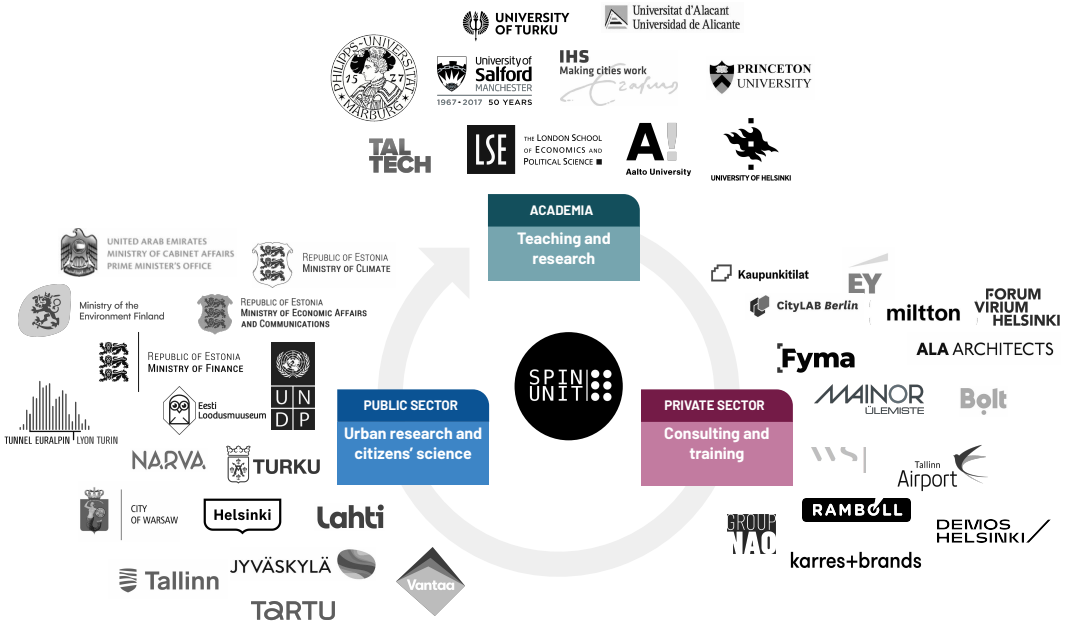
Tallinna teenuste ligipääsetavuse analüüs

30.01.2024

Urban research and innovation practice based in Tallinn / Helsinki



SPIN UNIT

Our team for this project

DAMIANO CERRONE	Urbanist, PI
JOHN HADAWAY	Data analyst
KRISTJAN MÄNNIGO	Data analyst

Develop urban accessibility framework

→ Easy to replicate

→ Easy to use and understand

→ Integrated into an interactive platform

Collect, clean and classify	Develop analytic method
Run accessibility analysis	Suggestions for indexes and development

"A reliable instrument for planners to support equitable urban development"

Provide an equal distribution and access to public and private resources

DATA INFORMED POLICY MAKING

DATA ANALYSIS
INSIGHTS

DEVELOP POLICY TARGETS

ACTIONS!

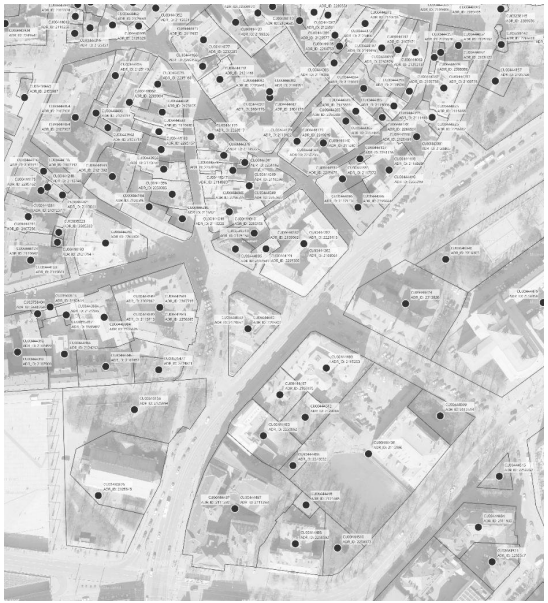
DATA ANALYSIS
TRACK AND EVALUATE POLICY TARGETS

HOW TO BUILD IT?

ORIGINS

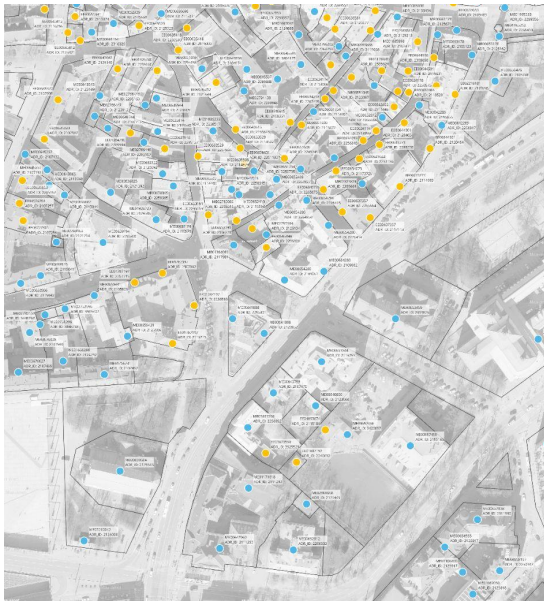
PARCEL ADDRESS POINTS

ADS address points (CU)	7 November 2023



BUILDINGS ADDRESS POINTS

ADS address points (EE, ME)	7 November 2023



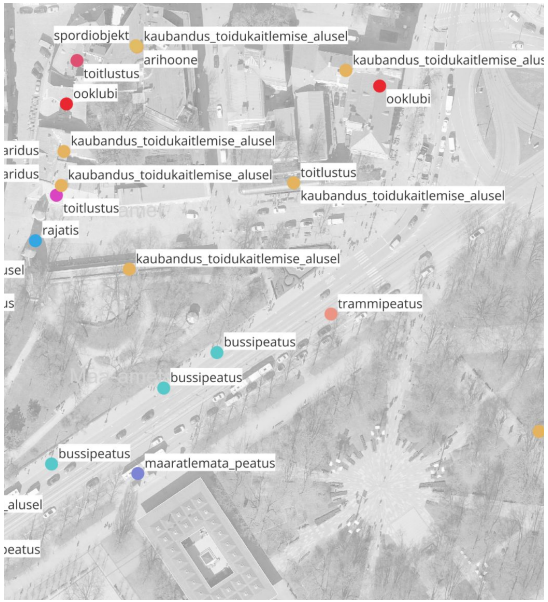
PARCELS

Land Board, Cadastral units	7 November 2023

DESTINATIONS

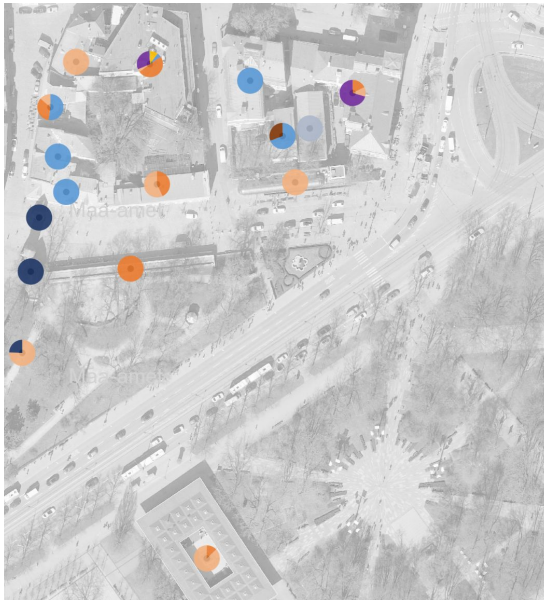
POINTS OF INTEREST

Land Board (LB) points of interest	November 2023
Schools, kindergartens (LB, EHIS)	Nov 2023, Jan 2024
Groceries, Open Street Map	January 2024



BUILDING USES - NET FLOOR AREA

Ehitisregister (EHR)	January 2024



GREEN AREAS

Tallinn LV, TAR	5 December 2023

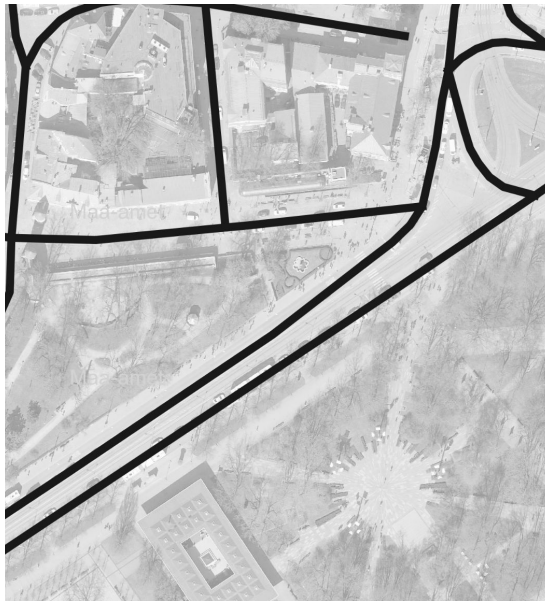
NETWORKS

PEDESTRIAN/BIKE NETWORK

Open Street Map	22 February 2024

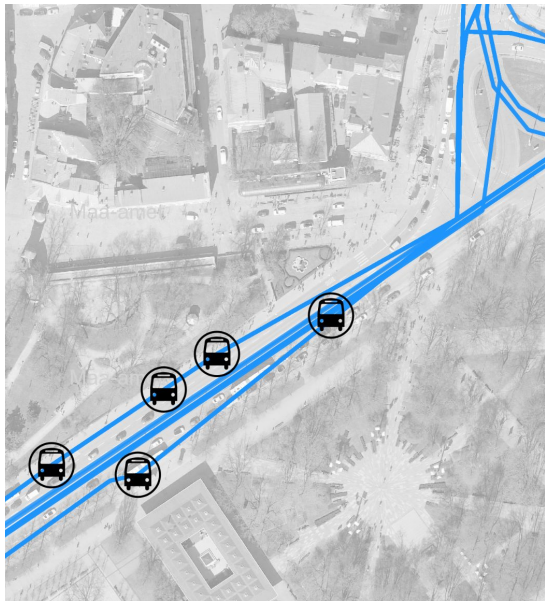
ROAD NETWORK

Open Street Map	22 February 2024



PUBLIC TRANSIT NETWORK

GTFS	16 November 2022



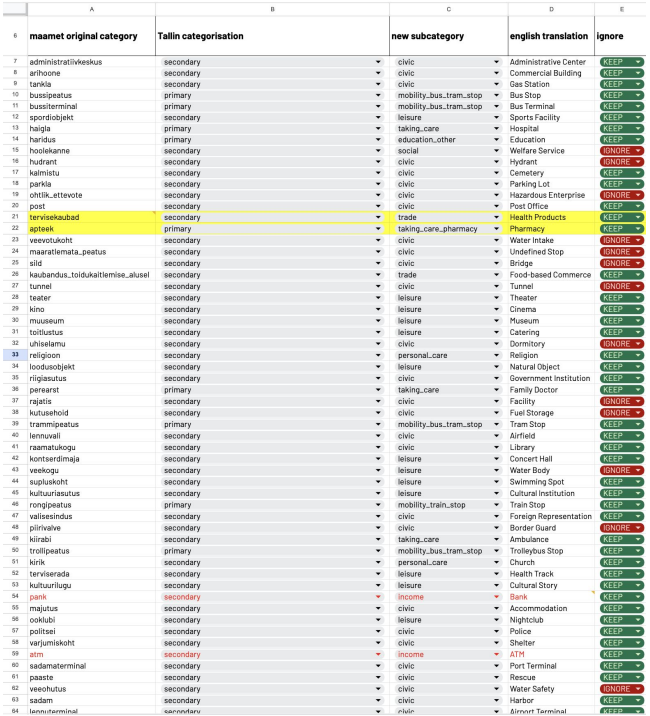
→ Tallinn city GIS specialists have manually updated the Open Street Map network.

MANUAL DATA CLASSIFICATION

Tallinn city specialists have manually classified all the destinations.

Reclassifying data is useful align the taxonomy of policy making with the one of the analyses

Primary schools, kindergartens	Hospitals, doctors, pharmacies	Bus, tram, train stops	Grocery stores, supermarkets…	Office buildings, banks…	Parks, forests	
Education	Taking care	Mobility	Nutrition	Income	Green areas	
PRIMARY DESTINATIONS (POIs)						
SECONDARY DESTINATIONS (POIs)						
Education	Civic	Leasure	Trade	Social	Personal care	Health network
Universities, Vocational schools	Post offices, services, parking	Bars, Restaurants, Cultural institutions	Food based commerce, health produces	Social services	Places of prayer	Cycling & hiking networks



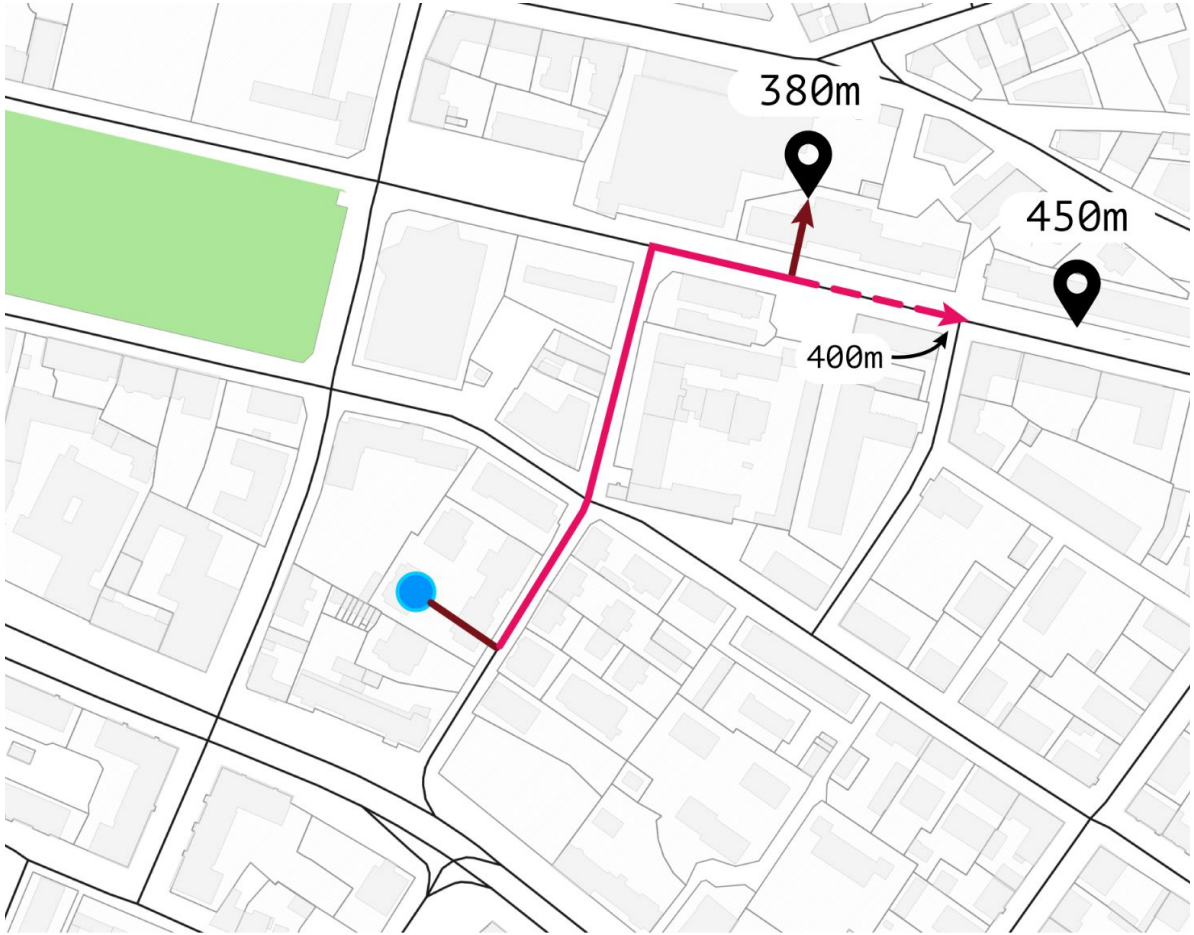
	A	B	C	D	E
6	maamet original category	Tallin categorisation	new subcategory	english translation	ignore
7	administratiivkeskus	secondary	civic	Administrative Center	KEEP
8	arihoone	secondary	civic	Commercial Building	KEEP
9	tankla	secondary	civic	Gas Station	KEEP
10	bussipeatus	primary	mobility_bus_tram_stop	Bus Stop	KEEP
11	bussiterminal	primary	mobility_bus_tram_stop	Bus Terminal	KEEP
12	spordiobjekt	secondary	leisure	Sports Facility	KEEP
13	haigla	primary	taking_care	Hospital	KEEP
14	haridus	primary	education_other	Education	KEEP
15	hoolekanne	secondary	social	Welfare Service	IGNORE
16	hudrant	secondary	civic	Hydrant	IGNORE
17	kalmistu	secondary	civic	Cemetery	KEEP
18	parkla	secondary	civic	Parking Lot	KEEP
19	ohtlik_ettevote	secondary	civic	Hazardous Enterprise	IGNORE
20	post	secondary	civic	Post Office	KEEP
21	tervisekaubad	secondary	trade	Health Products	KEEP
22	apteek	primary	taking_care_pharmacy	Pharmacy	KEEP
23	veevotukoht	secondary	civic	Water Intake	IGNORE
24	maaratlemata_peatus	secondary	civic	Undefined Stop	IGNORE
25	sild	secondary	civic	Bridge	IGNORE
26	kaubandus_toidukaitlemise_alusel	secondary	trade	Food-based Commerce	KEEP
27	tunnel	secondary	civic	Tunnel	IGNORE
28	teater	secondary	leisure	Theater	KEEP
29	kino	secondary	leisure	Cinema	KEEP
30	muuseum	secondary	leisure	Museum	KEEP
31	toitlustus	secondary	leisure	Catering	KEEP
32	uhiselamu	secondary	civic	Dormitory	IGNORE
33	religioon	secondary	personal_care	Religion	KEEP
34	loodusobjekt	secondary	leisure	Natural Object	KEEP
35	riigiasutus	secondary	civic	Government Institution	KEEP
36	perearst	primary	taking_care	Family Doctor	KEEP
37	rajatis	secondary	civic	Facility	IGNORE
38	kutusehoid	secondary	civic	Fuel Storage	IGNORE
39	trammipeatus	primary	mobility_bus_tram_stop	Tram Stop	KEEP
40	lennuvali	secondary	civic	Airfield	KEEP
41	raamatukogu	secondary	civic	Library	KEEP
42	kontserdimaja	secondary	leisure	Concert Hall	KEEP
43	veekogu	secondary	leisure	Water Body	IGNORE
44	supluskoht	secondary	leisure	Swimming Spot	KEEP
45	kultuuriasutus	secondary	leisure	Cultural Institution	KEEP
46	rongipeatus	primary	mobility_train_stop	Train Stop	KEEP
47	valisessindus	secondary	civic	Foreign Representation	KEEP
48	piirivalve	secondary	civic	Border Guard	IGNORE
49	kiirabi	secondary	taking_care	Ambulance	KEEP
50	trollipeatus	primary	mobility_bus_tram_stop	Trolleybus Stop	KEEP
51	kirik	secondary	personal_care	Church	KEEP
52	terviserada	secondary	leisure	Health Track	KEEP
53	kultuuriilugu	secondary	leisure	Cultural Story	KEEP
54	pank	secondary	income	Bank	KEEP
55	majutus	secondary	civic	Accommodation	KEEP
56	ooklubi	secondary	leisure	Nightclub	KEEP
57	politsei	secondary	civic	Police	KEEP
58	varjumiskoht	secondary	civic	Shelter	KEEP
59	atm	secondary	income	ATM	KEEP
60	sadamaterminal	secondary	civic	Port Terminal	KEEP
61	paaste	secondary	civic	Rescue	KEEP
62	veeohutus	secondary	civic	Water Safety	IGNORE
63	sadam	secondary	civic	Harbor	KEEP
64	lennuterminal	secondary	civic	Airport Terminal	KEEP

BUILD ANALYTIC FRAMEWORK

PEDESTRIAN OR CYCLIST NETWORK ANALYSIS

Origin → destination analysis along the pedestrian and cyclist networks.

1 - We interpolate the network's edges.	The network edges are interpolated at 25m intervals, creating new nodes.
2 - The origins and destinations are snapped to the closest node along the network.	For each origin and destination, the closest node within a maximum search radius of 400m is found and snapped to.
3 - We calculate the distance from each snapped origin to each snapped destination.	From each snapped origin, we find the shortest paths (Dijkstra's) to snapped destinations that are within a maximum search radius, greater than the length of the largest relevant distance.
4 - We then tally the counts of the different categories.	For each relevant distance (i.e 500m, 1200m), the categories of the destinations that are reached within it are tallied.



PEDESTRIAN OR CYCLIST NETWORK ANALYSIS

Origin → destination analysis along the pedestrian and cyclist networks.

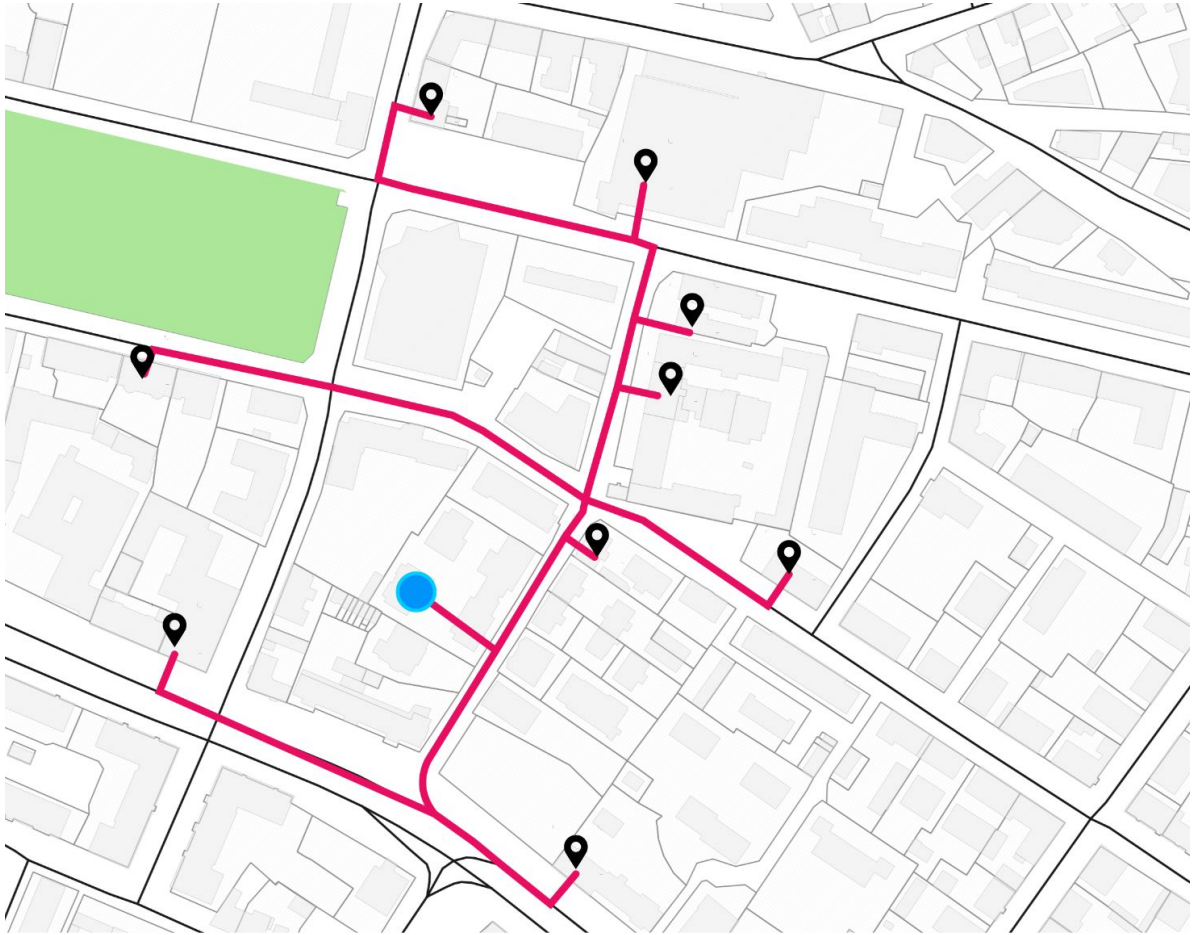
1 - From every building in Tallinn, find all the destinations within a given distance for pedestrian and bicycles and travel time.

2a - If they are an service, count how many are reached.

2b - If they are a building or park, count their net floor area

3 - Combine all the data back to the origin.

4 - Transfer the data to the cadastral parcels.



PEDESTRIAN + CYCLIST NETWORK ANALYSIS

Handling destinations for which we need to capture their floor area (Green area and Net Floor Area of building uses) along the pedestrian and cyclist networks.

Public green areas (Tallinna Strateegiakeskus)	The polygons are gridded at 50m intervals, and the centroids of those grid cells become points. These points are then snapped, per the method described earlier. If multiple points belonging to a single green area are reached from an origin, that green area is only counted once.
Cycling/health network (Maa-amet + Tallinna Strateegiakeskus)	The cycling/health network is converted to points at a 50m interval, and those points are snapped to the network per the method described earlier. The cycling/health network is treated as one entity, so the maximum count from an origin is one.

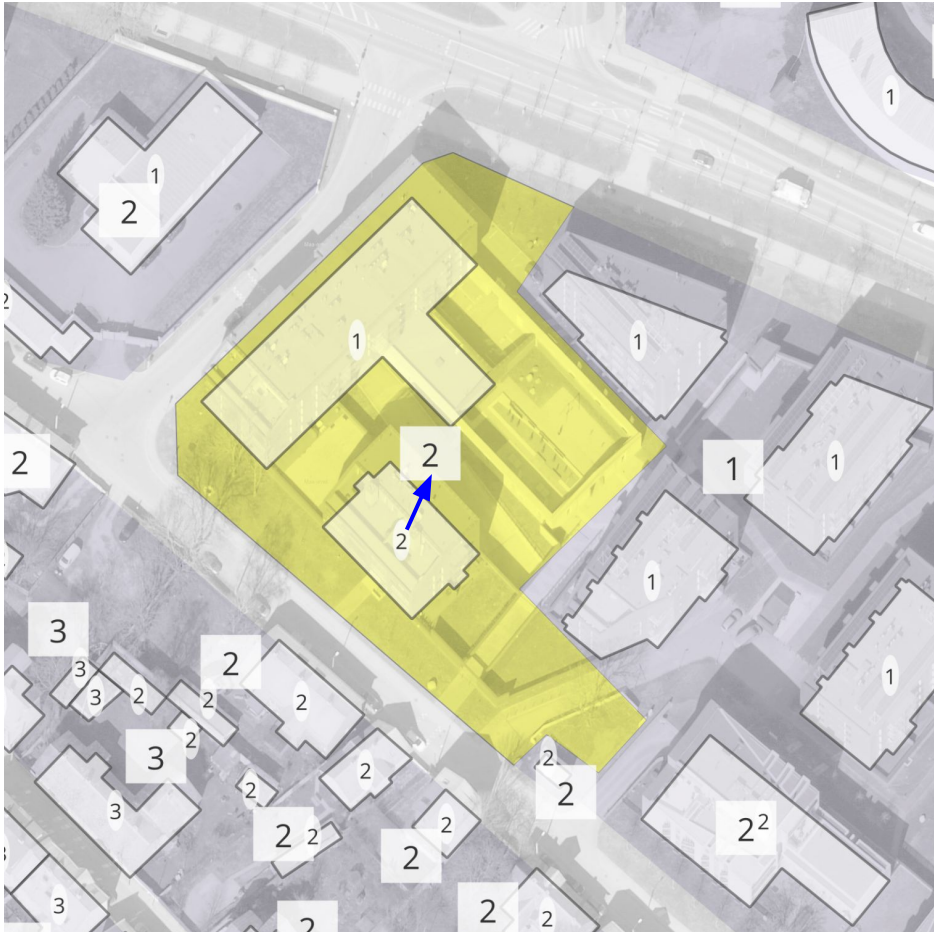
AGGREGATION

The highest value from each address point within the parcel is recorded and used as the starting point for the indices

IF THERE IS MORE THAN ONE BUILDING PER CADASTRAL PARCEL.

COUNT - We pick the building with the highest count of destinations reached on the block and avoid using very low values from buildings in the backyard.

AREA SUM - We don't add up the areas because it would cause us to count the same space more than once when we analyze square meters per person reached.



CREATE METRICS AND INDEXES

Any metric and index can be developed and mapped for each address point, building or parcel in the city.

Building ID	Network	Grocery 400m	Grocery 1200m	Grocery 5000m	Grocery 30mins	[Destination]_[Distance/time]_[Unit]	Parcel ID
ID1	Pedestrian	2	3	null	null	[value]	PID1
ID1	Cyclist	null	2	7	null	[value]	PID1
ID1	Public transportation	null	null	null	10	[value]	PID1
ID2	Pedestrian	1	5	null	null	[value]	PID1
ID2	Cyclist	null	3	9	null	[value]	PID1

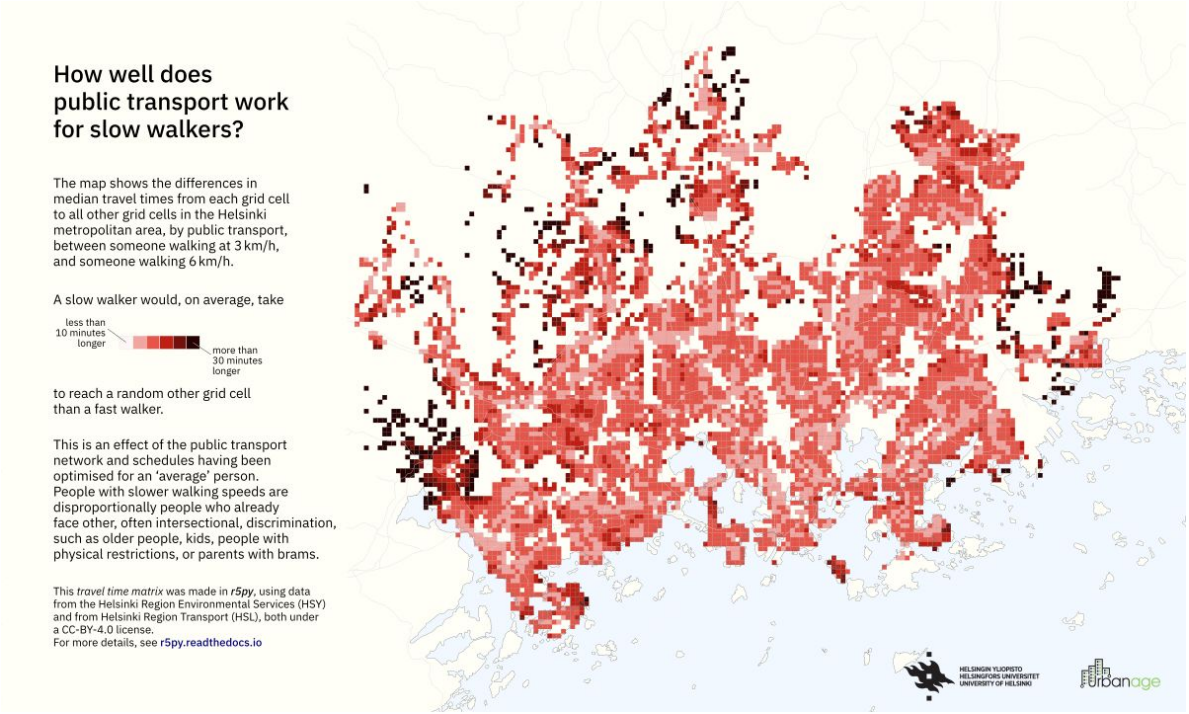
500 data columns for each building

Parcel ID	PRIMARY SERVICE INDEX	SECONDARY SERVICE INDEX
PID1	[value]	[value]
PID2	[value]	[value]
PID3	[value]	[value]

MOTORIST AND PUBLIC TRANSIT

r5py: Rapid Realistic Routing with R5 in Python.

Fink, C., Klumpenhouwer, W., Saraiva, M., Pereira, R., & Tenkanen, H., 2022: DOI:10.5281/zenodo.7060437

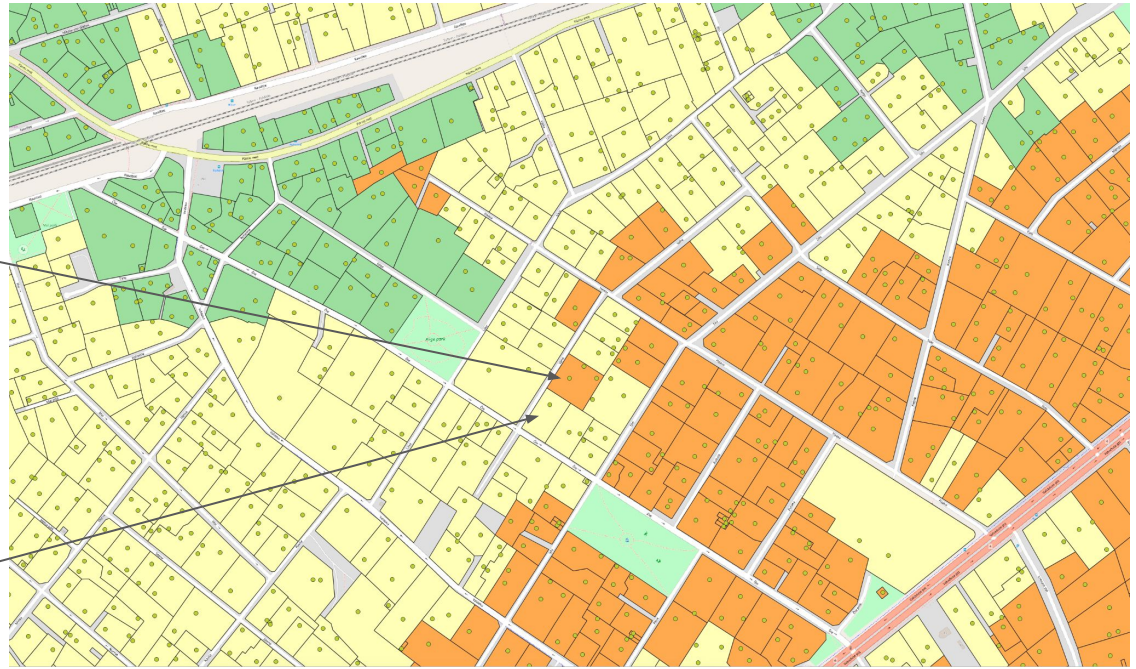


VALIDATION

We created a debugging tool that allows us to explore individual cases.

ID: A
Civic services within 15 minutes: **7**

ID: B
Civic services within 15 minutes: **14**



INITIAL INDEX AND METRICS

TALLINN ACCESSIBILITY INDEX

Threshold based index

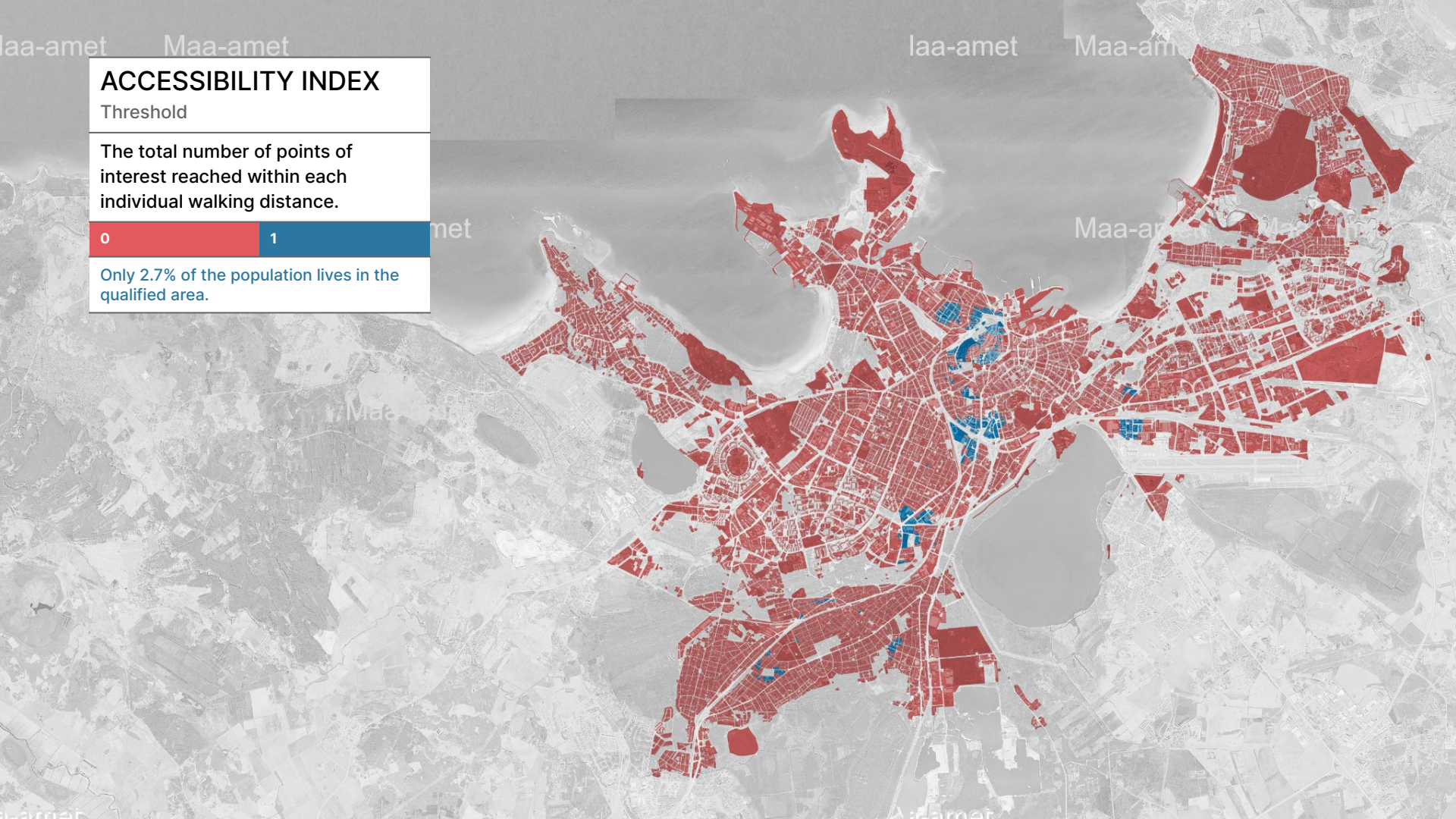
Primary education place (municipal, state,private)	1200m
Kindergarten (municipal, private)	1200m
Train stop	1000m
Bus / tram stop	400m
Grocery store	800m
Pharmacy	800m
Green area	300m
Health network	500m

CONDITIONS NOT MET ON PARCEL
7/8 conditions met (TUNNUS:78408:801:1580)

Primary education place (municipal, state,private) within 1200m	2
Kindergarten (municipal, private) within 1200m	2
Train stop within 1000m	1
Bus / tram stop within 400m	1
Grocery within 800m	1
Pharmacy within 800m	1
Green area within 300m	0
Health network within 500m	1

CONDITIONS MET ON PARCEL
8/8 conditions met (TUNNUS: 78408:801:2560)

Primary education place (municipal, state,private) within 1200m	2
Kindergarten (municipal, private) within 1200m	3
Train stop within 1000m	2
Bus / tram stop within 400m	2
Grocery within 800m	3
Pharmacy within 800m	3
Green area within 300m	1
Health network within 500m	1


ACCESSIBILITY INDEX
Threshold
The total number of points of interest reached within each individual walking distance.
0
1
Only 2.7% of the population lives in the qualified area.

ACCESS TO TRAIN

Along the pedestrian network

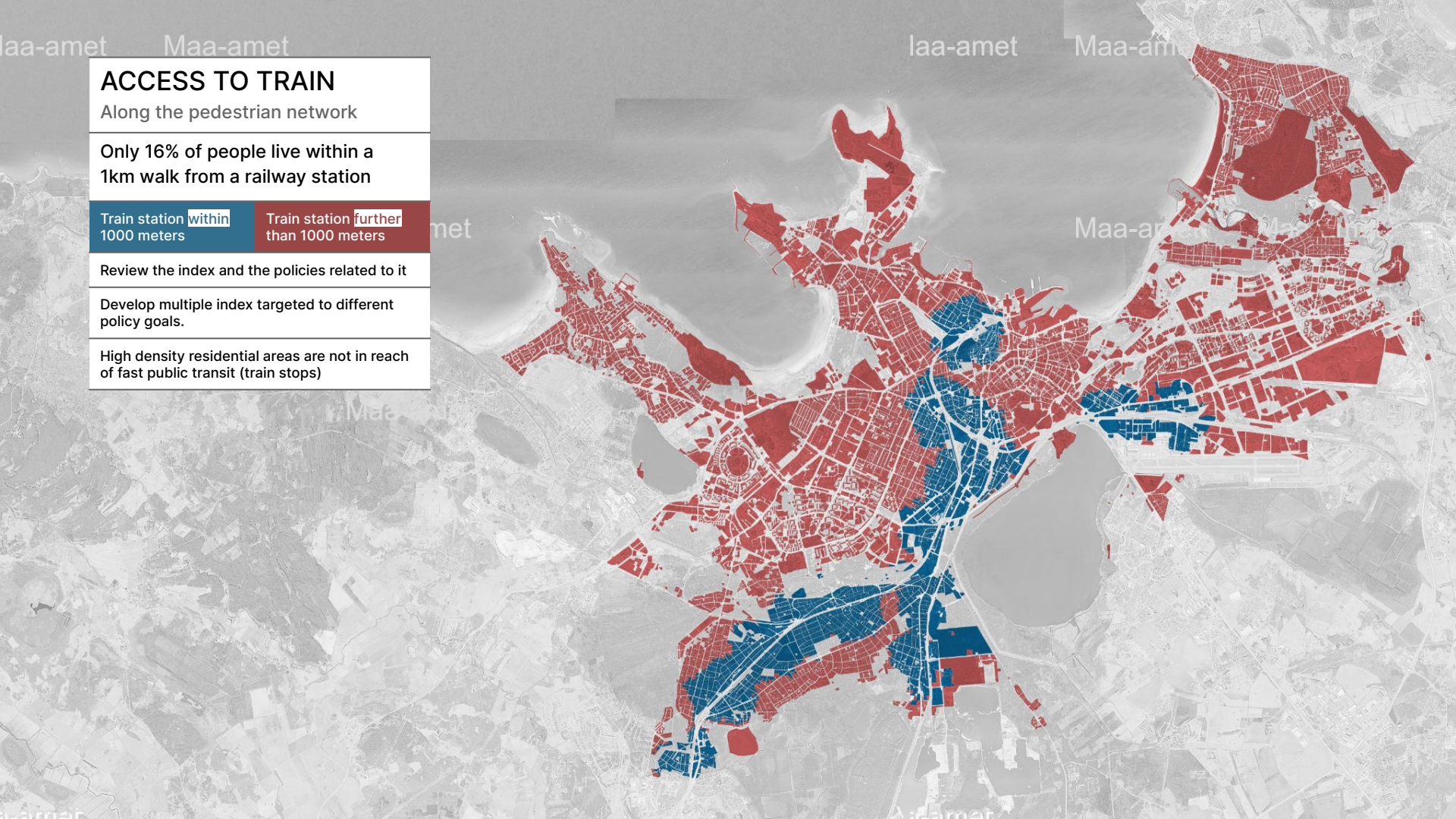
Only 16% of people live within a 1km walk from a railway station

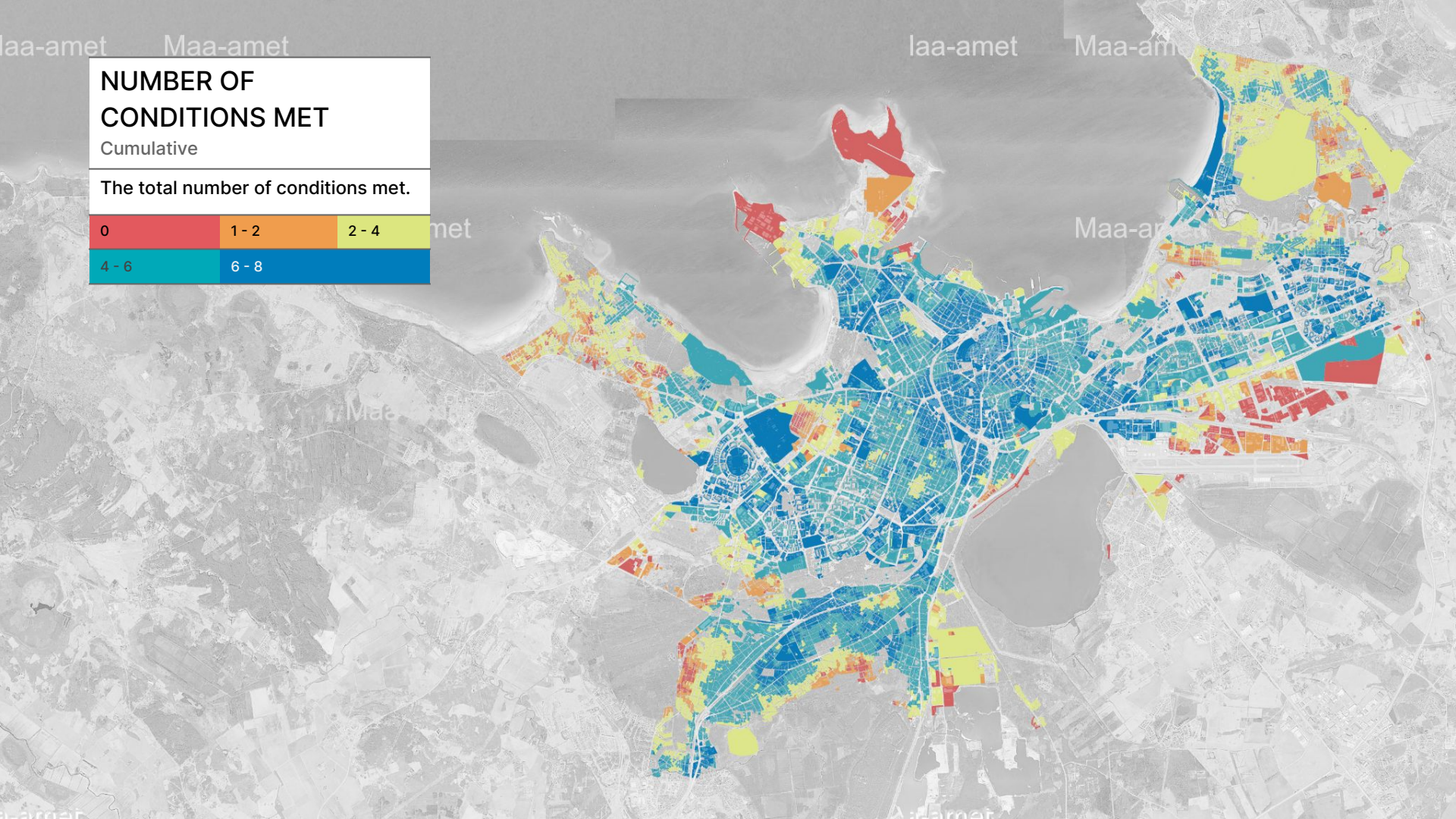
Train station within 1000 meters	Train station further than 1000 meters

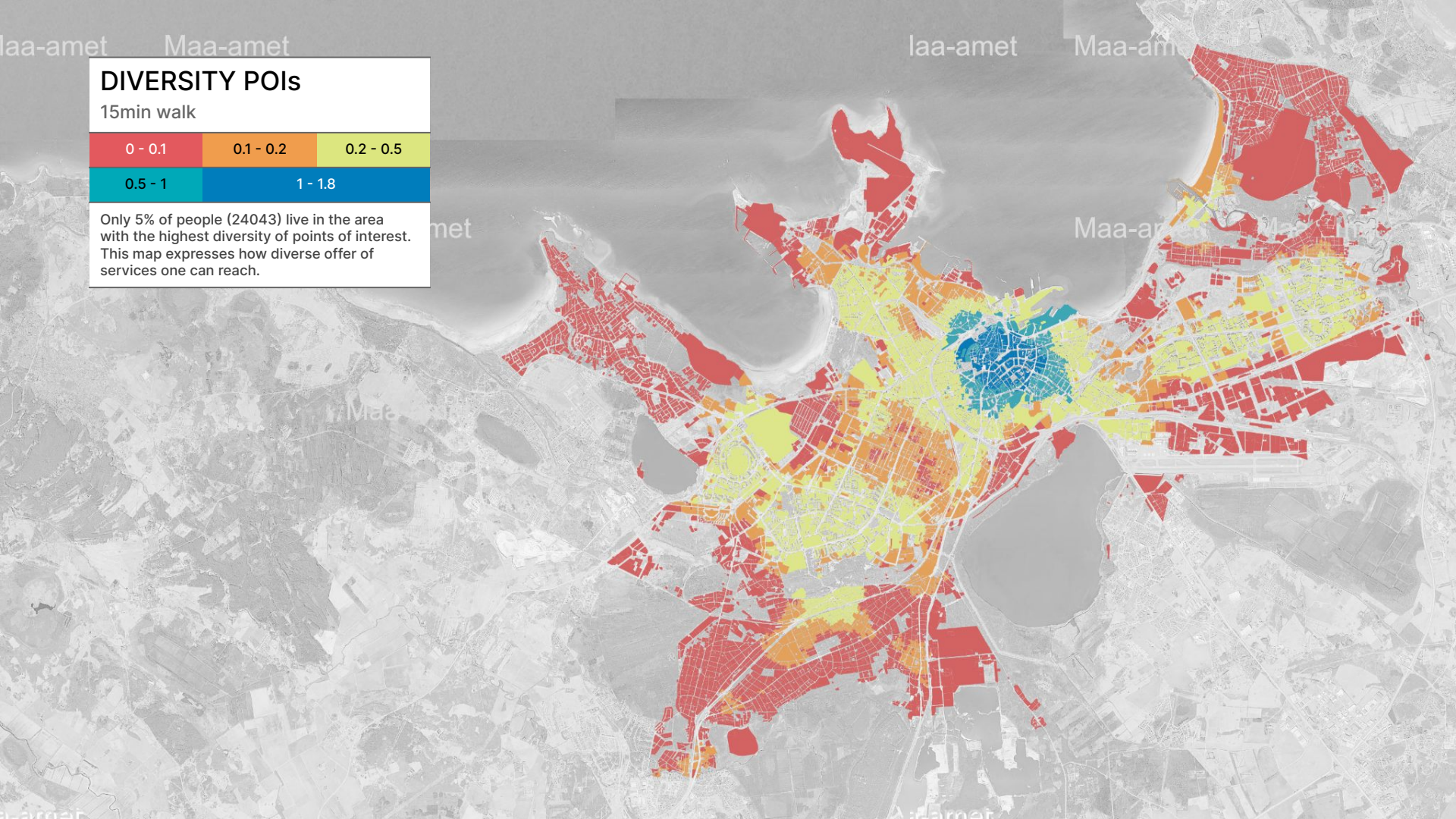
Review the index and the policies related to it

Develop multiple index targeted to different policy goals.

High density residential areas are not in reach of fast public transit (train stops)




NUMBER OF CONDITIONS MET
Cumulative
The total number of conditions met.
0
1 - 2
2 - 4
4 - 6
6 - 8


DIVERSITY POIs
15min walk
0 - 0.1
0.1 - 0.2
0.2 - 0.5
0.5 - 1
1 - 1.8
Only 5% of people (24043) live in the area with the highest diversity of points of interest. This map expresses how diverse offer of services one can reach.

HUMAN CENTRIC METRICS AND INDICES

How many people have access to primary and secondary services?

"A reliable instrument for planners to support equitable urban development"

Provide an equal distribution and access to public and private resources

Service accessibility analysis of Tallinn

Population data by building

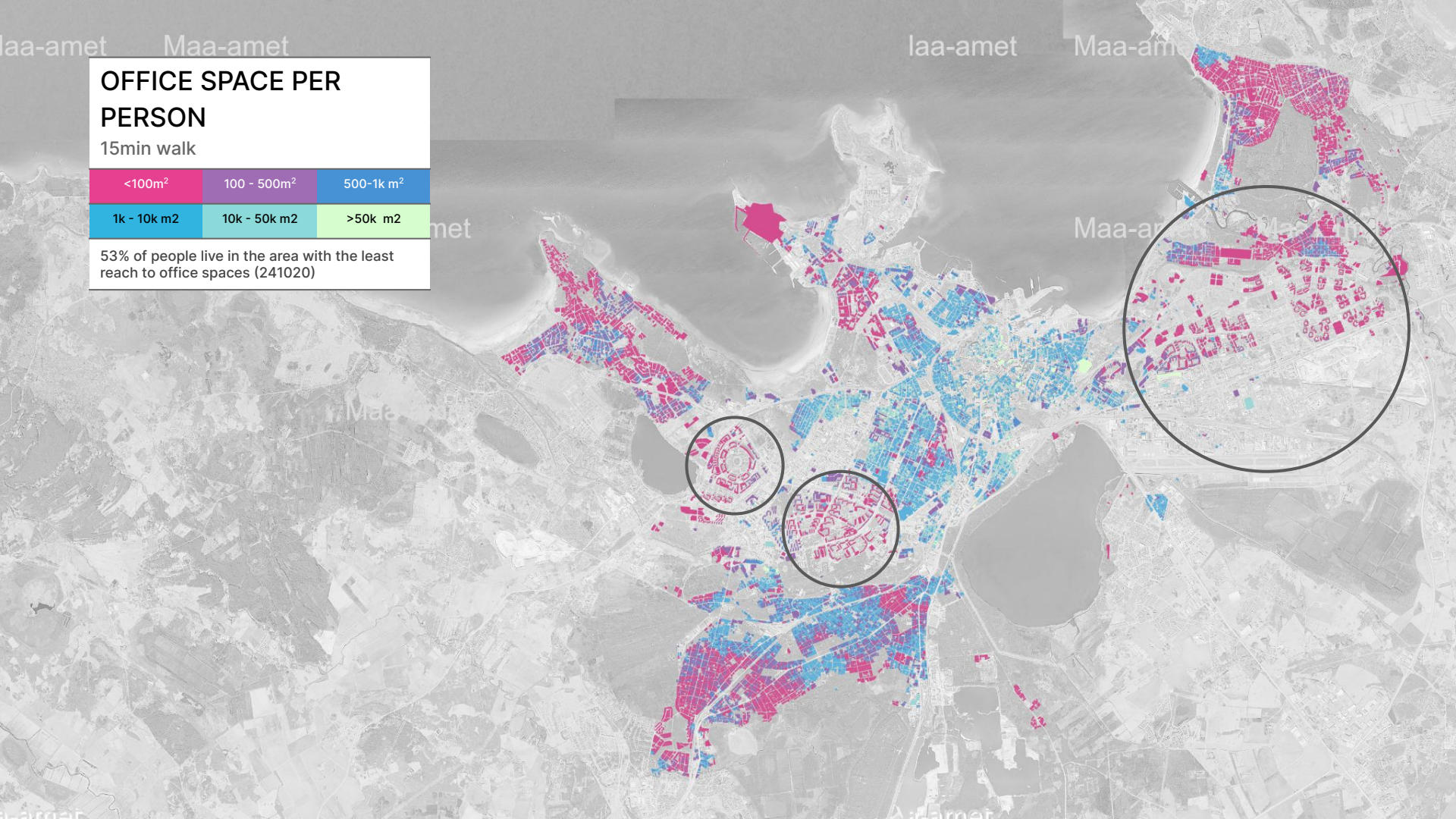
PRIMARY ACTIVITIES PER-PERSONS

15min walk

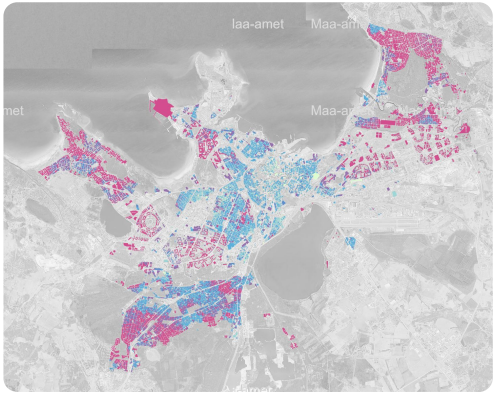
< 3	3 - 5	5 - 10
10 - 20	> 20	

85% of Tallinn population have less than 3 primary activities within a 15min walk

Review classification method

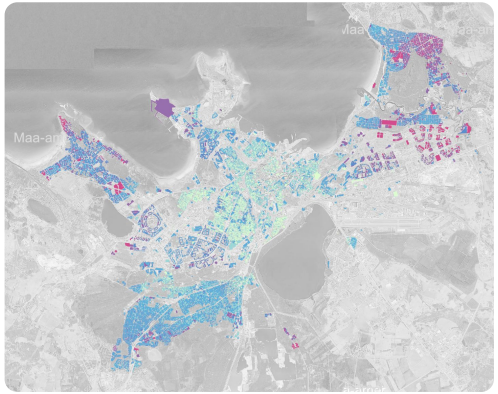

OFFICE SPACE PER PERSON
15min walk
<100m²
100 - 500m²
500-1k m²
1k - 10k m2
10k - 50k m2
>50k m2
53% of people live in the area with the least reach to office spaces (241020)

COMPARING ACCESSIBILITY ACROSS MOBILITY MODES



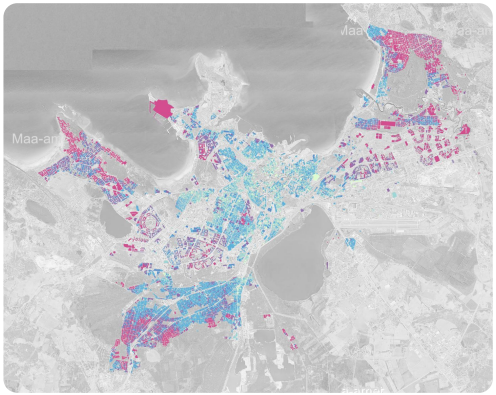
15min WALK

53% of people live in the area with the least reach to office spaces



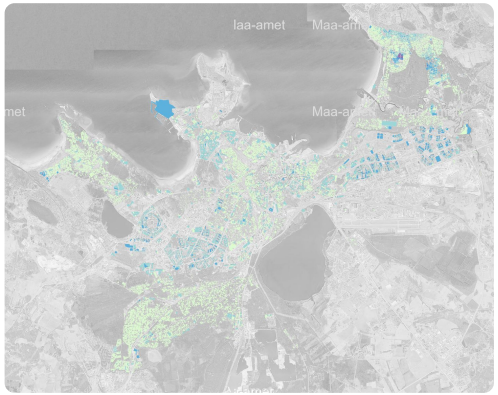
15 MIN CYCLING

7% of people live in the area with the least reach to office spaces (241020)



15min PUBLIC TRANSPORT

33% of people live in the area with the least reach to office spaces



15min DRIVE

0% of people live in the area with the least reach to office spaces (241020)

INSIGHT - DATA ANALYSIS - DEFINE POLICY TARGETS

Biodiversity intervention enhances immunoregulatory pathways and provide an incentive to reduce the risk of immune-mediated diseases in urban societies.

We analyzed changes in the skin, gut microbiota and blood immune markers of children during a 28-day biodiversity intervention.

The World Health Organization (WHO) has suggested that every city should have a minimum of 9 square metres of green space per person

Zhang et al., 2020; . discussed the impact mechanism of urban green spaces in promoting public health, highlighting the need to understand the complex impact mechanism behind it

Kameoka et al., 2022; . emphasized the benefits of urban greenery for people's lives from public health and social scientific perspectives.

Konijnendijk, 2022; . recognized the important contributions of urban trees and green spaces to climate moderation and public health

Long et al., 2022; . highlighted the benefits of green space accessibility for promoting physical and mental health of urban residents.

Mizen et al., 2019; . access to green-blue spaces, such as parks and beaches, may provide opportunities to support and promote good public mental health and well-being (Mizen et al., 2019).

GREENERY P-PERSON

M2 of green area per person within a 15min walk

20 444 people have less than 9 m2 publicly accessible green area (parks)

60% of residential parcels have more than 5000m2 of parks per person
176 007 people

<9m²/pop	9-100m²/pop	100-250m²/pop
250-1k m²/pop	1k-5k m²/pop	>5k m²/pop

Suggest adding the newly released tree canopy cover.

Suggest develop a block-based green factor

Pelgulinna

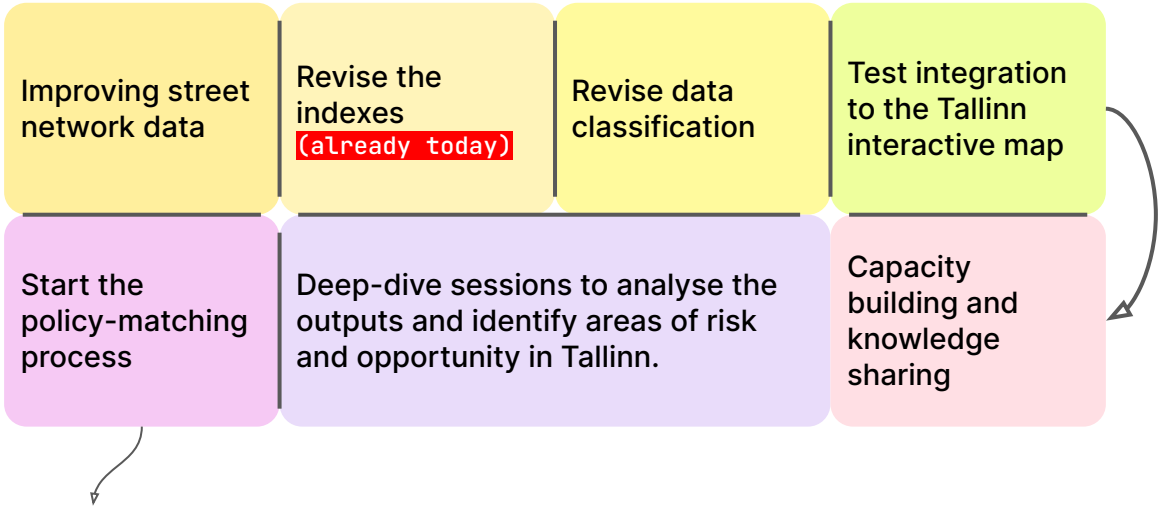
Kristiine

Mustika Keskus

Kitseküla

DEVELOPING A LOCAL DEFINITION OF 15MIN CITY

Defining and mapping the conditions for good city life in Tallinn



Internal sessions amongst GIS specialists, strategists and policymakers to establish which metrics should be used or developed to track policies.

Turku Open Platform

Choose walking distance: 200 400 800m 1200m

Set anchors on the map: POI 1 POI 2 POI 3

Space

Building Reach	6.4	4.5	5.3
FAR	8.7	8.5	7.7
Pedestrian Access	7.8	7.5	8.7
Urban Access	6.8	7.2	7.4
Walkability	6.6	7.2	7.6

Activities

Consumption	6.9	7.4	4.2
Mobility	6.3	6.4	5.9
Necessary Activities	7.4	7.4	7.7
Optional Activities	8.2	8.6	7.7
	9.2	9.2	9.4
	6.8	6.5	4
Lively Places	6.1	6.4	4.3
Popular Indoor	4.6	6.3	3.3
Popular Outdoor	5.7	7.4	4.7
Real Estate	5.4	4.5	5

Measures the ability to reach urban amenities that host and foster activities for the free time, such as leisure, shopping, doing sport or social activities.

Show selected heatmaps: FAR