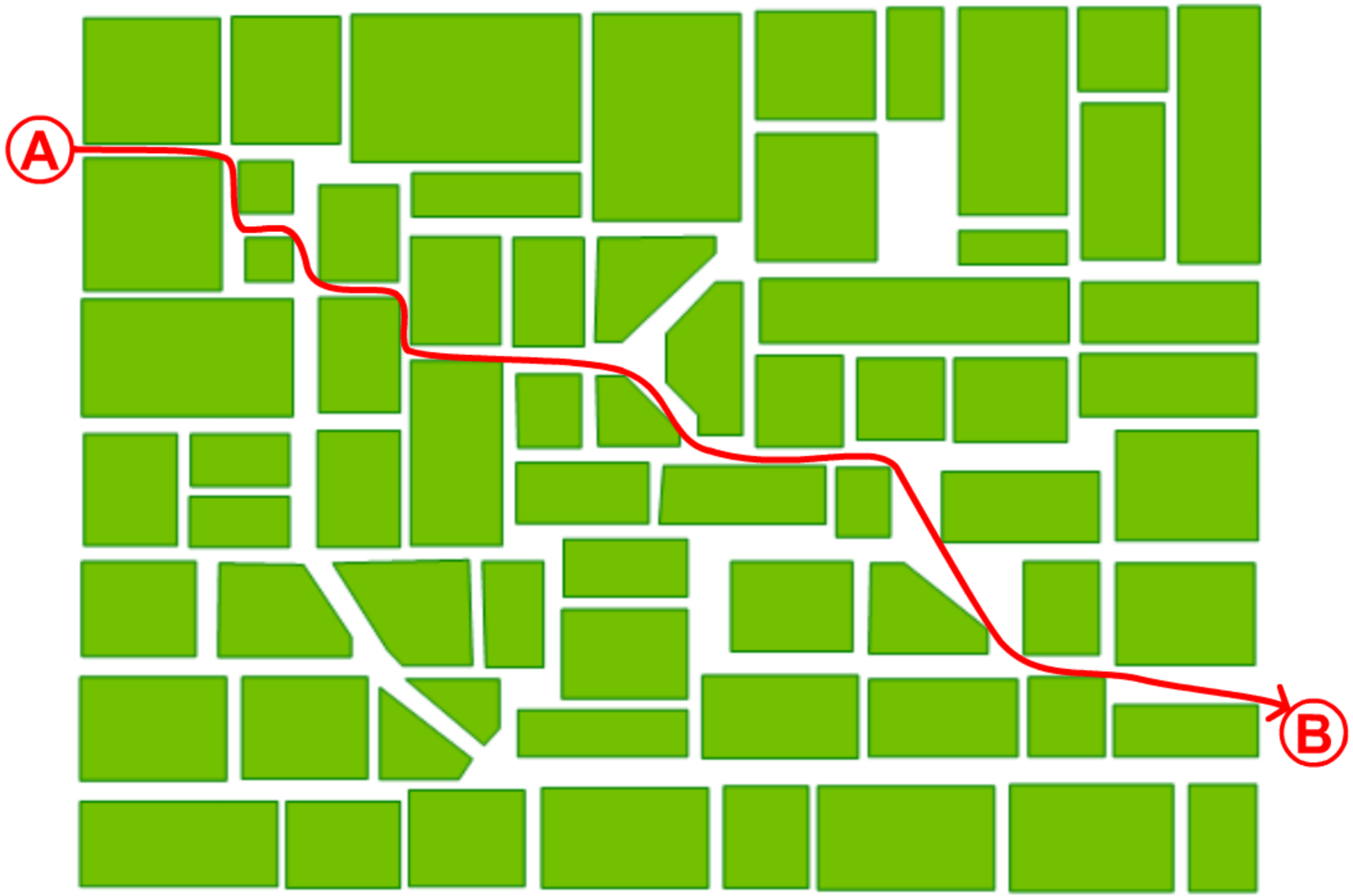
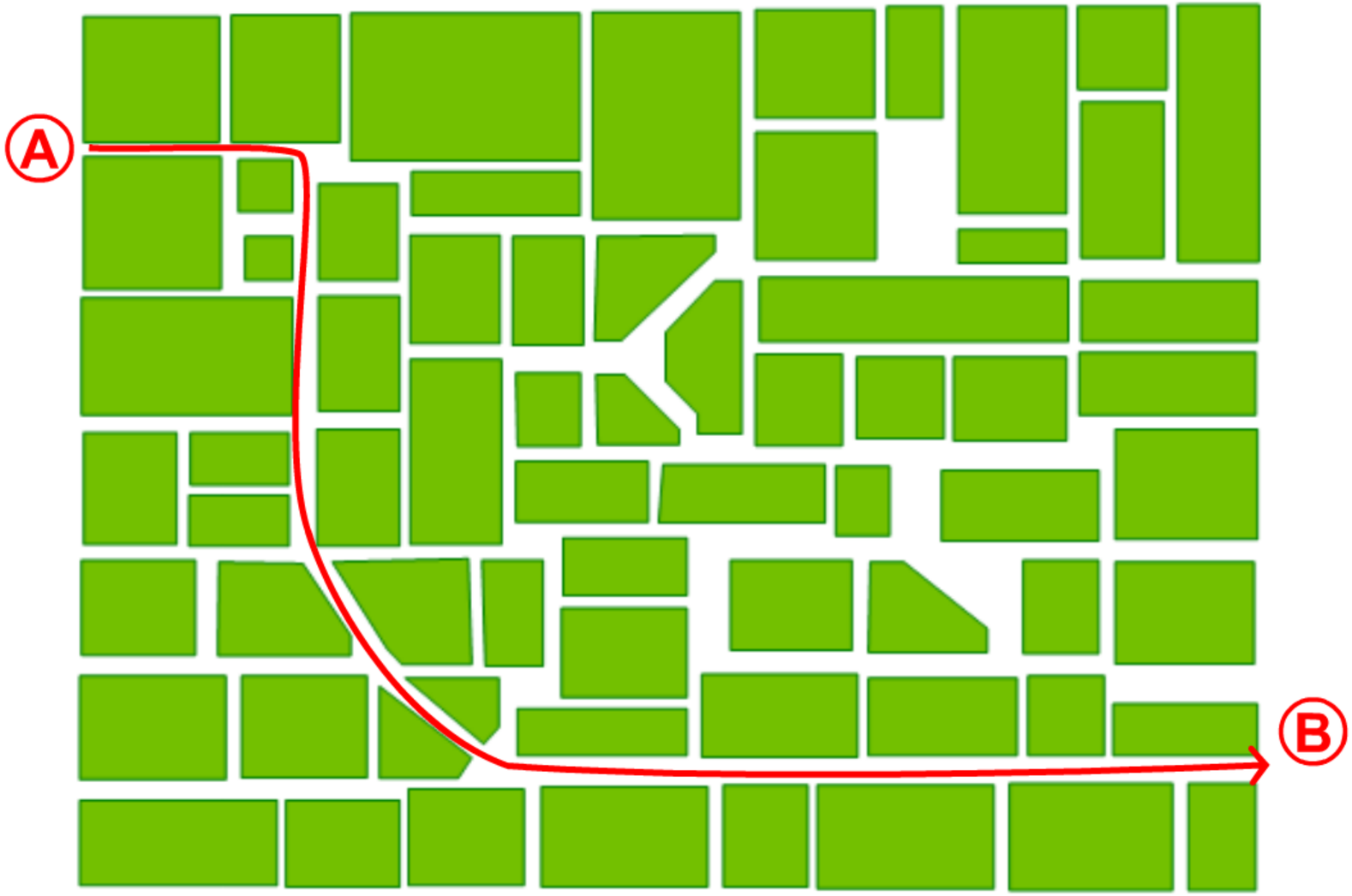
Shortest path / least metric distance

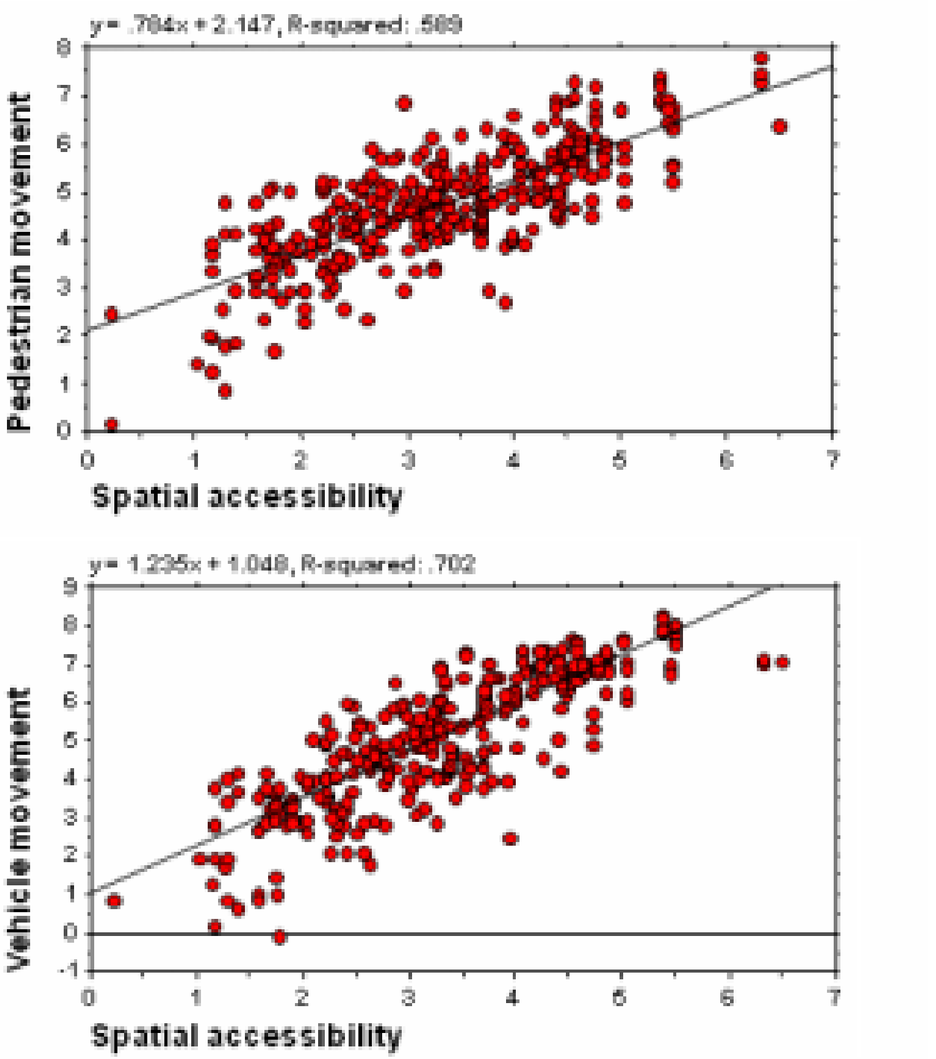


Simplest path / least angle change



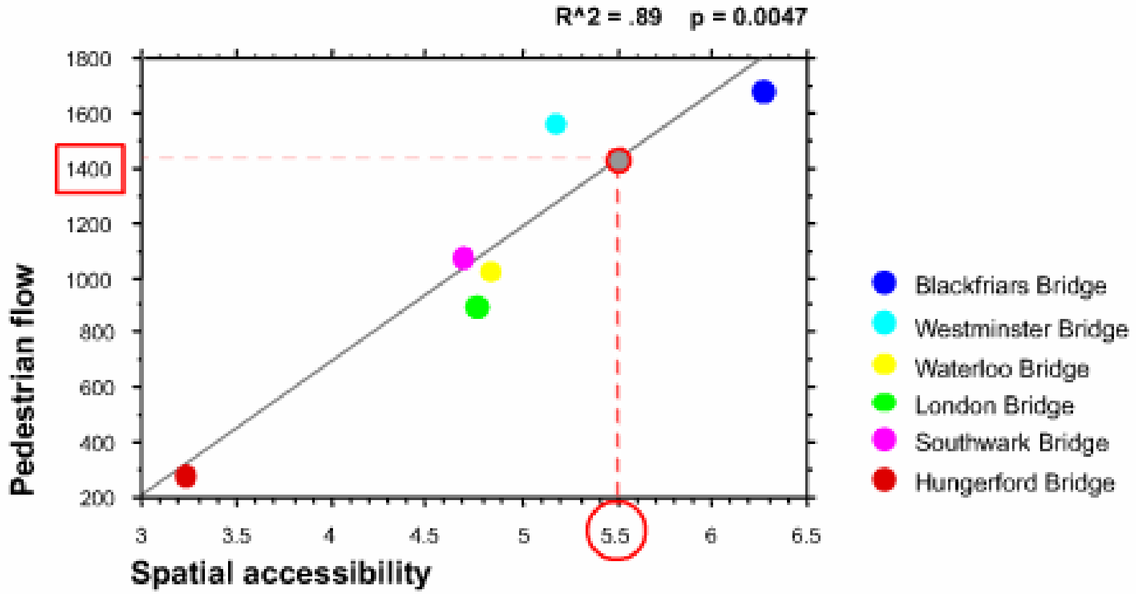
Spatial layout organizes movement

- 60-80% of movement flows are due to the structure of the network – more accessible places get more movement
- The volumes of movement are mostly determined by density – the distribution of movement is mostly determined by the relative accessibility of the network
- To predict movement there must be a correlation between flows and accessibility values in the given context

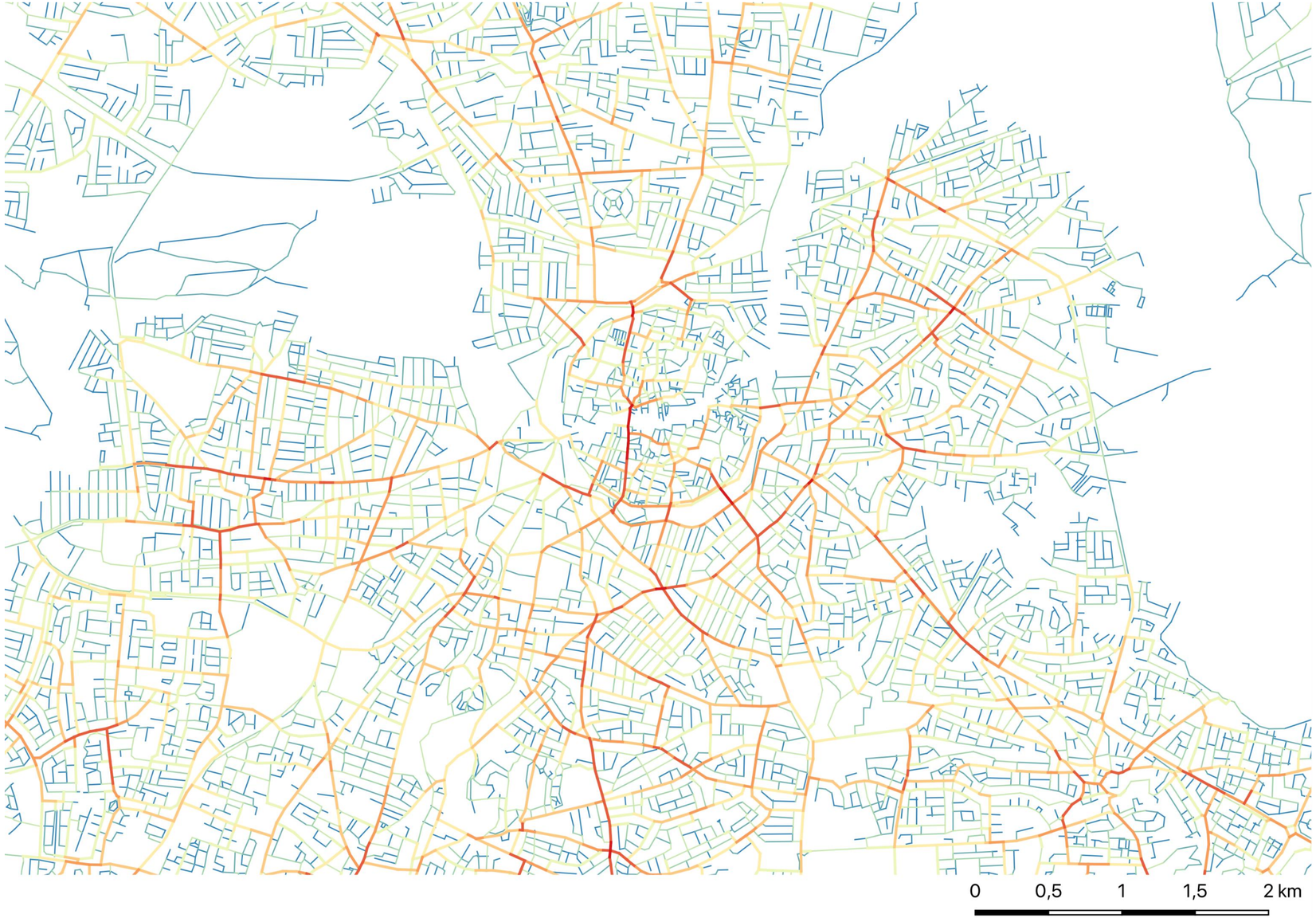


Workflow for predictive modelling

- Data collection on pedestrian movement across Larnaca
- Find the best correlation
- Evaluate volumes in relation to density
- Estimate density within the masterplan
- Project pedestrian movement values onto masterplan street network
- Different scenarios can be evaluated [indicating economic potential of different layouts]



Betweenness centrality



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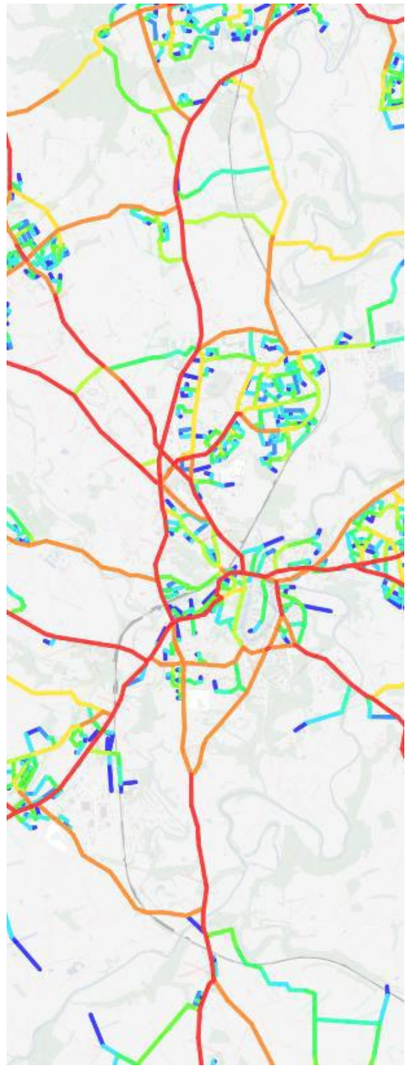
Key relationships



Urban form

Movement

Land use

Economy

Crime

Sustainability

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applications in cyprus

a predictive tool of design impacts

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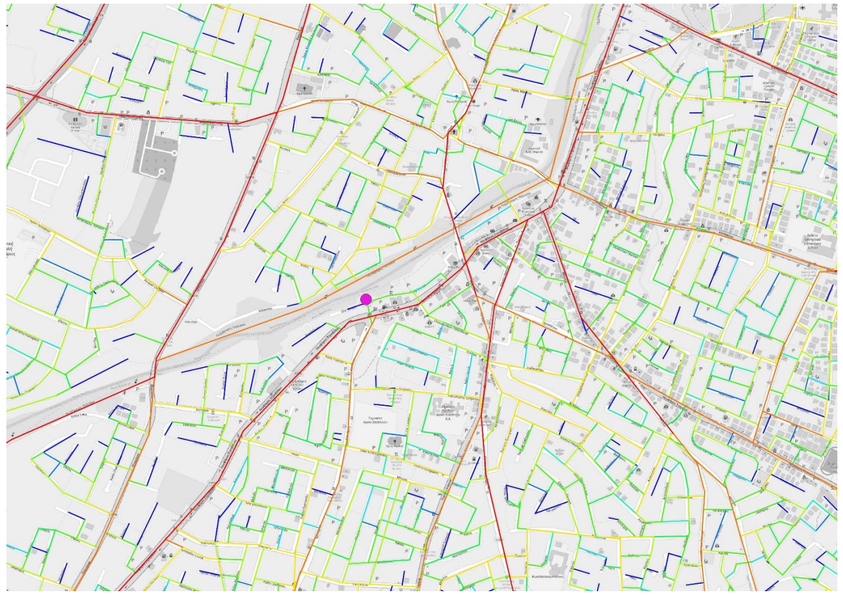
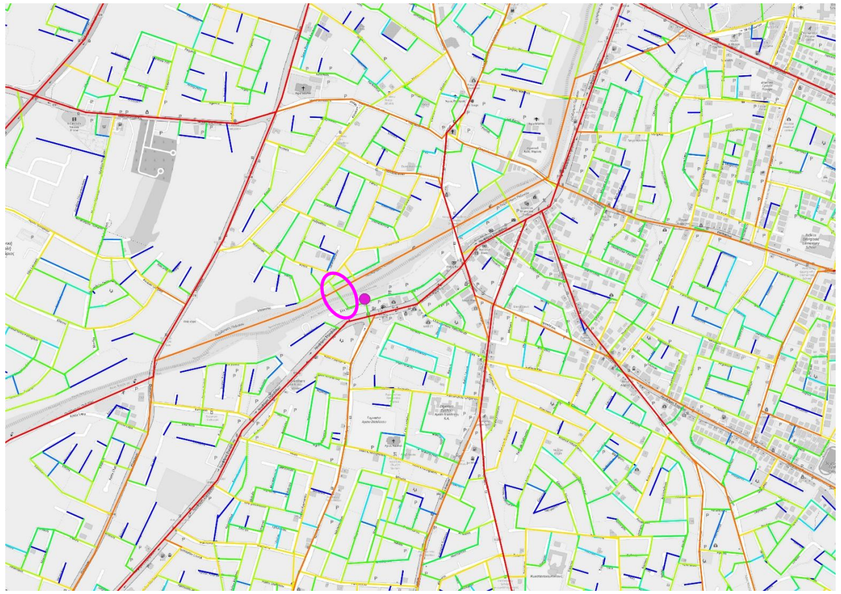
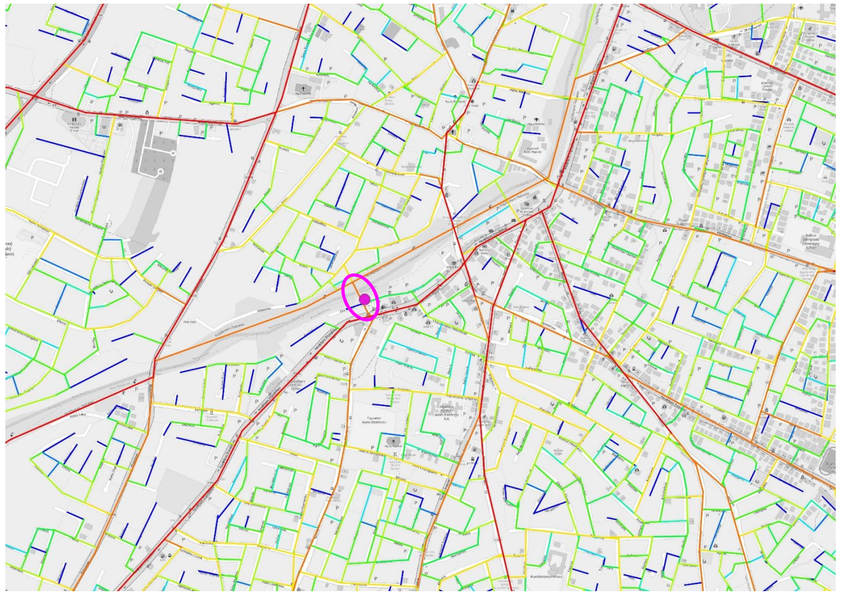
Connecting places to other places across the whole city



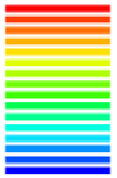
Existing



Masterplan Bridge connectivity value: 0,878



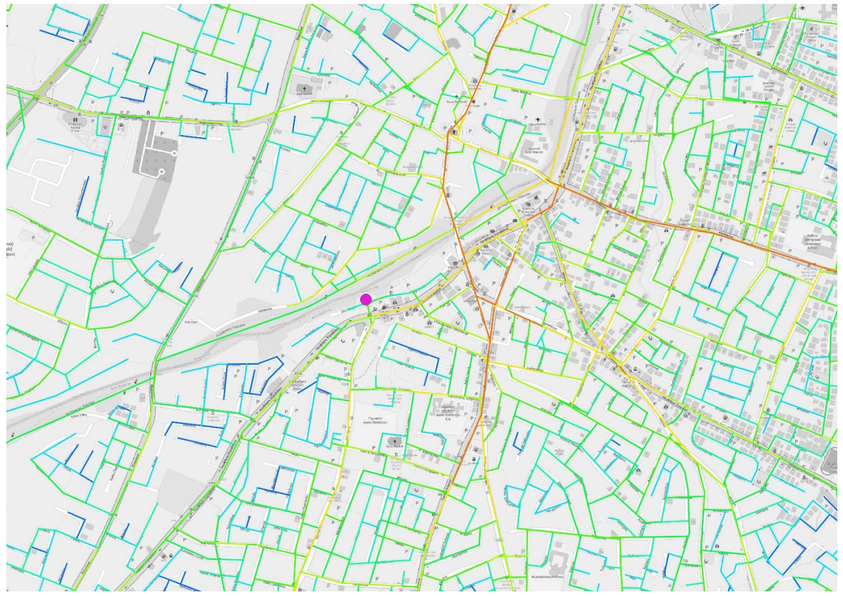
Alternative Bridge connectivity value: 1,458



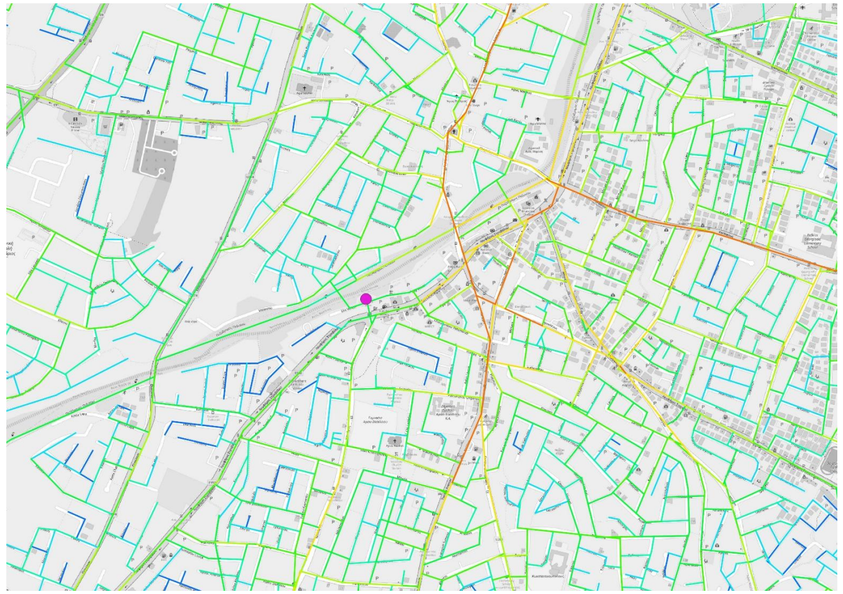
High Connectivity

Low Connectivity

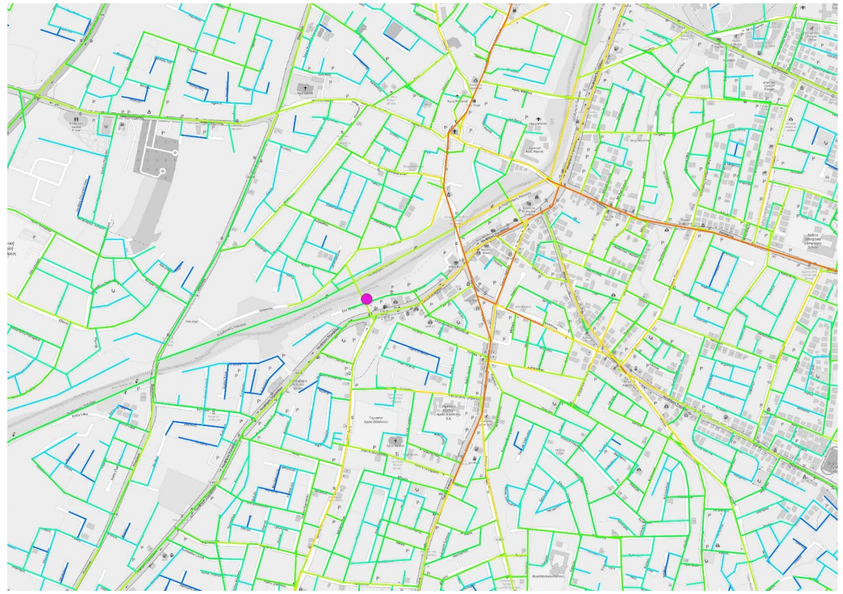
Easy to reach from places within 800m



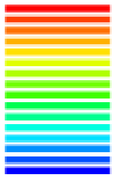
Existing



Masterplan Station accessibility value: 0,991



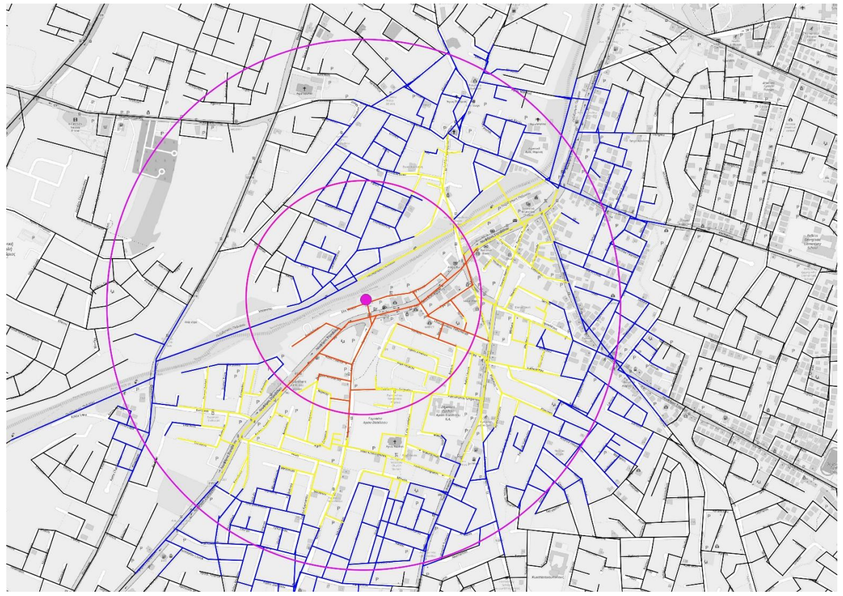
Alternative Station accessibility value: 0,980



High Connectivity

Low Connectivity

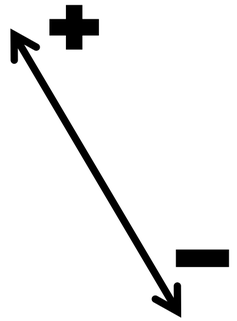
400-1200m network distance from bus station



Existing

Masterplan

Alternative



Within 400m

Within 800m

Within 1200m

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evaluating service provision

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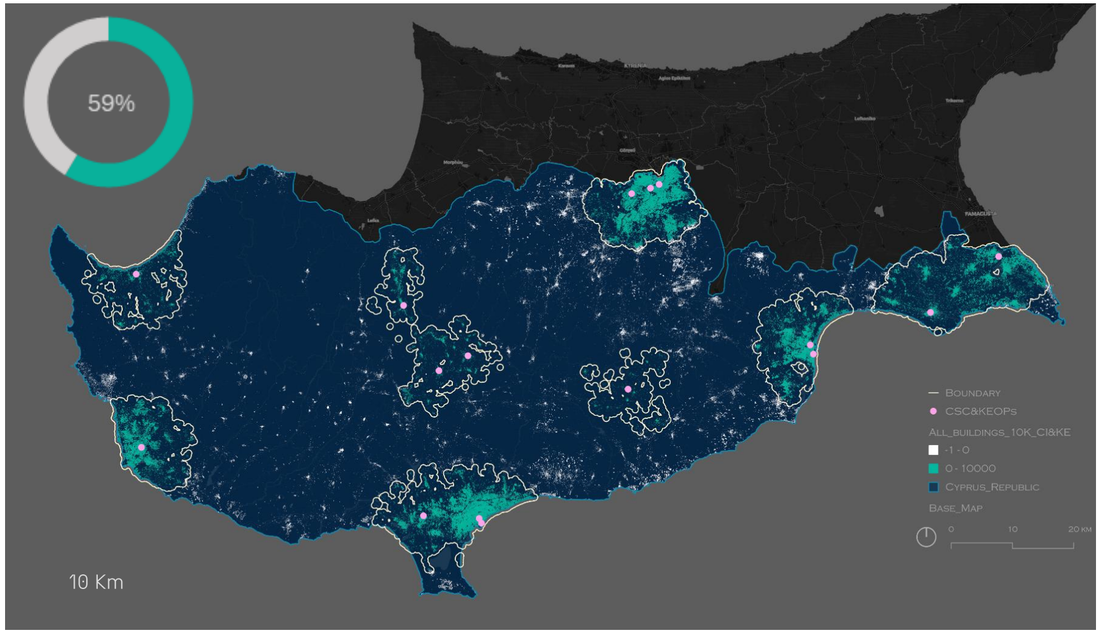
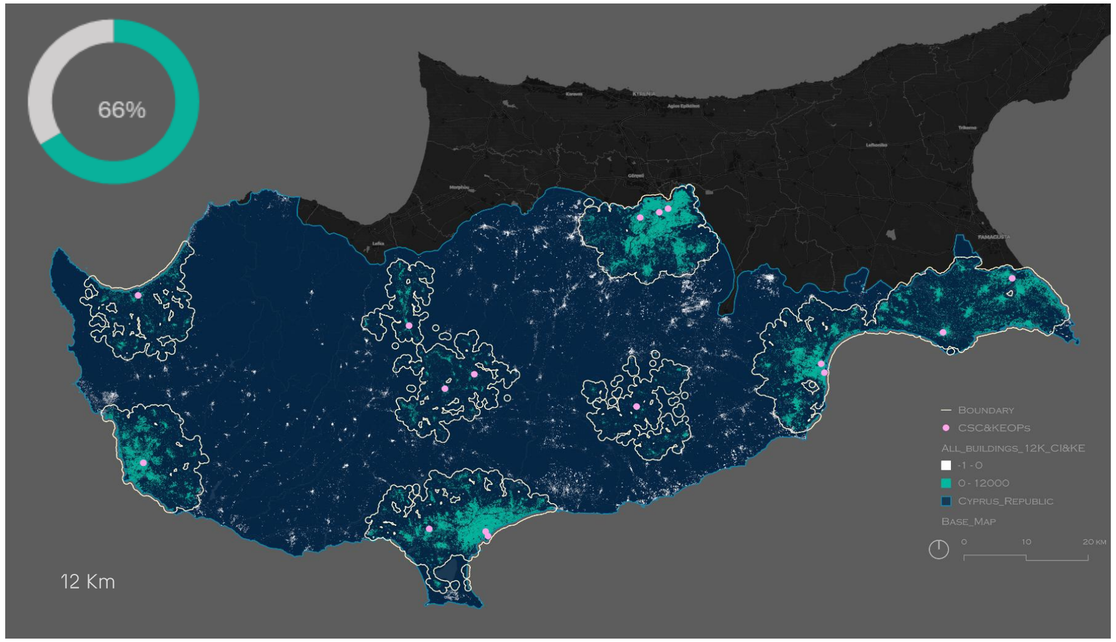
National scale: KEPs and KEPOs

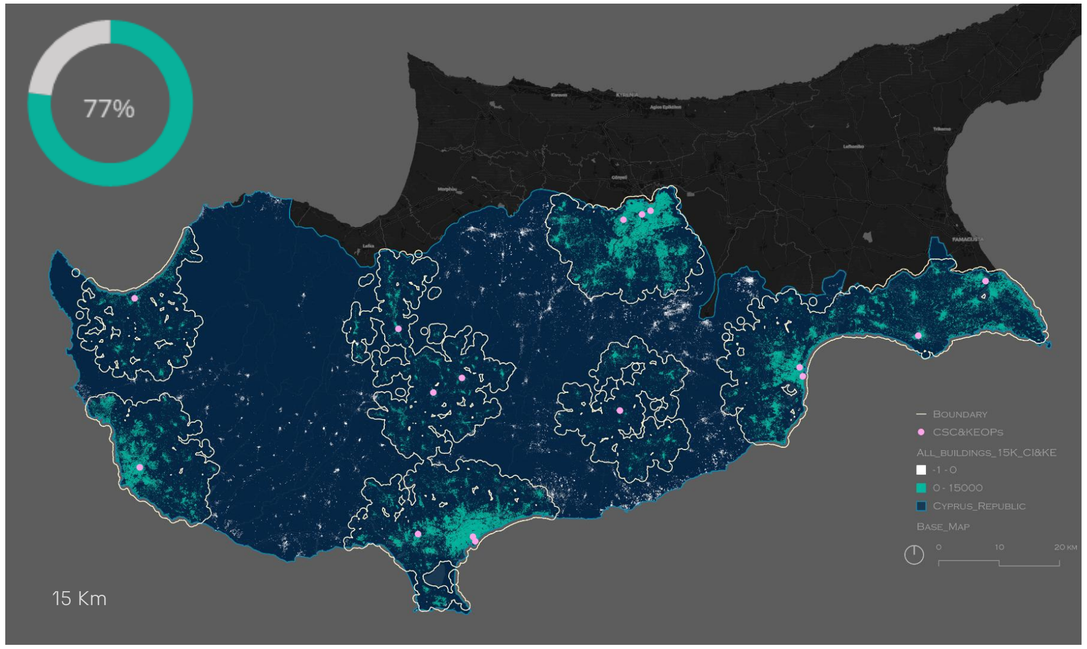
The national scale analysis reveals that the KEPs and KEPOs together serve:

- **59%** of the population at a 10Km distance
- **66%** of the population at a 12Km distance
- **77%** of the population at a 15Km distance

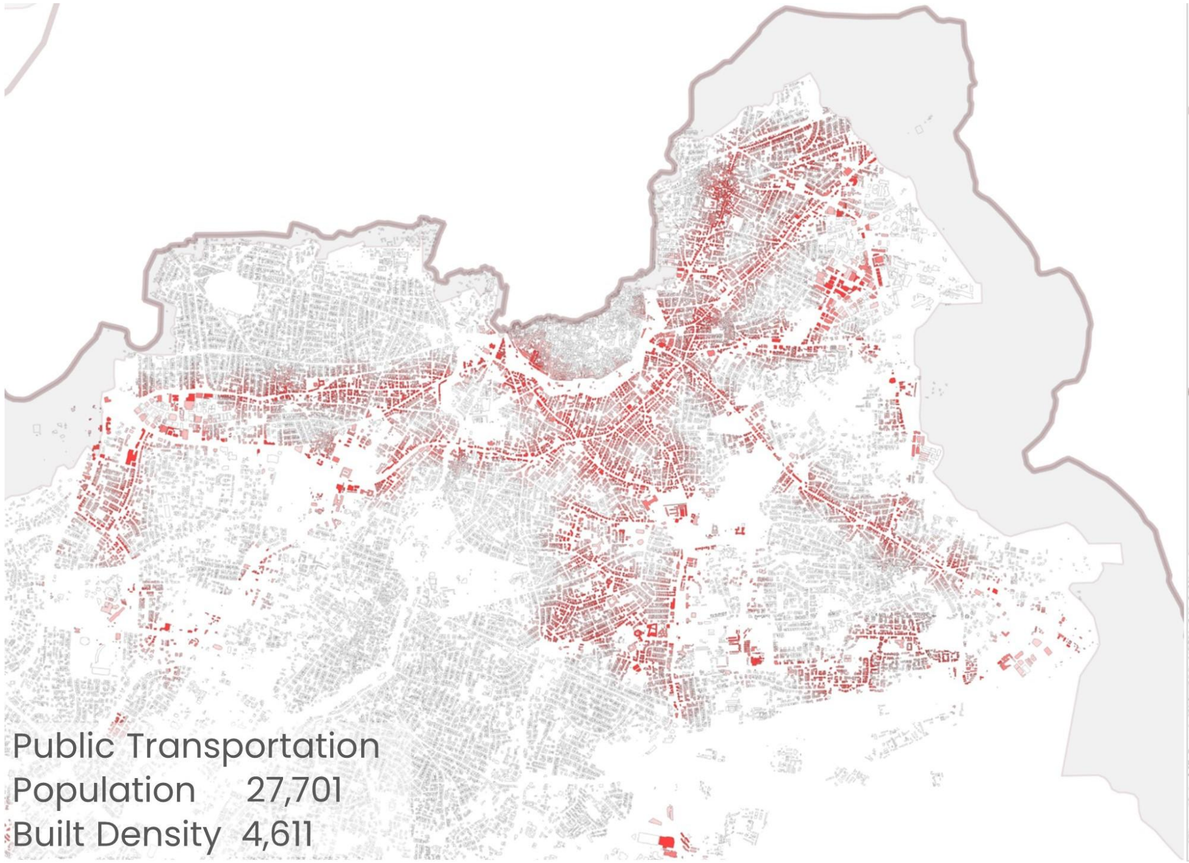
Underserved areas are identifiable in the maps even at a 15Km radius.

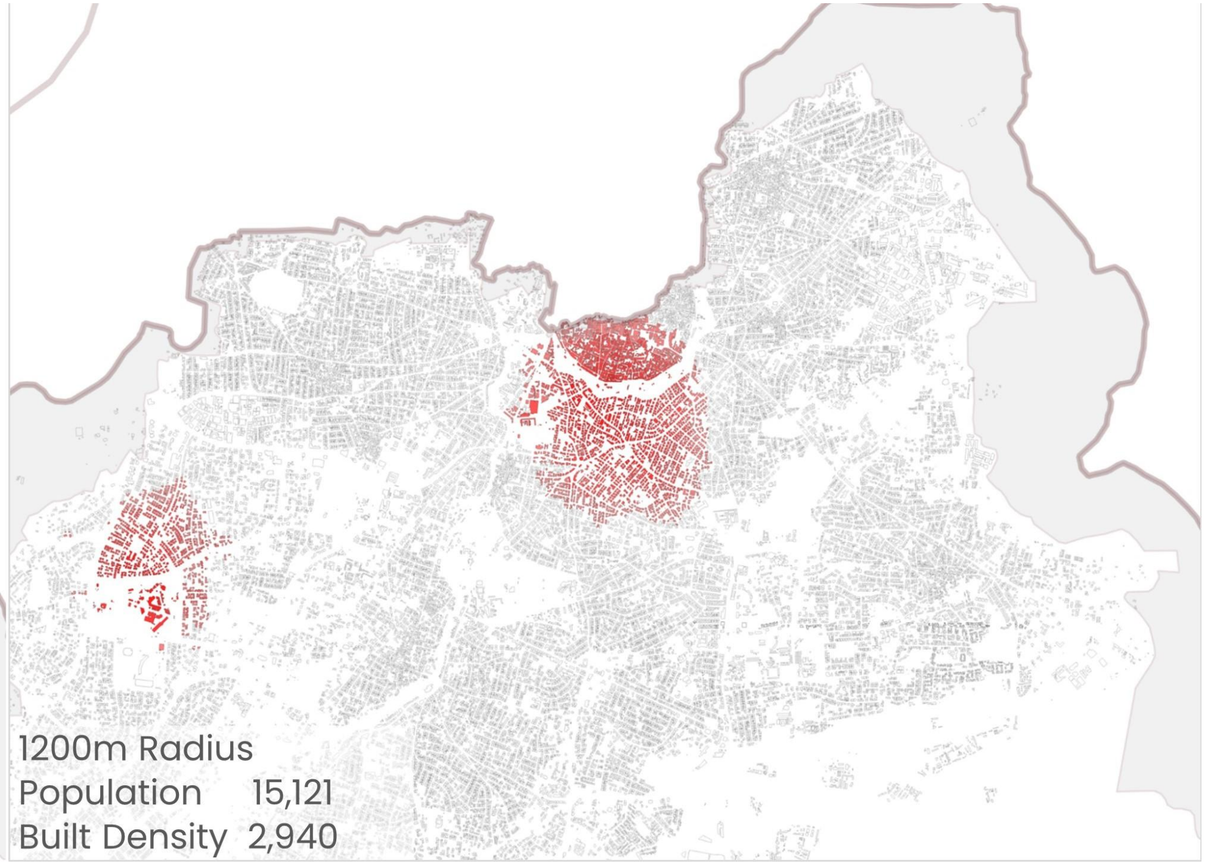






Urban scale: KEPs





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twinning towards
research excellence
in evidence-based planning
and urban design

TWIN2EXPAND

TWIN2EXPAND is a project funded by Horizon Europe. It aims to enhance research capacities in evidence-based urban design and planning (EBDP) as a field of critical importance in the R&I of integrated approaches and technologies for effective spatial planning and sustainable urban governance.

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UCL

CHALMERS UNIVERSITY OF TECHNOLOGY

Politecnico di Torino

Space Syntax

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This project has received funding from the European Union's Horizon Europe Research and Innovation Programme under Grant Agreement No. 101078890

UK Research and Innovation

This project has received funding from the UK Research and Innovation (UKRI) under the UK government's Horizon Europe funding guarantee under grant numbers 10052856 and 10050784.

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TWIN2EXPAND

What are the challenges and barriers of applying existing spatial models, KPIs and tools focusing on social-economic performance in *data challenging urban environments*?

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Generating lightweight models from open datasets. Uses python scrips, costumized

1 Download Extents

2 Download network

* can use custome boundaries

Primal and dual street network representations
The primal representation of street networks_ intersections are represented by nodes and streets by links.
Dual representation_ nodes correspond to streets and links correspond to the connections between them

"raw" network

"clean" network

Algorithmically clean a network,
(requires some time to experiment
with the underlying parameters)
Finally, edit the network directly in QGIS

3 Compute centrality

There are three network centrality methods available depending on whether we're using a node-based or segment-based approach, with the former available in both shortest and simplest (angular) variants.

4 Compute accessibility

Landuse Schema that includes POI

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Models

Testing deviation

LIGHT WEIGHT MODEL

Model built exclusivery with the Python workflows. No manual editing

HYBRID MODEL

Python workflows + manual review and editing*

COMPLETE MODEL

Model simplified using predefined methods from the Space Syntax toolkit, involving error removal and data generalization.

Angular Integration / Closeness Centrality

Angular/ Network Betweeness

Angular Choice/ Betweeness centrality

DEVIATION CALCULATION

(correlations of values outputted by the models).

Nicosia/Larnaca

* time spent, protocol

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Research question	Description	Scale
R1	Assessing the viability of <specific locations> based on population density that they will serve and their accessibility by different transport modes.	Urban
R2	What is the accessibility of amenities and services from and within Pedieos linear park [existing + masterplan].	Project
R3	What is the accessibility of the masterplan's waterfront / amenities and services from the waterfront.	Project
R4	What is the accessibility of green public spaces in relation to tree coverage [Nicosia].	Urban
R5	What is the accessibility of intercity bus stops + rural bus stops in relation to key services in the area between Larnaca and Nicosia.	Territorial
R6	What is the accessibility of heritage and cultural sites from cycling routes.	National

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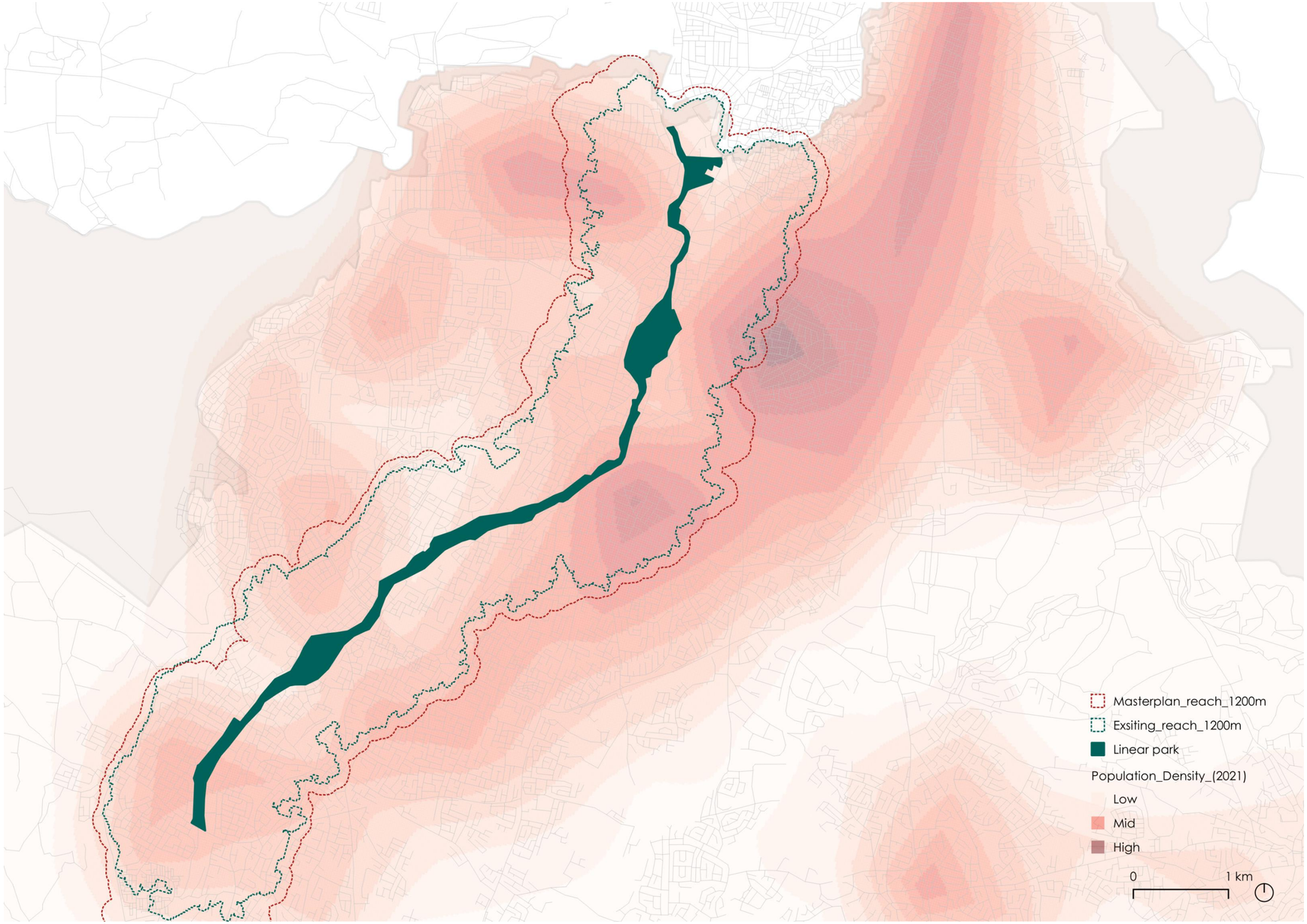
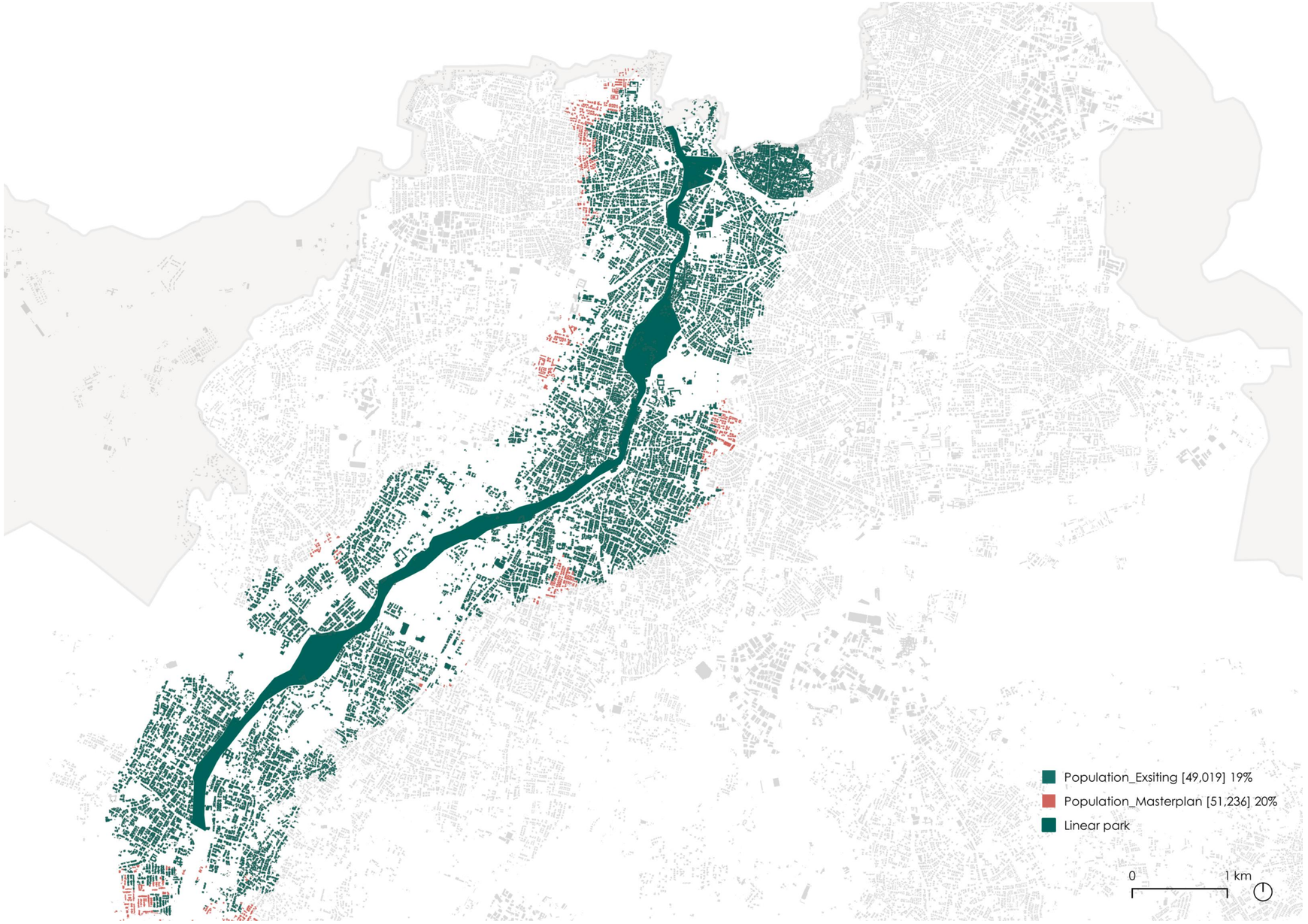
Pedieos: existing and masterplan. Density reach.



Pedieos: existing and masterplan. Population Reach.



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