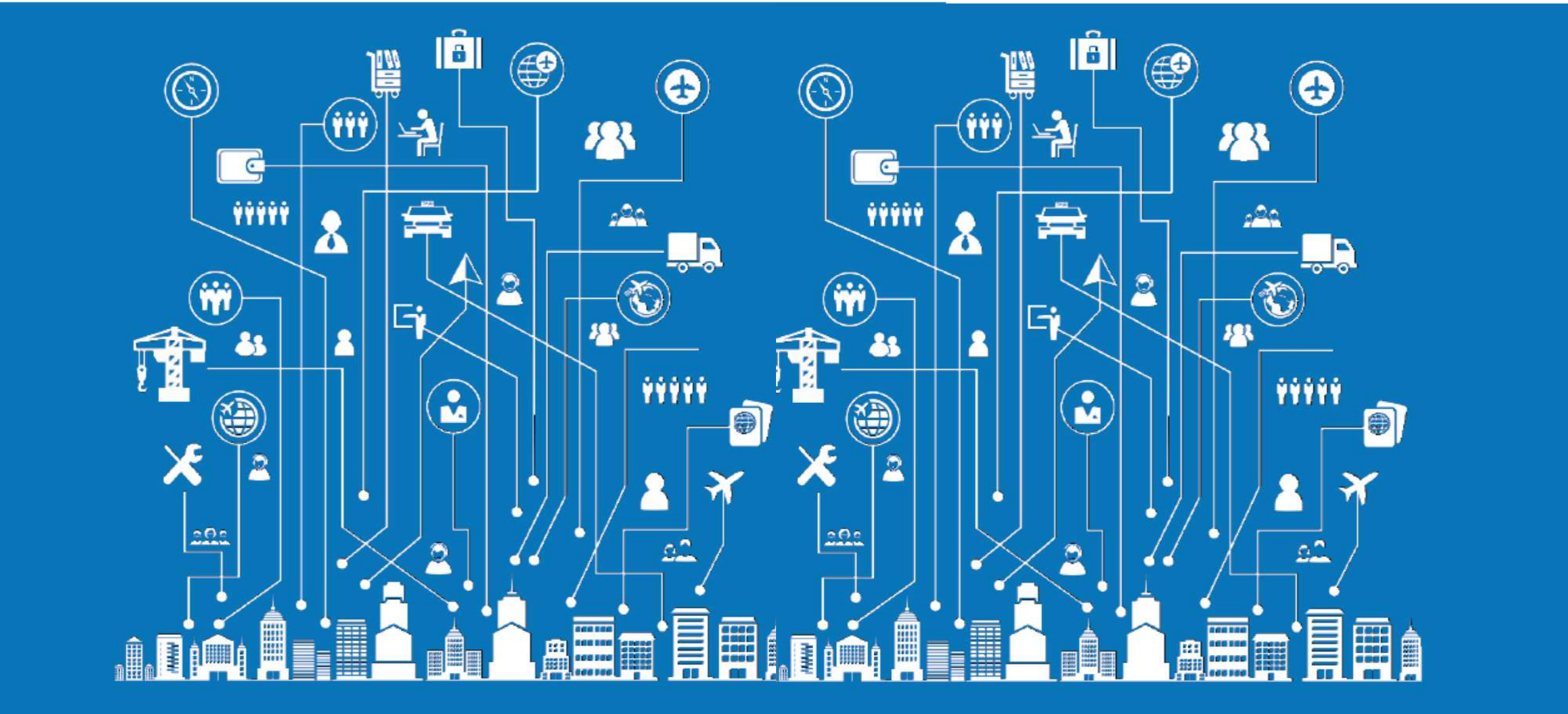
IMM DesignLab

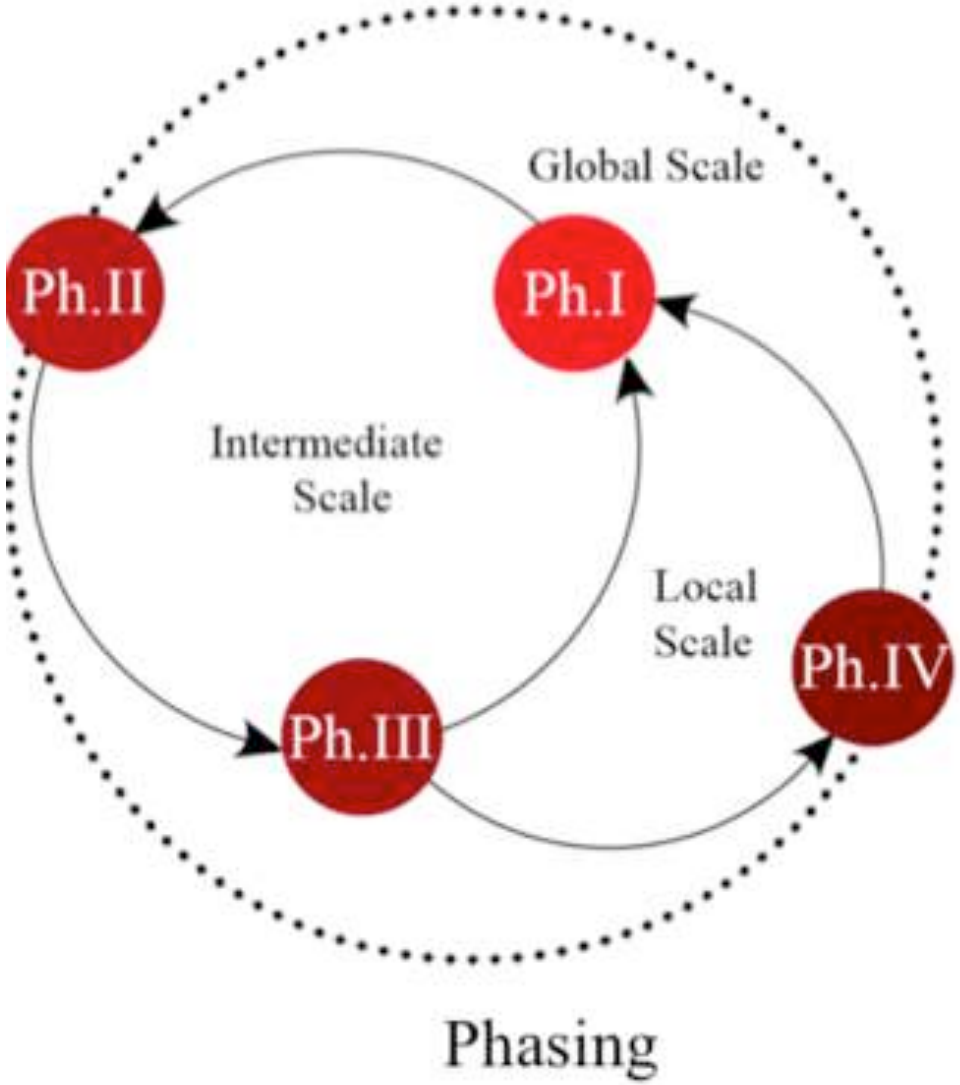
URBAN DIAGNOSTIC

IMM recognizes the city as a Complex Adaptive System comprised by the synergic integration of elementary parts, which through their arrangement and the architecture of their ligands provide a certain physical and provisional arrangement of the System.



COMPLEX ADAPTIVE SYSTEM

As special class of complex system that has the capacity for adaptation and evolution through a dynamic between micro and macro-level feedback loops over time. Such systems consists of agents interacting in a non linear fashion and creating networks of connection so as to act and react to each other's behaviour. Through adaptation, agents have the capacity to locally synchronize their states or activities, and out of these local interaction the system can self organize with the emergence of globally coherent patterns of organization



Phasing

SUSTAINABLE FORM

CITY CONTEXT

- P1 Investigation/Analysis
  - a. Horizontal Investigation
  - b. Vertical Investigation
  - c. Performance Evaluation
- P2 Formulation
  - a. Detection of the Catalysts
  - b. DOP Arrangement
- P3 Modification/Design
  - a. Horizontal Modification
  - b. Vertical Modification
- P4 Optimization/Retrofitting
  - a. Performance Assumption
  - b. Local Optimization

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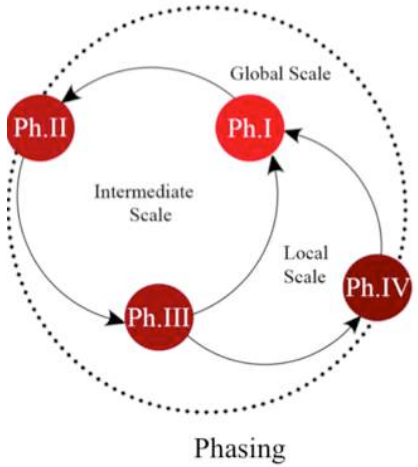
Phasing



Phasing

Complex, spontaneous and non-linear phasing

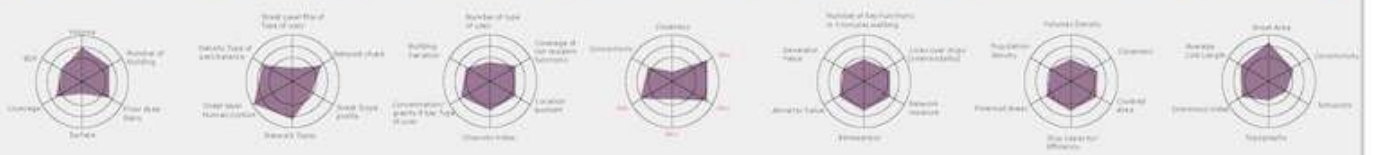
STRUCTURE

COMPONENTS

	BUILT-UPS	VOIDS	LINKS	THE TYPES OF USES
BUILT-UPS		Porosity	Effectiveness	Proximity
VOIDS	Porosity		Interface	Diversity
LINKS	Effectiveness	Interface		Accessibility
THE TYPES OF USES	Proximity	Diversity	Accessibility	

KEY CATEGORIES WITH MATRICES

Porosity | Proximity | Diversity | Interface | Accessibility | Effectiveness | Permeability



P1 Investigation/Analysis

PERFORMANCE INVESTIGATION

- Measurement
- Survey
- Existing

PERFORMANCE

INPUT

INDICATORS

01 — a) Urban built density (building Volume Density (BVD))
b) SDG 11.3.1 Ratio of land consumption rate to population growth rate
c) Number of buildings per hectare
d) Number of inhabitants per hectare
e) Street Green Ratio (SGR)
f) Land cover change
g) Albedo surface fraction
h) Solar energy potential
i) Block Density
j) SDG 11.1.1 Proportion of urban population living in slums, informal settlements or inadequate housing
m) Land Cover in a given area

02 — a) The magnitude of the velocity at the cell center
b) Mannings Street Indicator

03 — a) Ratio between numbers of residents and activities*
b) Housing diversity* (h)
c) Jobs/housing ratio (h)
d) Ratio of place dedicated to innovation and knowledge* (h)

04 — a) Percentage of Areas designated for nature protection and biodiversity under international, national schemes
b) Proportion of protected Area in the city
c) Proportion of different land-use categories
d) Number of native Plants
e) Number of native birds
f) Number of native butterflies
g) Number of native species
h) How prevalent are invasive alien species
i) Proportion of the resident living 300m of a park
j) Number of different natural ecosystems found in the city
m) Vegetation cover in urban core
n) Indicator of vegetation cover in runoff area

05 — a) a) Green Cover Ratio (GCR)
b) Extent and number of parks (%)
c) Percentage of trees in the city in relation to city area
d) Land Surface Albedo (LSA)
e) Tree Cover Ratio (TCR):
f) Percentage of Residents within Walking Distance of a Recreation Area ii
g) 11.7.2: Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities*

06a — a) Length of biking roads (km)
b) Population with walkable access to bike trails
c) Number of bike parking spots
d) Bike Sharing
e) Percentage of daily trips by bicycle

06b — a) Number of key functions in a walking distance from residential buildings
b) Car free or minimal car traffic streets
c) Percentage of daily trips on foot
d) Pedestrian street paths (%)
e) Number of people within walkable distance to frequent transit stops
f) Number of Crosswalks
g) Visually active frontages. Percentage of walkways segments with visual connection to interior building activities. (%)
h) Physically permeable frontage. Number of entrances per 100 meters of block frontage
i) Sidewalks that are lined with continuous ground-floor activity in a given area (%)
l) Shade and shelter (%) in a given area

07a — a) Private passenger transport energy use per person
b) Passenger number in public transport
c) Inhabitants living within 2,5 minutes walk/meet from public transport, %
d) Length of roads per capita, Road Ratio
e) Vehicles distance travelled (VDT)
f) Passage annual distance travelled per passenger of car
g) Departure frequency (on a normal weekday between 6:00 and 20:00)*2
h) Number of cars owned by urban residents
i) Motorcycles per thousand inhabitants
l) Total number of journeys by public transport
m) Collective taxis per thousand inhabitants
n) Average length of a public transport trip
o) Average length of a private motorized trip
p) Average duration of a public motorized trip
q) Average duration of a private motorized trip
r) Length of reserved public transport routes per urban hectare - road modes
s) Length of reserved public transport routes per urban hectare - rail modes
t) Length of road per urban hectare
11.2.1: Proportion of the population that has convenient access to public transport by sex, age and persons with disabilities

... — ....

CHOOSING CATALYZERS

P3 Modification / Design

DOP Family

01 Ground Use	08 Interchangability
02 Permeability	09 Energy Management
03 Multiplicity and Variety	10 Food Management
04 Urban Biodiversity	11 Waste Management
05 Green Space	12 Water Management
06a Cyclability 06b Walkability	13 Governance/Management
07a Urban Flow (people) 07b Urban Flow and Mobility (Immaterial flow)	

P2 Formulation

Urban diagnostic

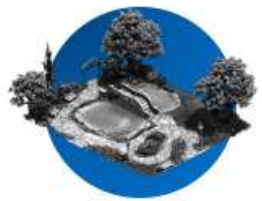
In IMM, urban diagnostic is a model-based approach able to define through an rigorous qualitative and quantitative representation, the state of a system and its performance. IMM investigating urban context as a Complex Adaptive System analyzes patterns of problems and malfunctioning conditions to infer the source of the problem. The identification of the cause or nature of malfunctioning condition or problems by systematic investigation makes our diagnostic work necessary for any effective transformation process.

Modification

Built Environment

COMPONENTS

Built-ups



Voids

Types of Uses

Mobility

STRUCTURAL ATTRIBUTES

POROSITY

PROXIMITY

DIVERSITY

INTERFACE

PERMEABILITY

INTERFACE

ACCESSIBILITY

EFFECTIVENESS

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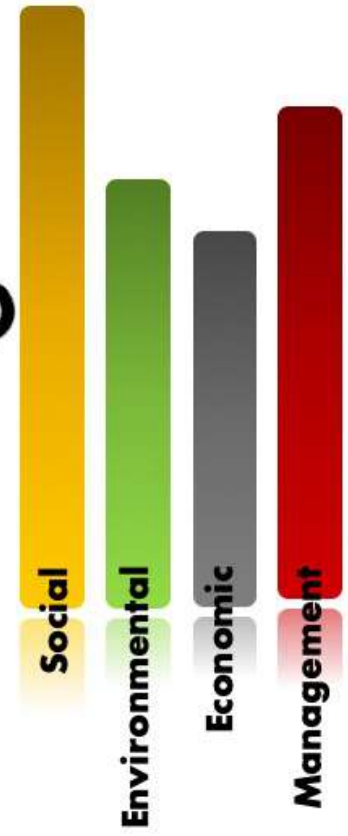
KEY CATEGORIES

PERFORMANCES



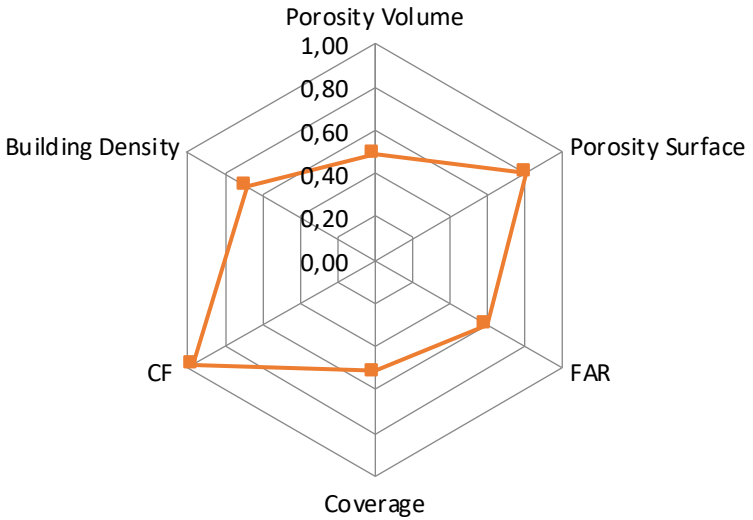
Porosity

“Porosity or void fraction is a measure of the void (i.e. "empty") spaces in a material, and is a fraction of the volume of voids over the total volume, between 0 and 1, or as a percentage between 0 and 100%”.

CASE STUDIES OF MILANO NEIGHBORHOODS:

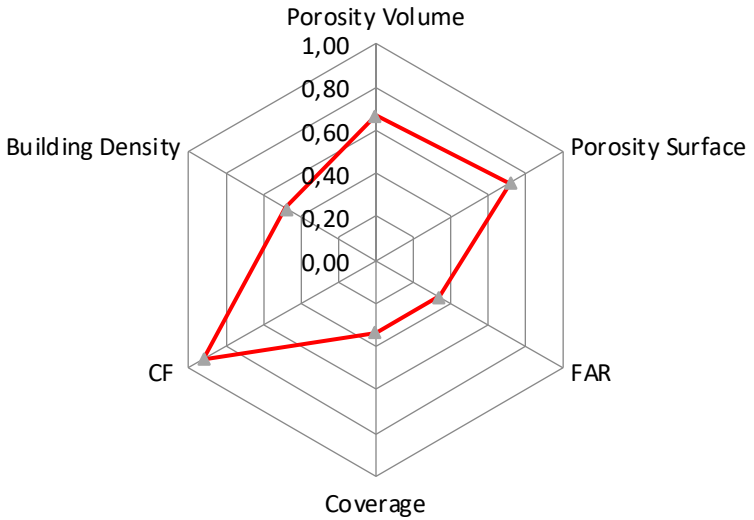
CITY CENTER

Porosity Spectrum diagram

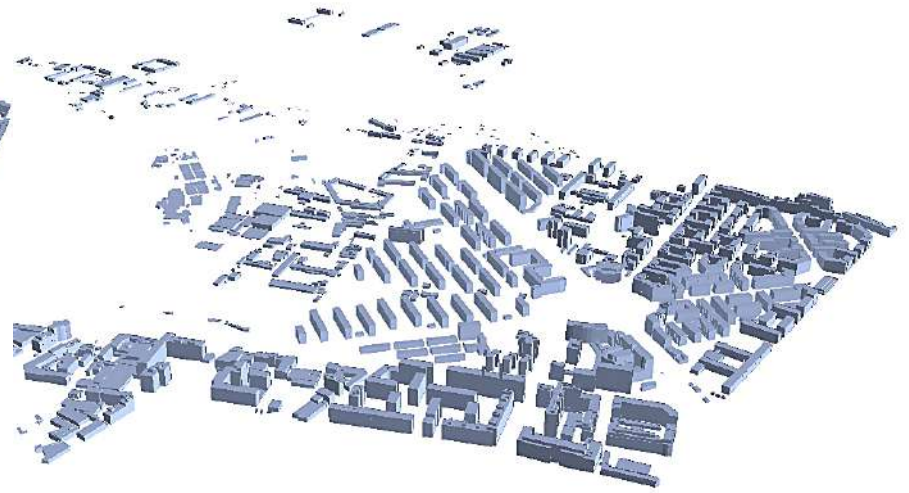


CITTA' STUDI

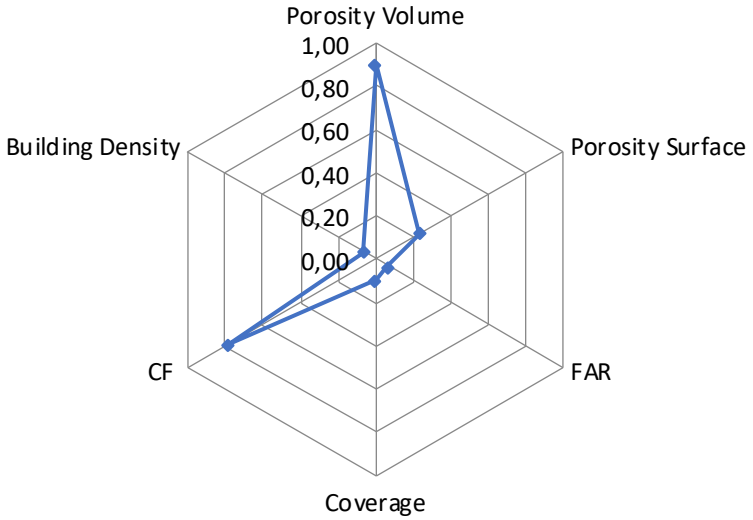
Porosity Spectrum diagram



PORTO DI MARE



Porosity Spectrum diagram

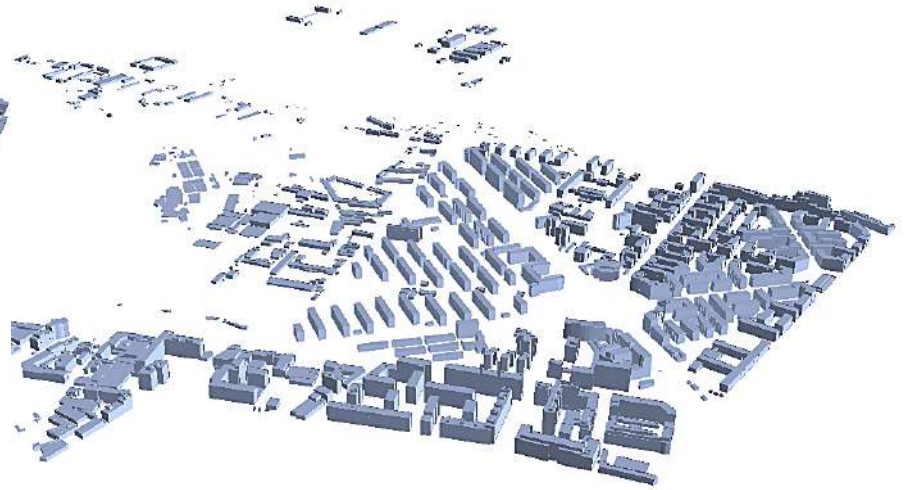


CASE STUDIES OF MILANO NEIGHBORHOODS:

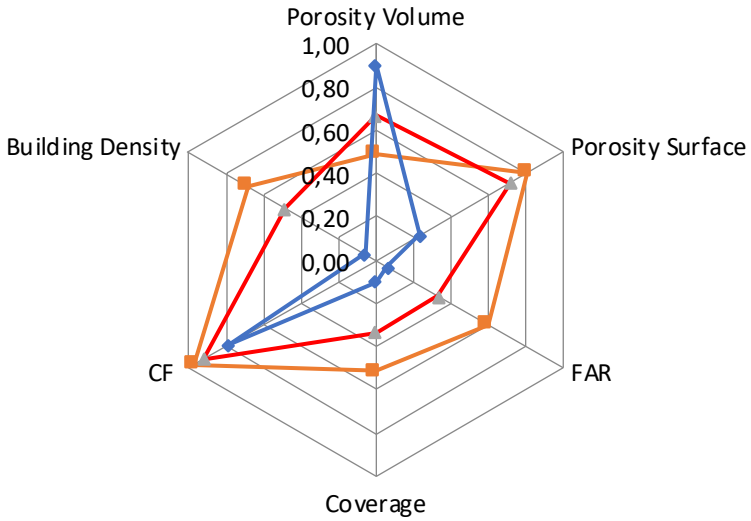
CITY CENTER

CITTA' STUDI

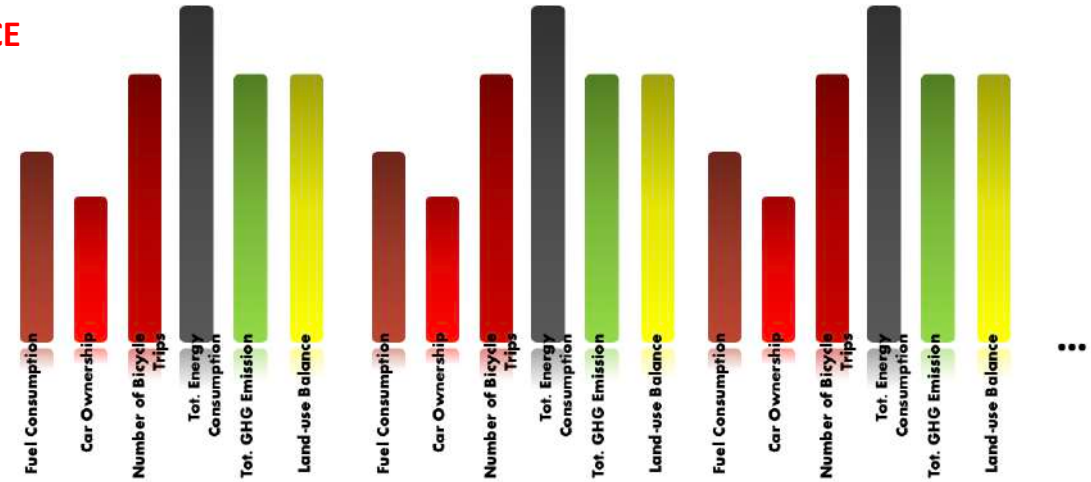
PORTO DI MARE



Porosity Milano



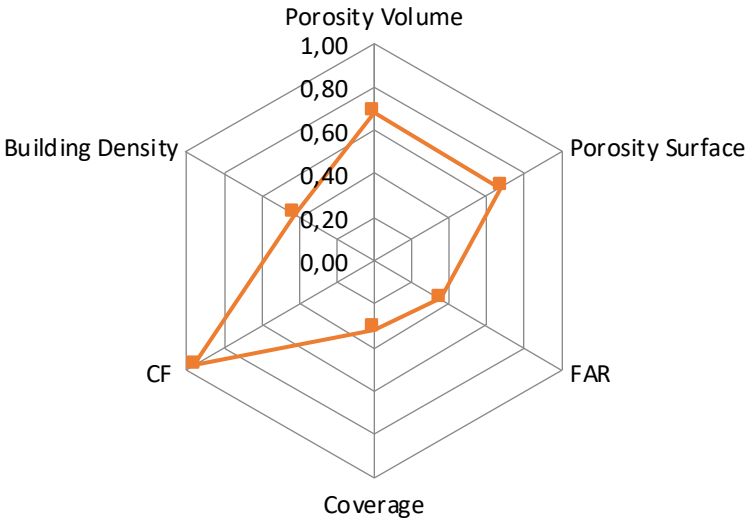
PERFORMANCE



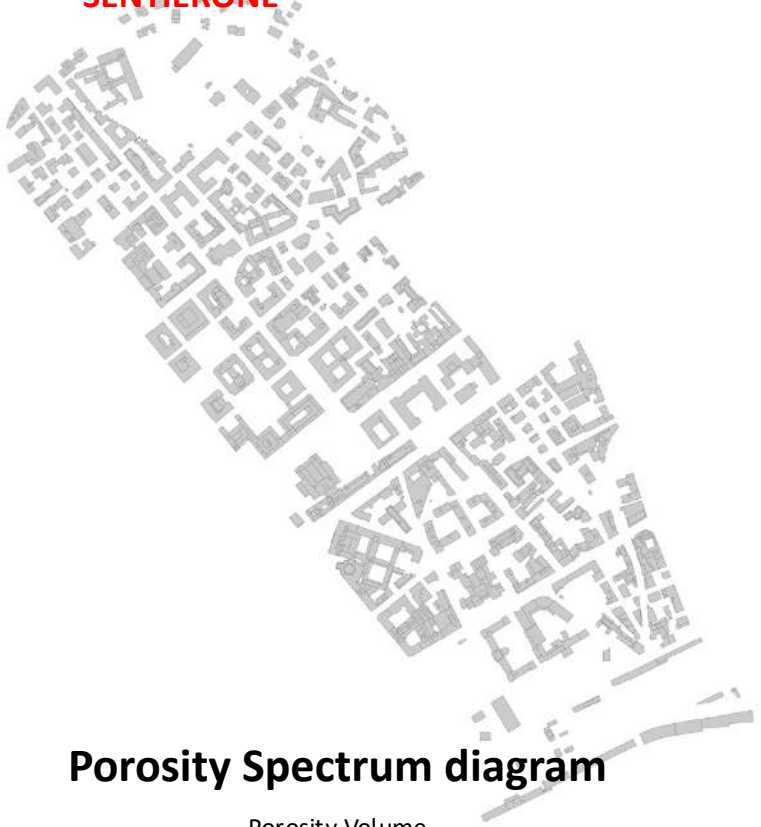
CASE STUDIES OF BERGAMO NEIGHBORHOODS:

CITTA' ALTA

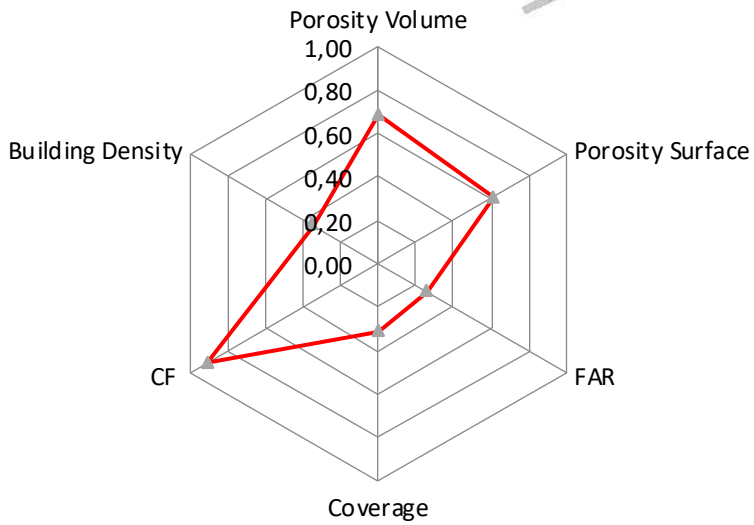
Porosity Spectrum diagram



SENTIERONE

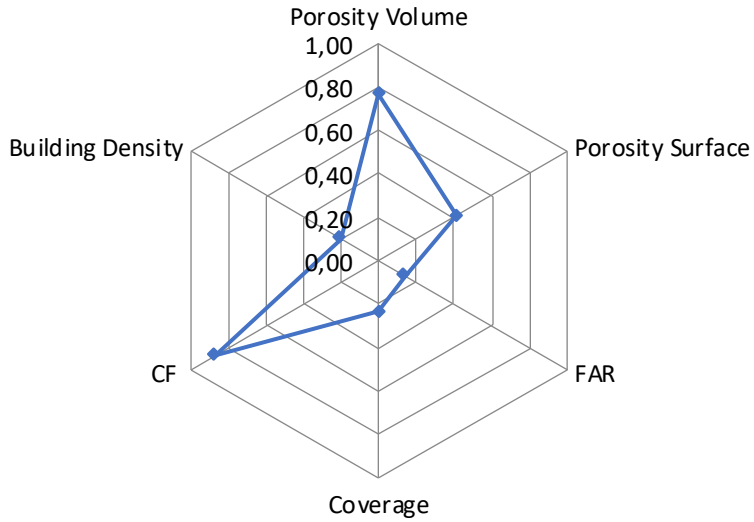


Porosity Spectrum diagram



VALTESSE

Porosity Spectrum diagram



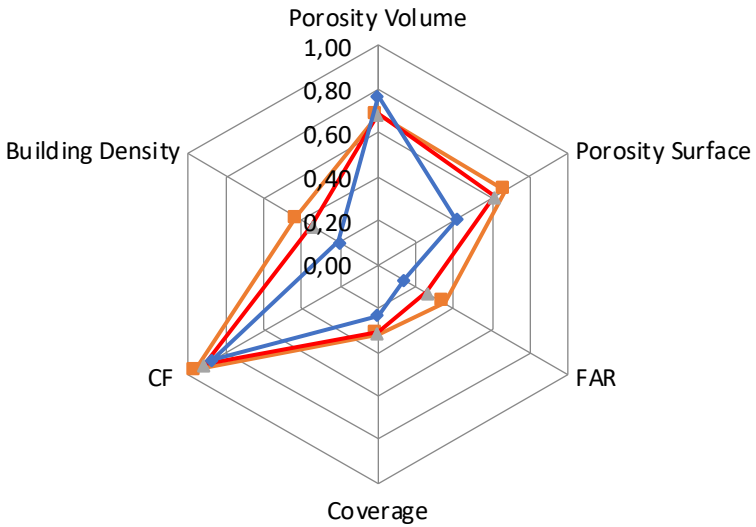
CASE STUDIES OF BERGAMO NEIGHBORHOODS:

CITTA' ALTA

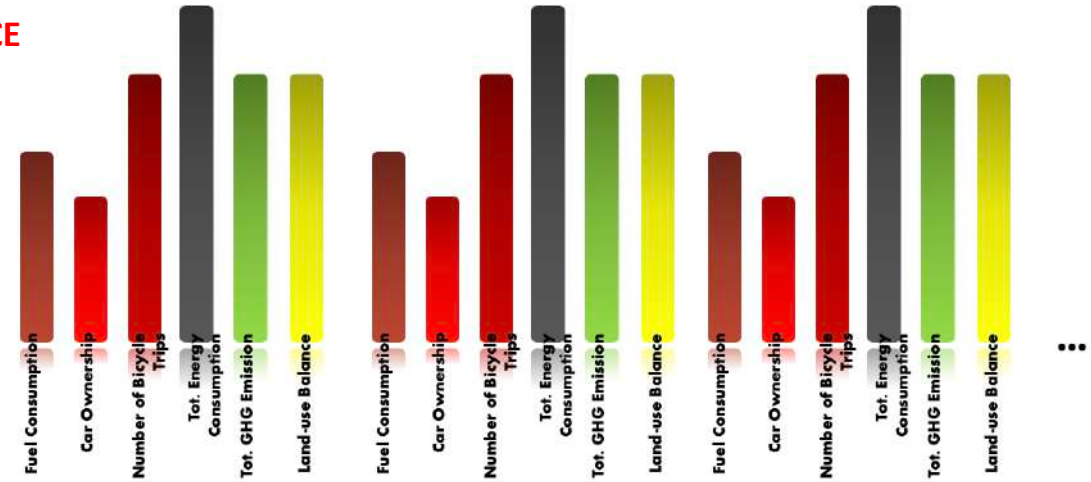
SENTIERONE

VALTESSE

Porosity Bergamo

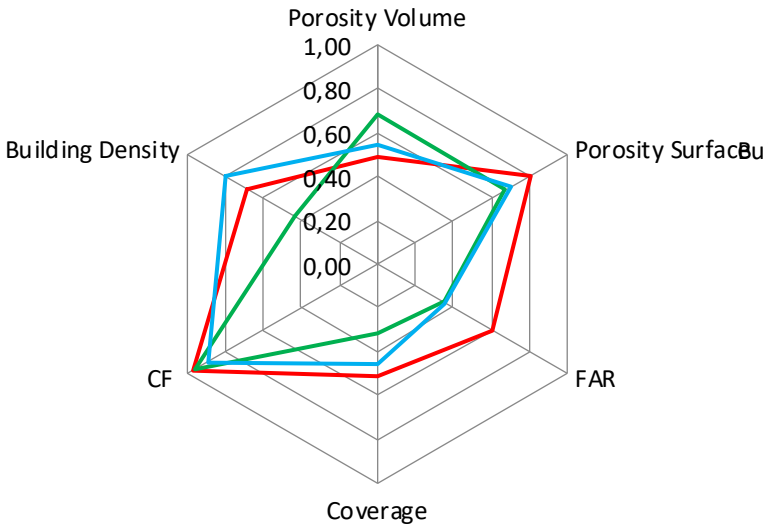


PERFORMANCE

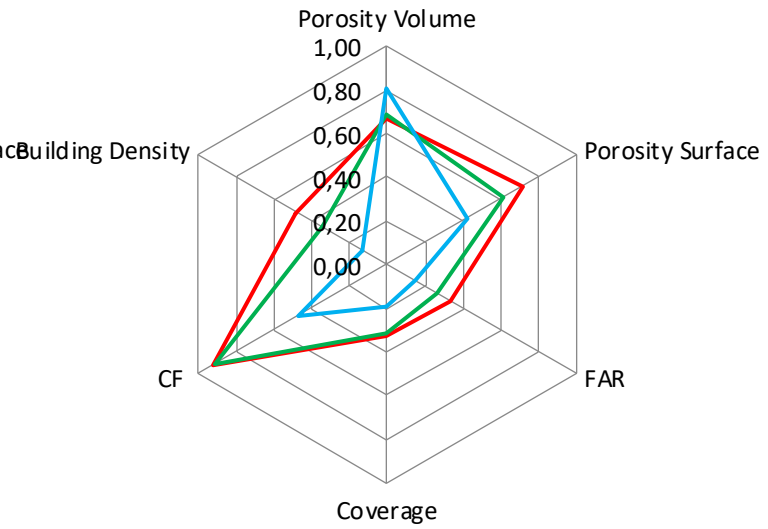


CASE STUDIES OF BERGAMO NEIGHBORHOODS:
Milano **Bergamo** **Brescia**

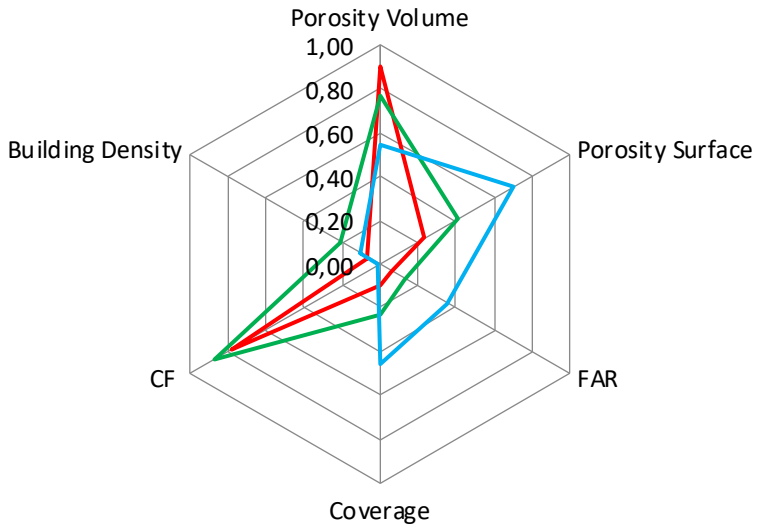
Porosity City Centers



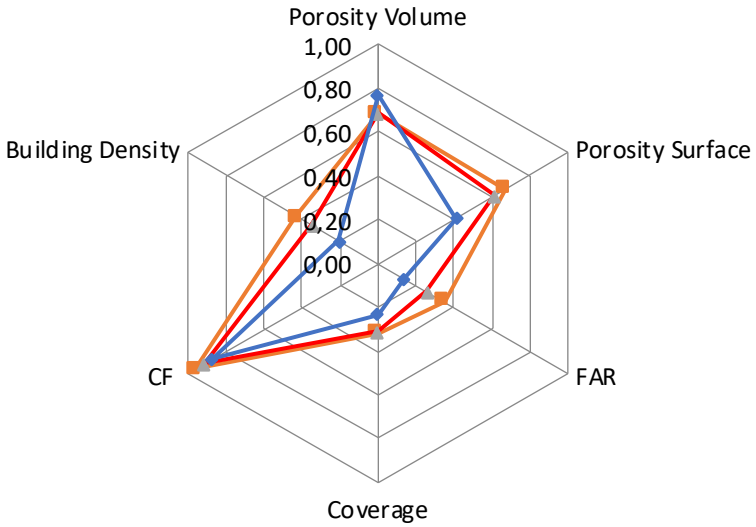
Porosity 20th Century



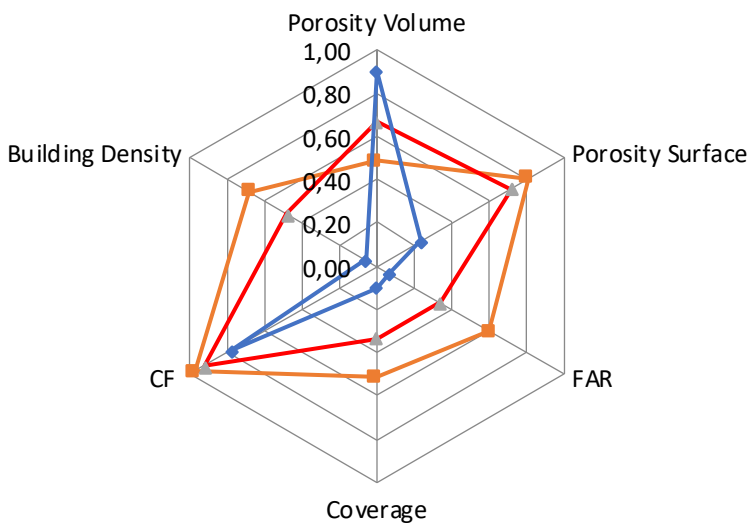
Porosity Boundaries



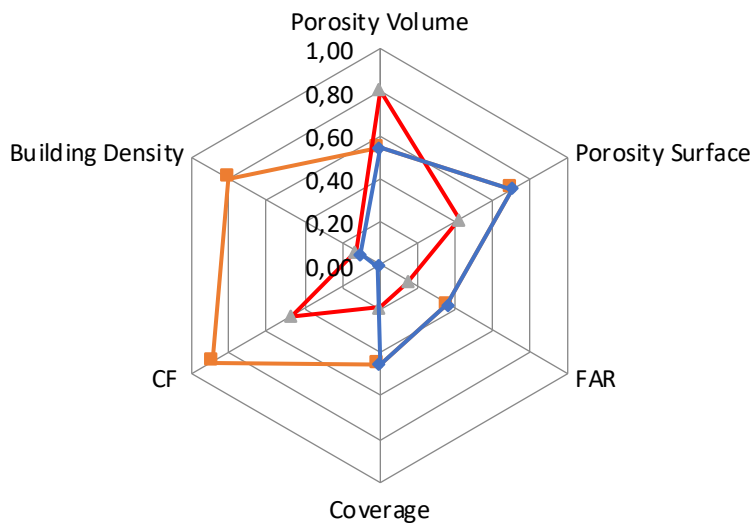
Porosity Bergamo



Porosity Milano



Porosity Brescia

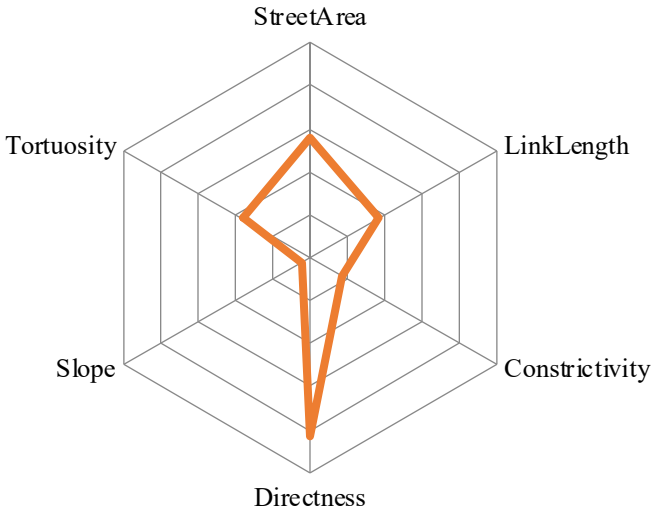


Permeability

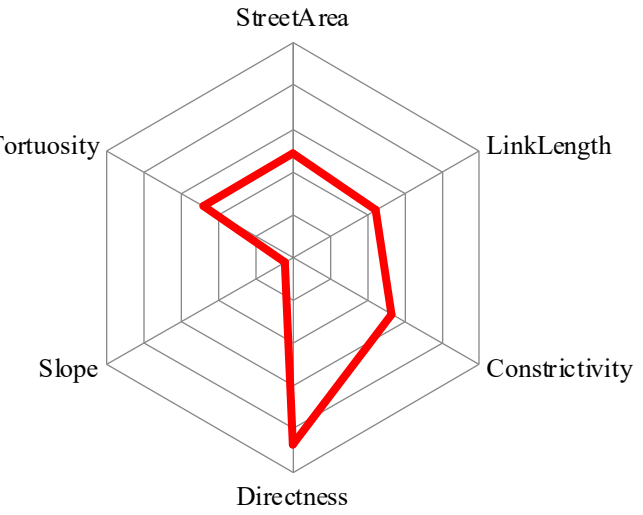
“In Fluid mechanic Permeability is a measure of the ability of a porous material to allow fluids to pass through it. It is related to Porosity but also to the shapes of the porous”.

CASE STUDIES OF MILANO NEIGHBORHOODS:

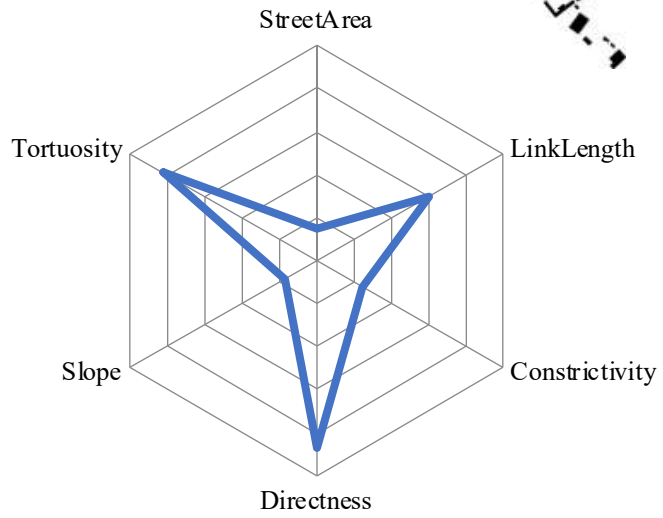
CITY CENTER



CITTA' STUDI



PORTO DI MARE



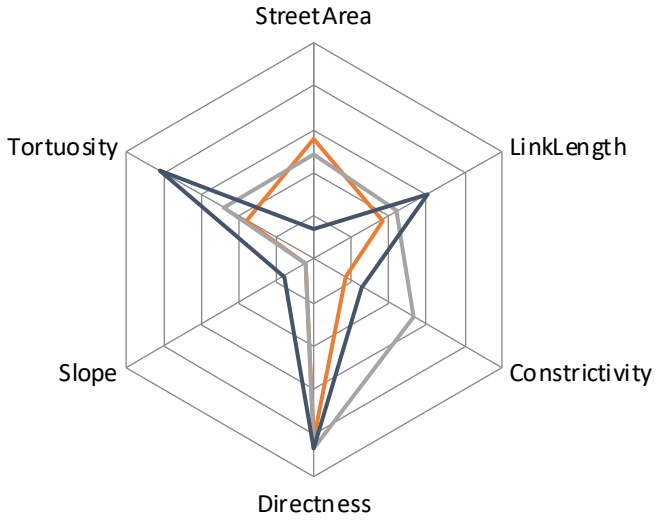
CASE STUDIES OF MILANO NEIGHBORHOODS:

CITY CENTER

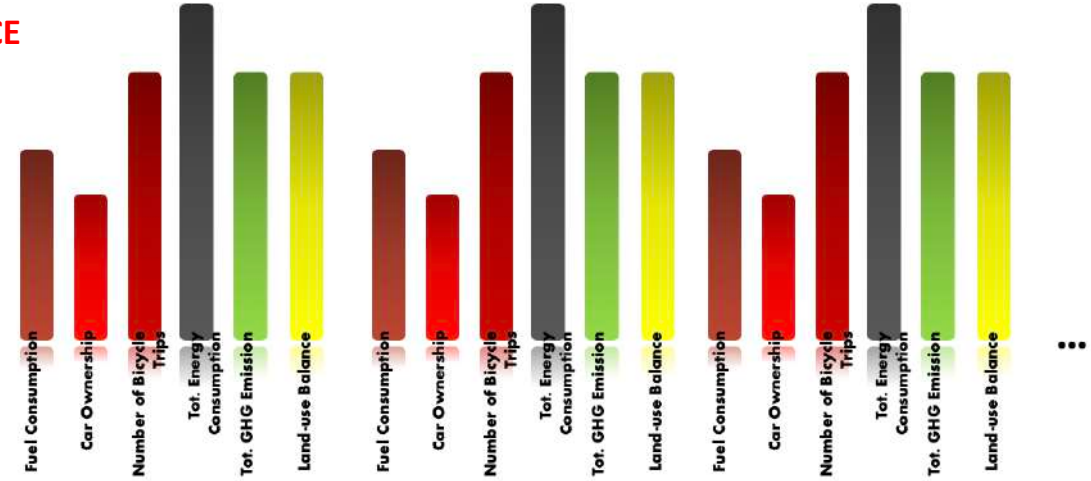
CITTA' STUDI

PORTO DI MARE

Permeability Milano SoA



PERFORMANCE



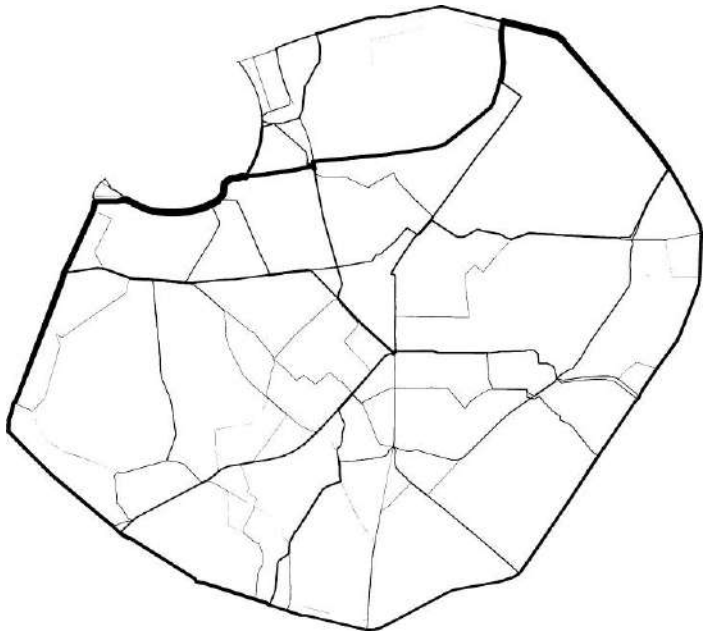


FIG. 3 Milano Mura M. Directness map, frequency of street passing through when traveling the shortest path between border points

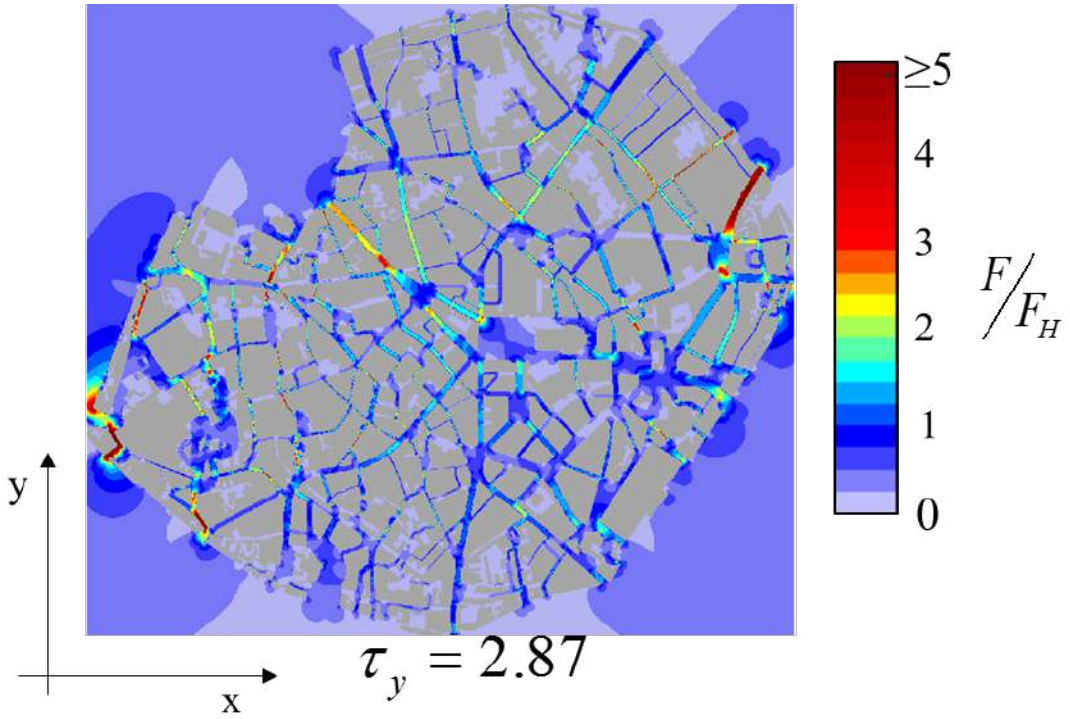
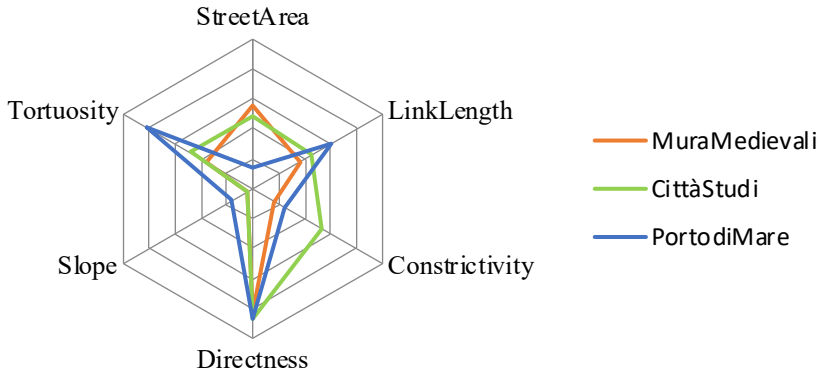


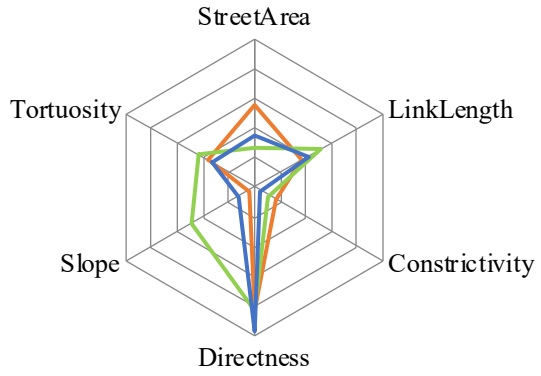
FIG. 5. Diffusive Flux (F) computed on Milano Mura M. urban structure normalized over the diffusive flux F_H computed in fee fluid in y-direction. The axis x-y represents the reference system and the resulting tortuosity value in y direction (τ_y) is equal to 2.87.

CASE STUDIES OF BERGAMO NEIGHBORHOODS:
Milano Bergamo Brescia

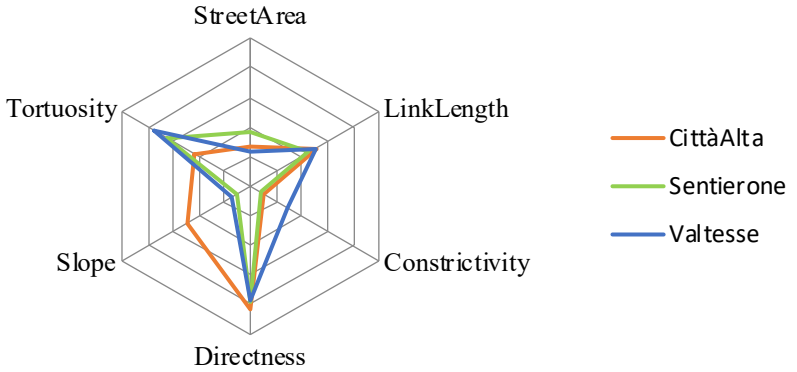
Permeability Milano



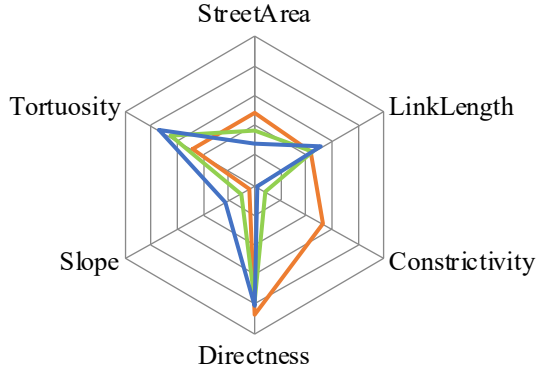
Permeability Walled City



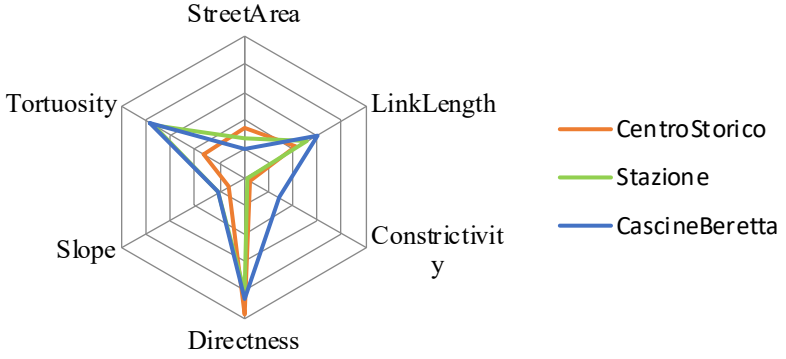
Permeability Bergamo



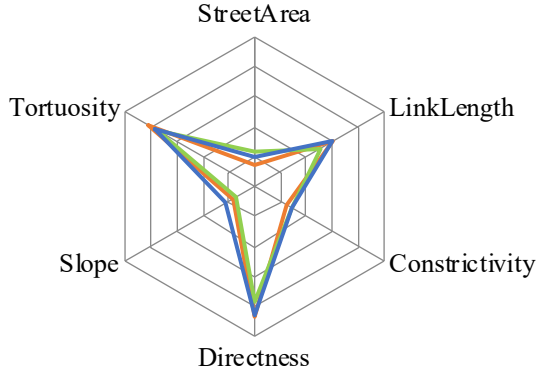
Permeability 20th Century



Permeability Brescia

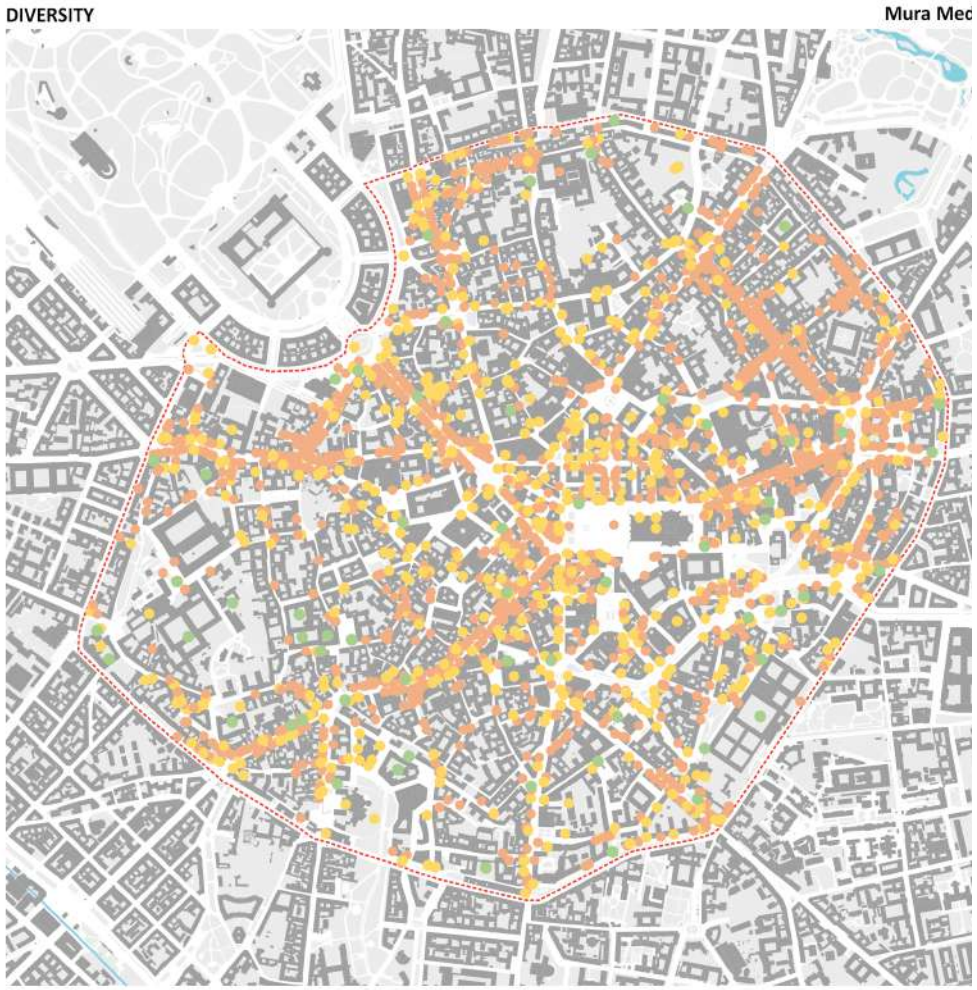


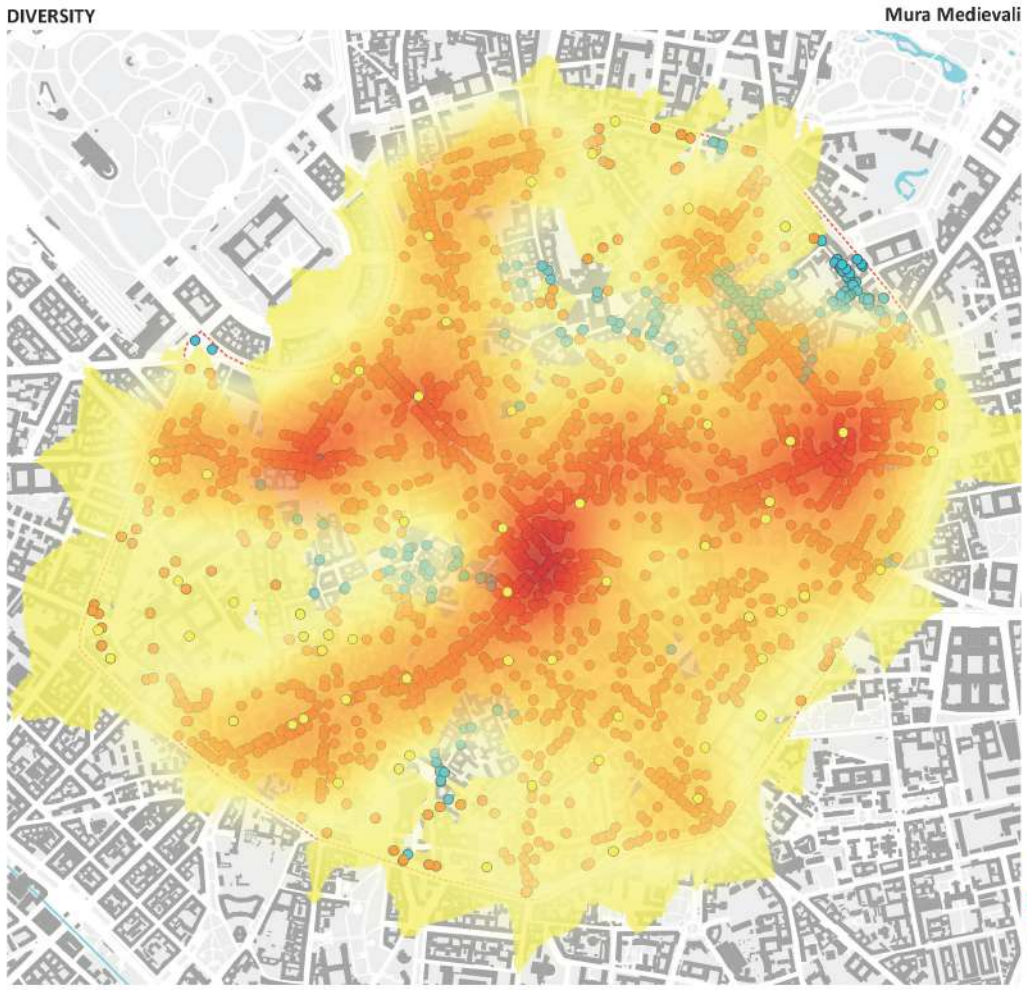
Permeability Boundaries

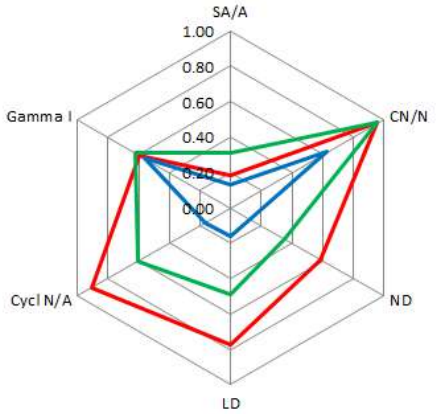


Diversity

"Diversity contributes to complexity and underpins system level robustness, allowing for multiple responses to external shocks and internal adaptations".

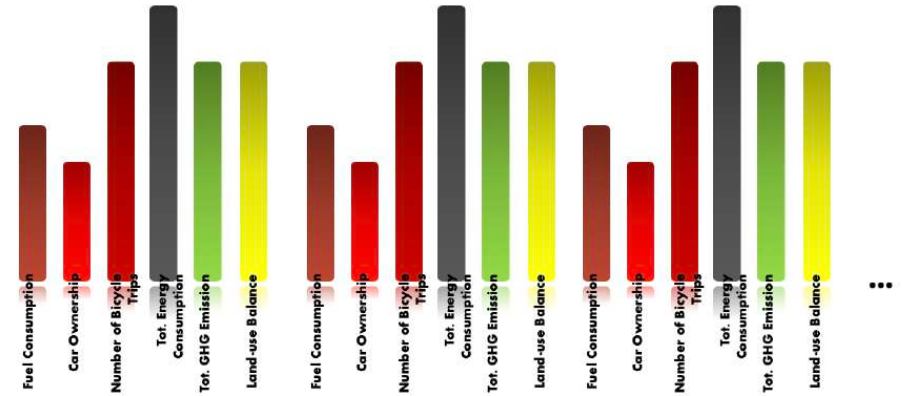


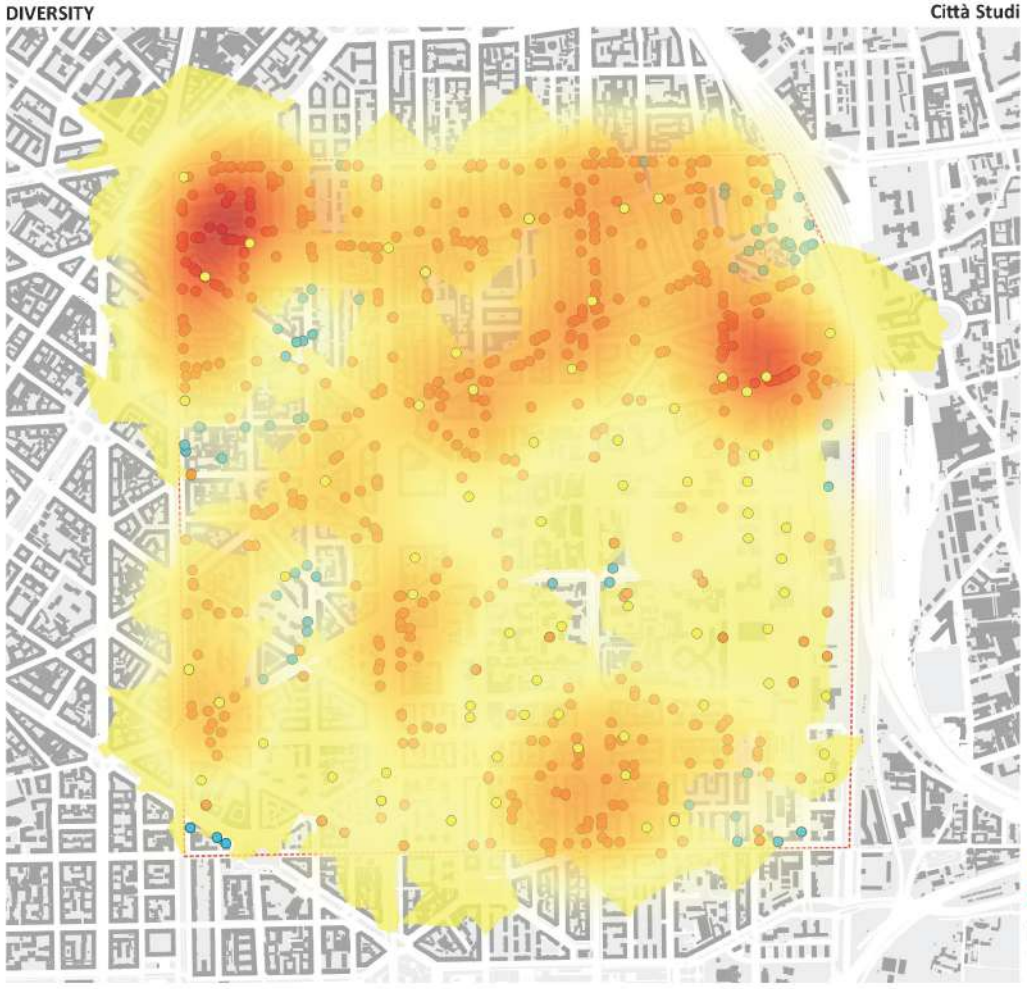




Diversity Milano

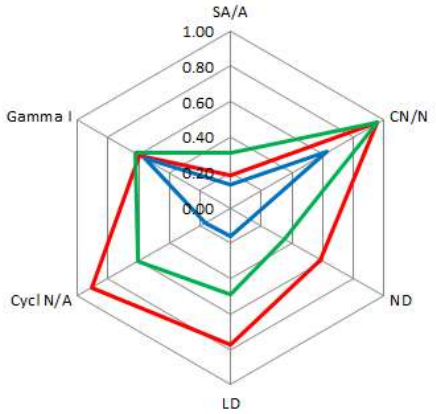
PERFORMANCE





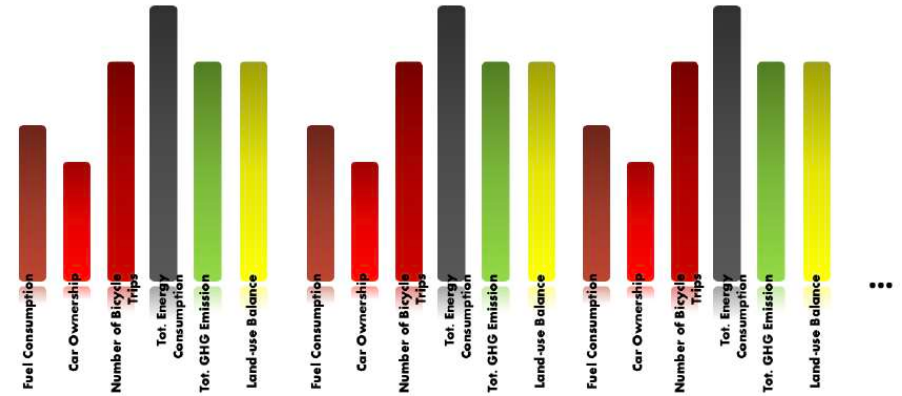
Heatmap
- Necessarie Regolari
- Opzionali | Occasionali (5min)
- Opzionali | Occasionali (fuori 5min)

Isocrone Pedonale
- 5 minuti
- Area Studio
- Edificato
- Isolati



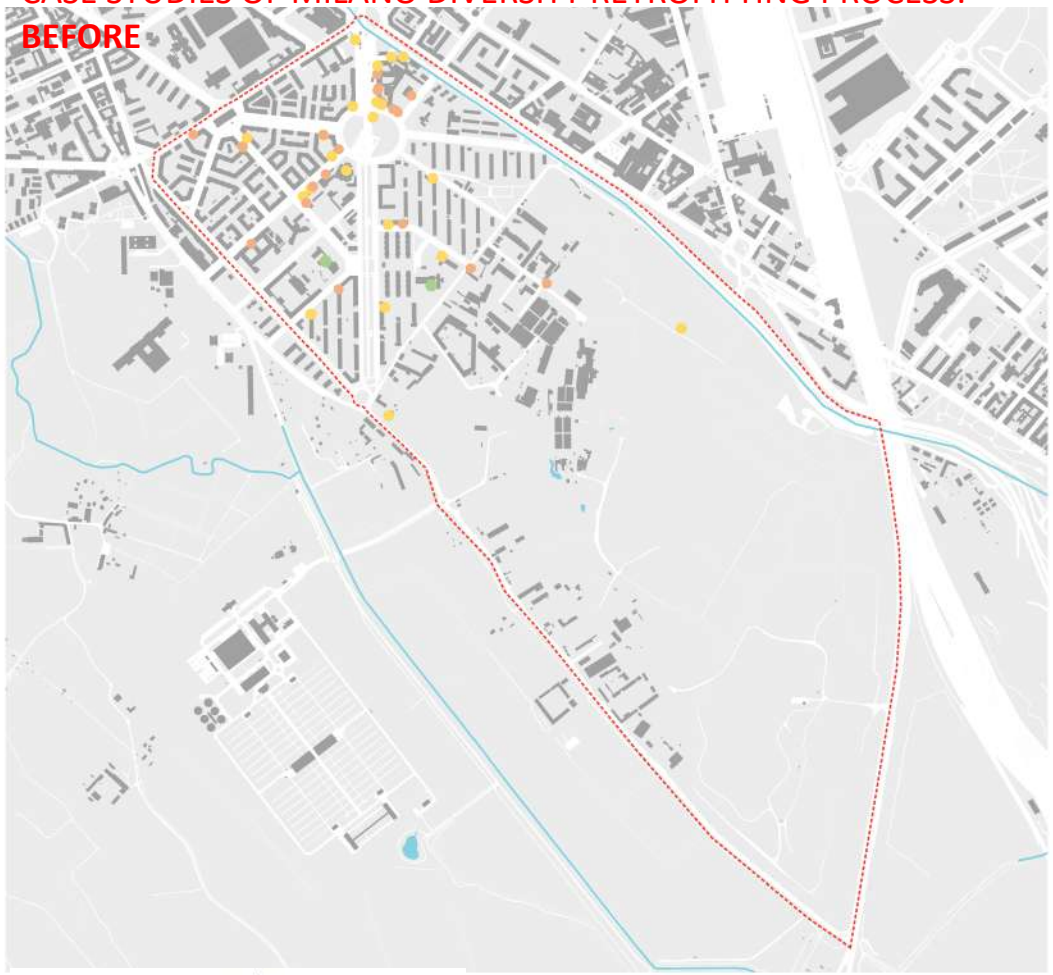
Diversity Milano

PERFORMANCE

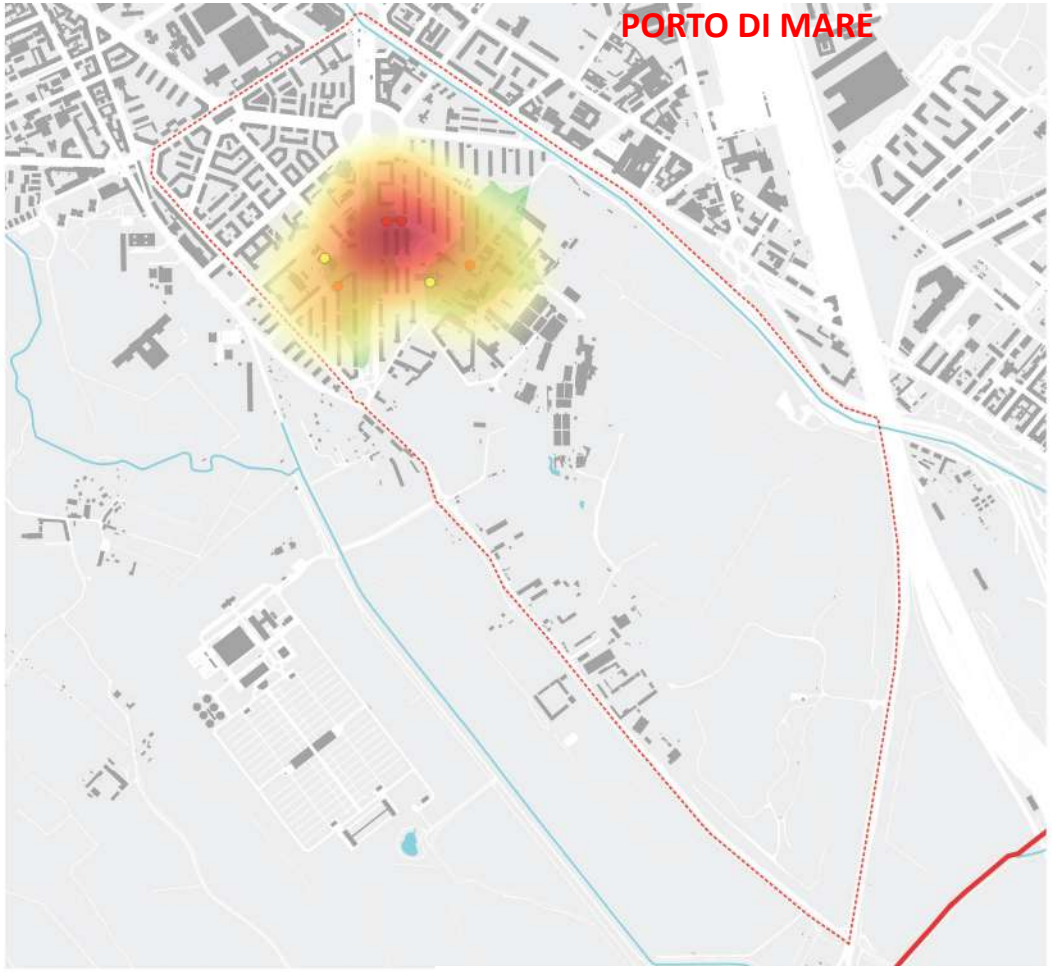


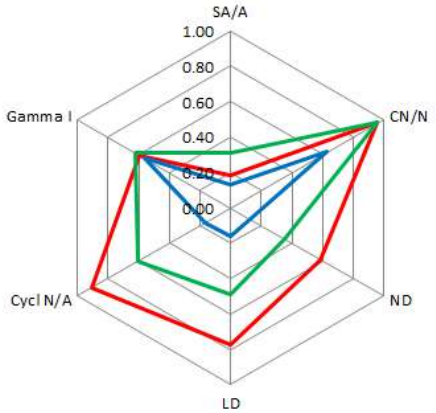
CASE STUDIES OF MILANO DIVERSITY RETROFITTING PROCESS:

BEFORE



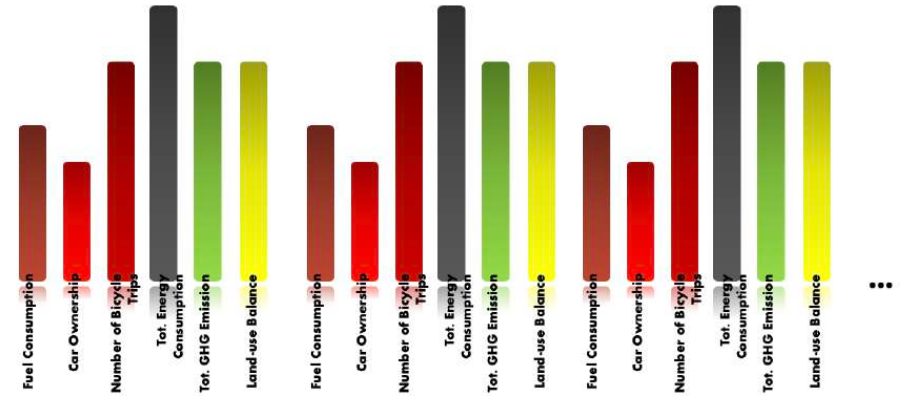
PORTO DI MARE





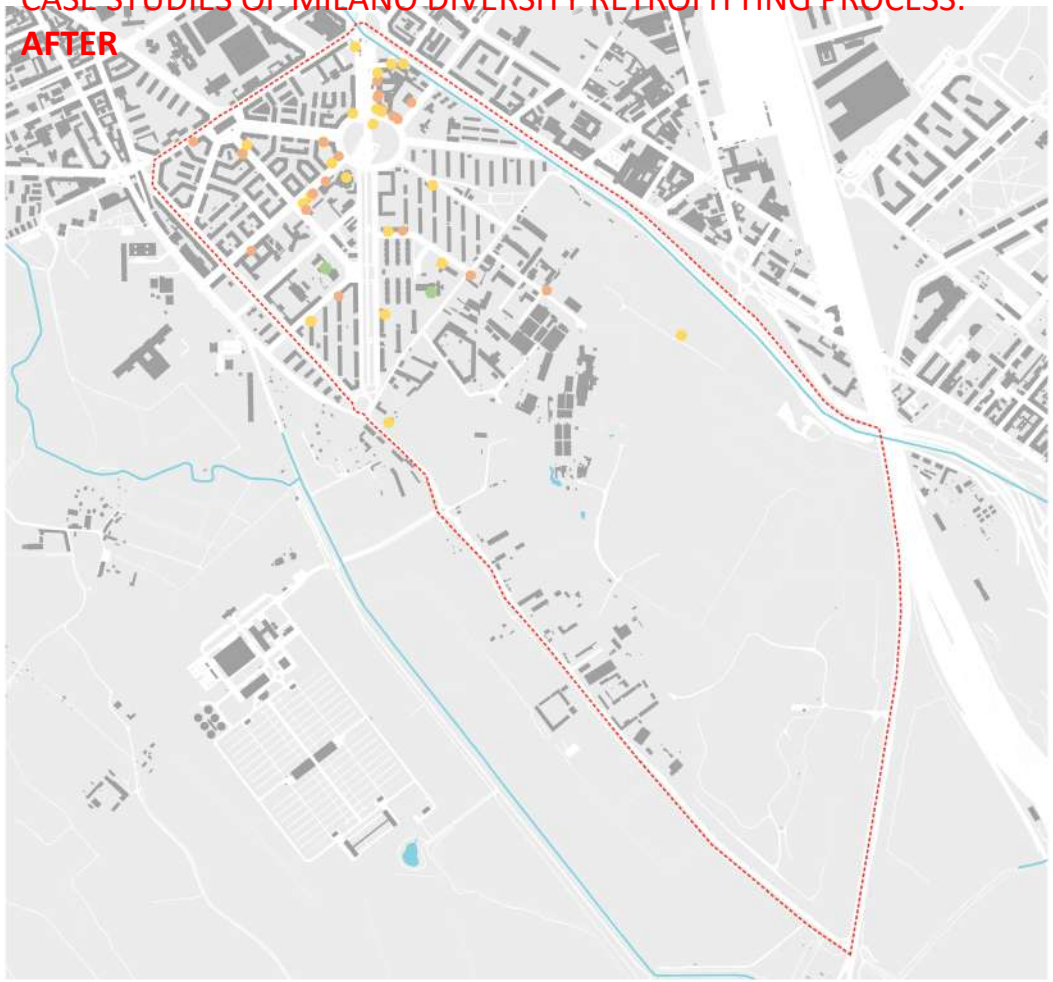
Diversity Milano

PERFORMANCE



CASE STUDIES OF MILANO DIVERSITY RETROFITTING PROCESS:

AFTER



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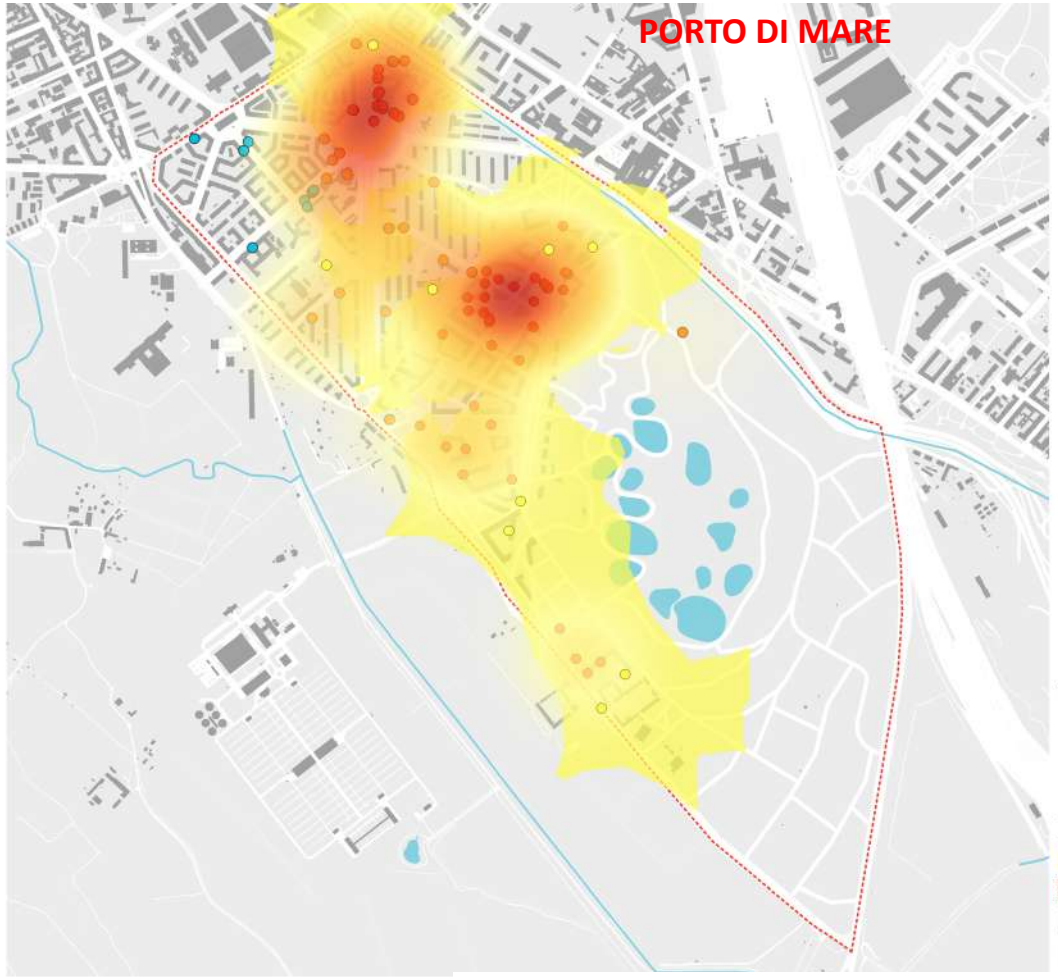
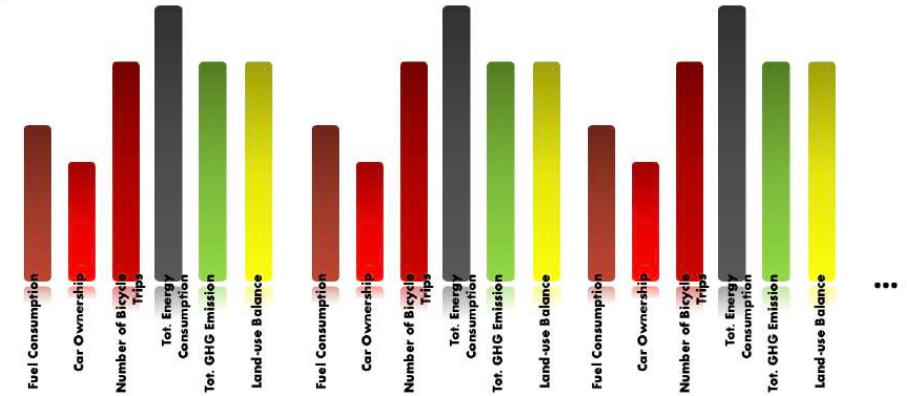
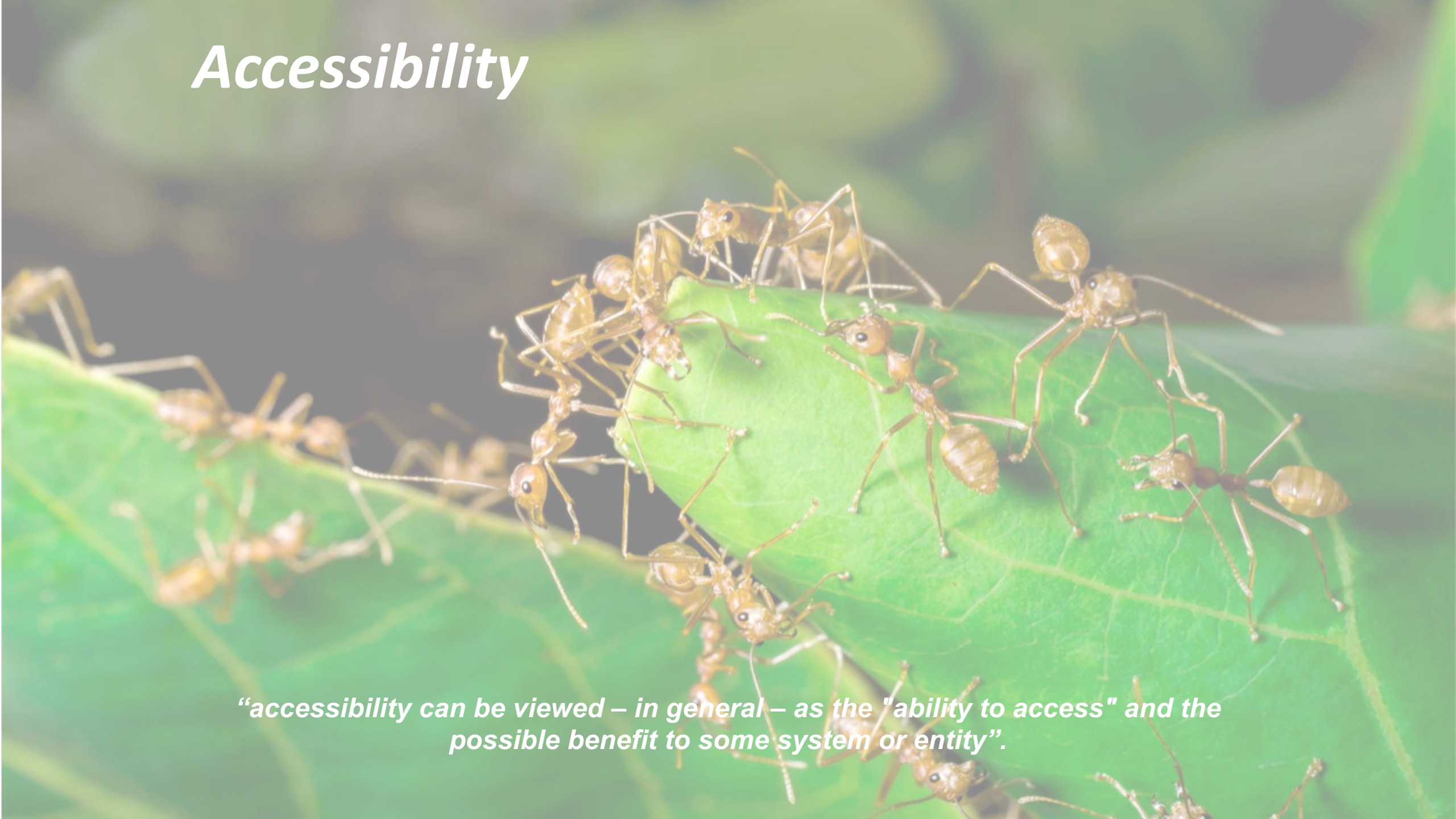


PERFORMANCE

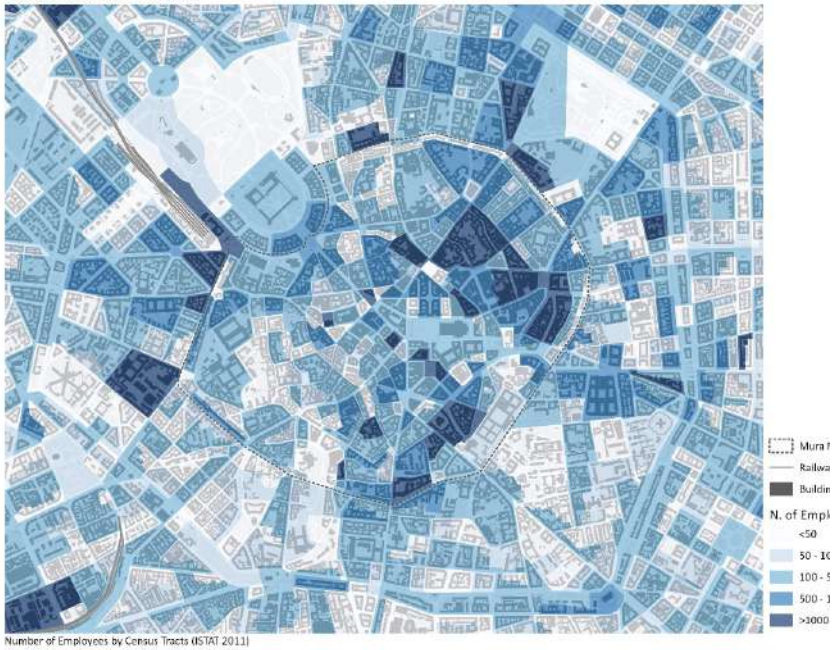


Accessibility



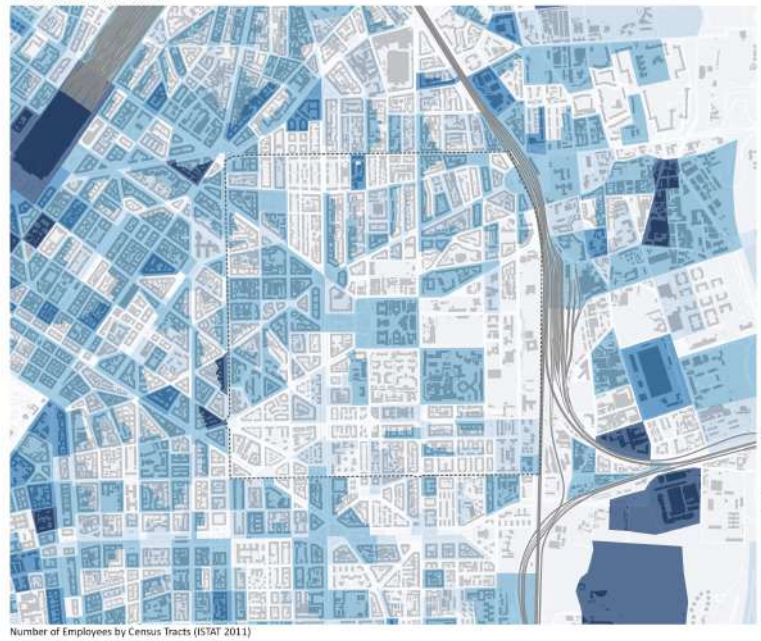
“accessibility can be viewed – in general – as the "ability to access" and the possible benefit to some system or entity”.

ATTRACTORS: Mura Medievali



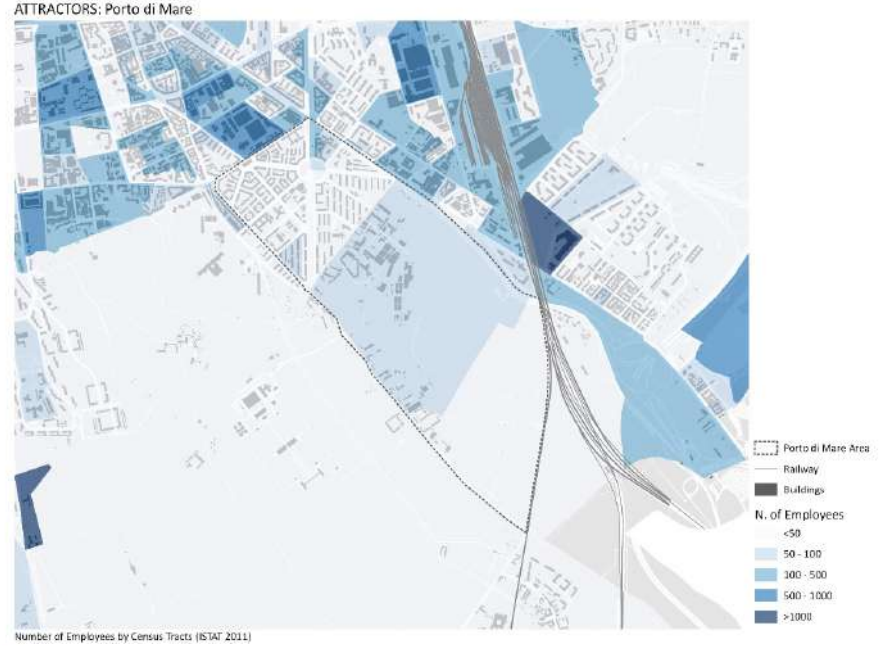
Number of Employees by Census Tracts (ISTAT 2011)

ATTRACTORS: Città Studi



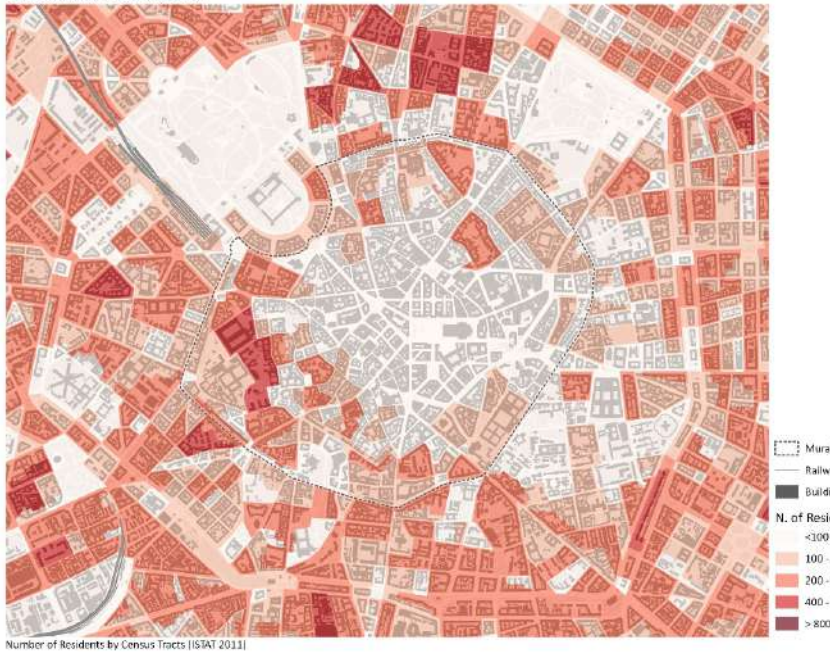
Number of Employees by Census Tracts (ISTAT 2011)

ATTRACTORS: Porto di Mare



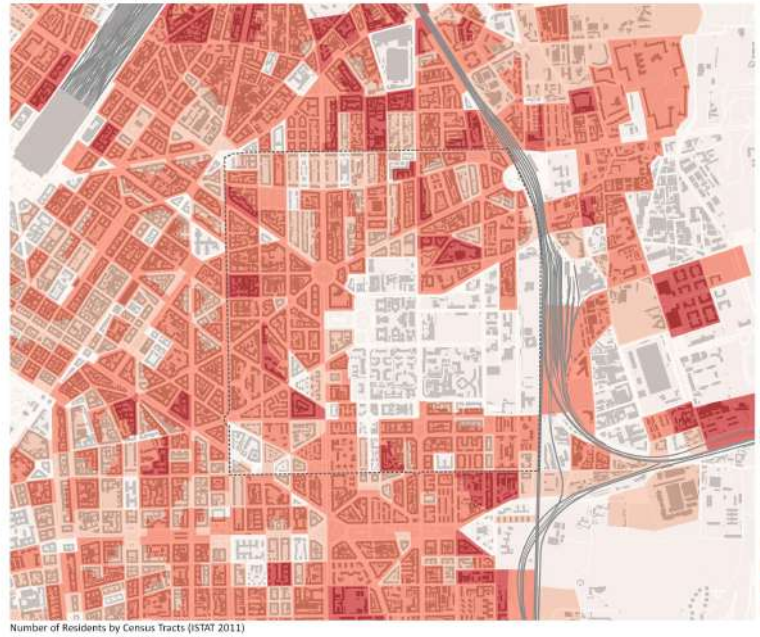
Number of Employees by Census Tracts (ISTAT 2011)

GENERATORS: Mura Medievali



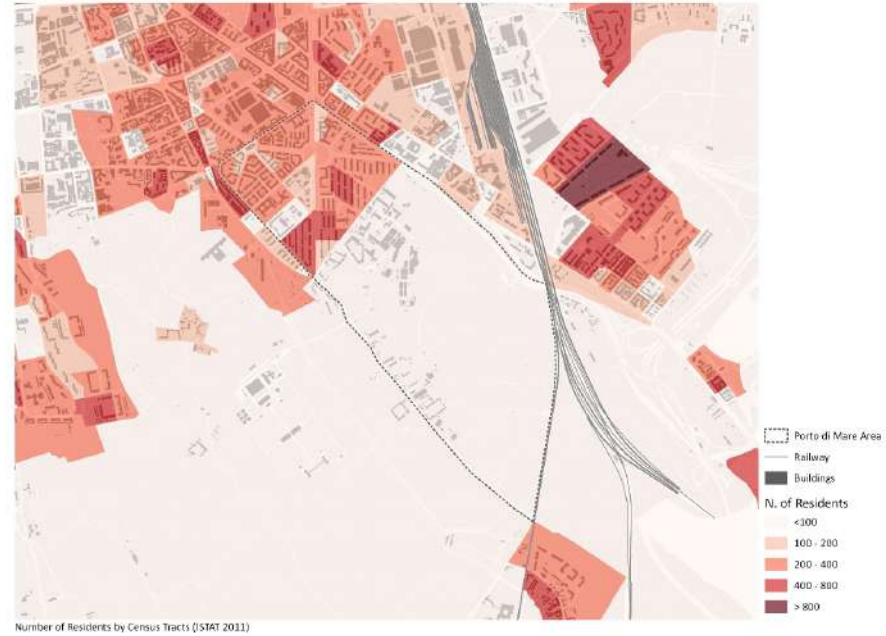
Number of Residents by Census Tracts (ISTAT 2011)

GENERATORS: Città Studi



Number of Residents by Census Tracts (ISTAT 2011)

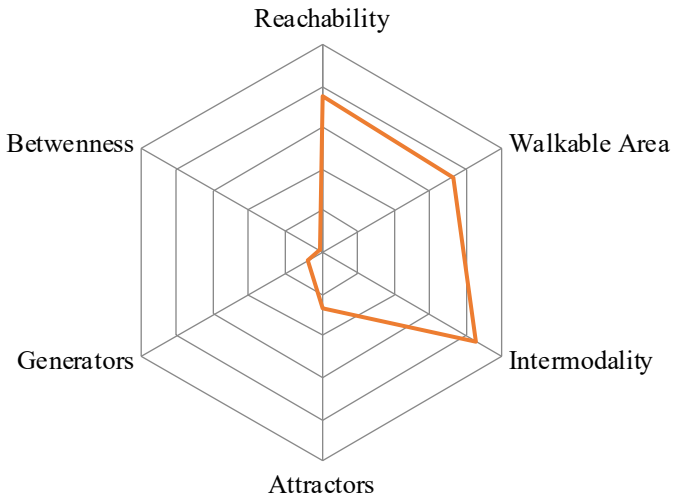
GENERATORS: Porto di Mare



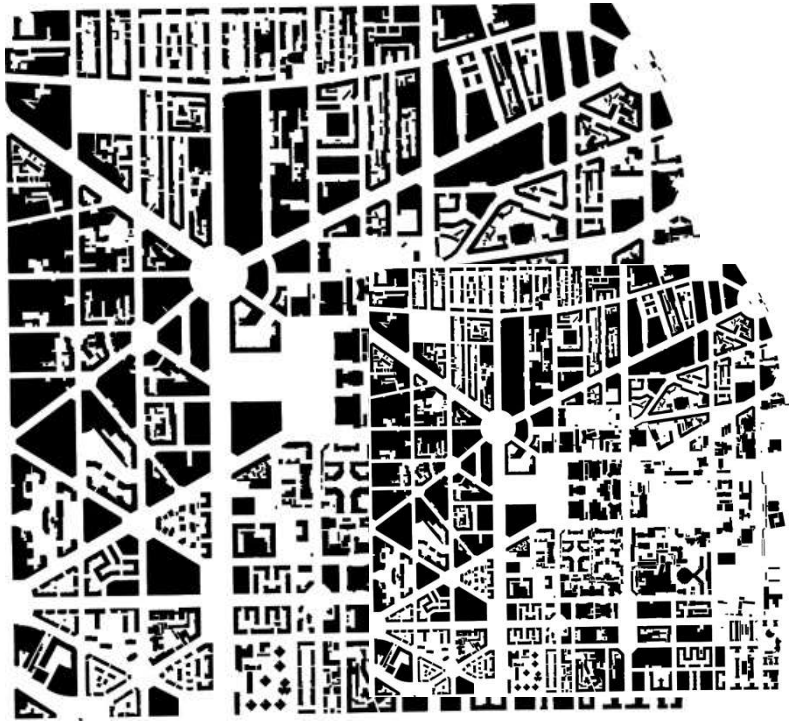
Number of Residents by Census Tracts (ISTAT 2011)

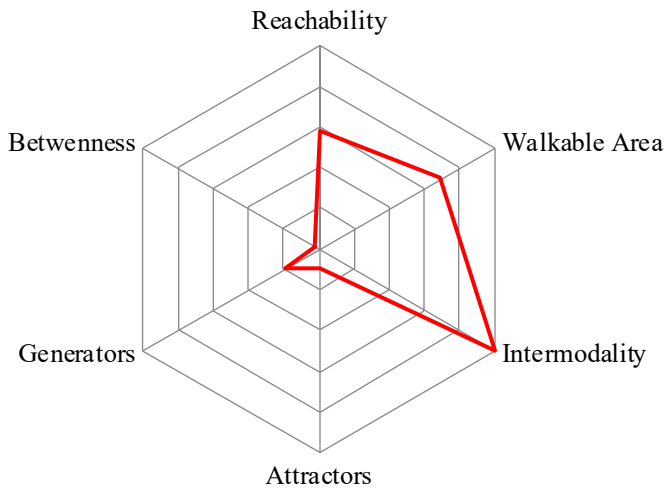
CASE STUDIES OF MILANO NEIGHBORHOODS:

CITY CENTER

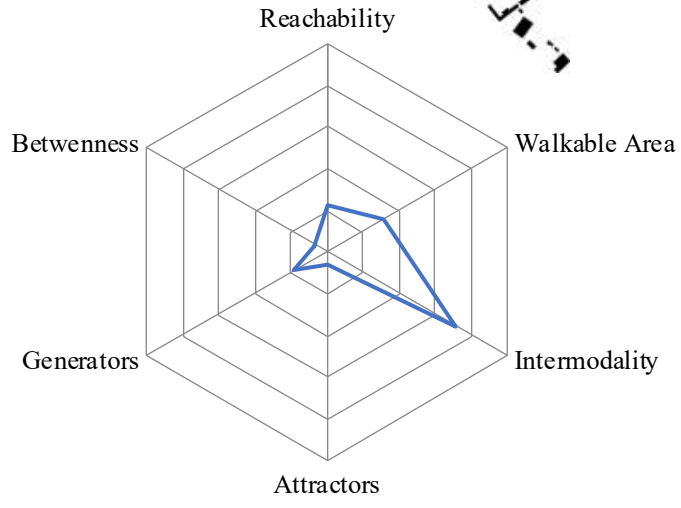


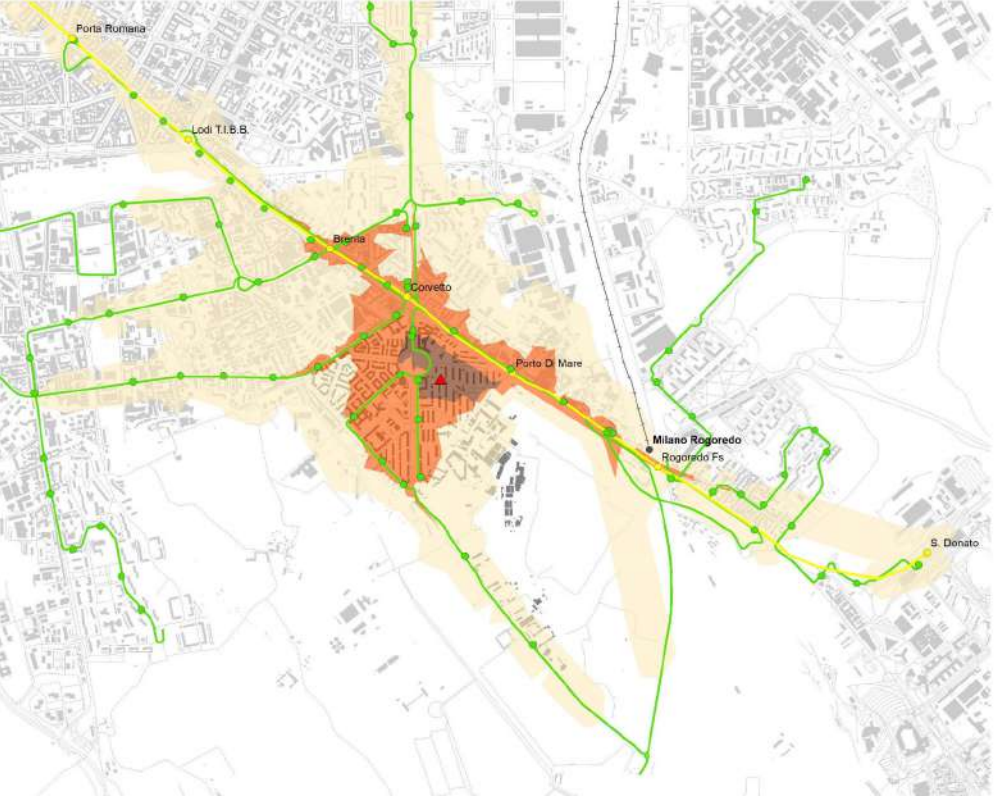
CITTA' STUDI

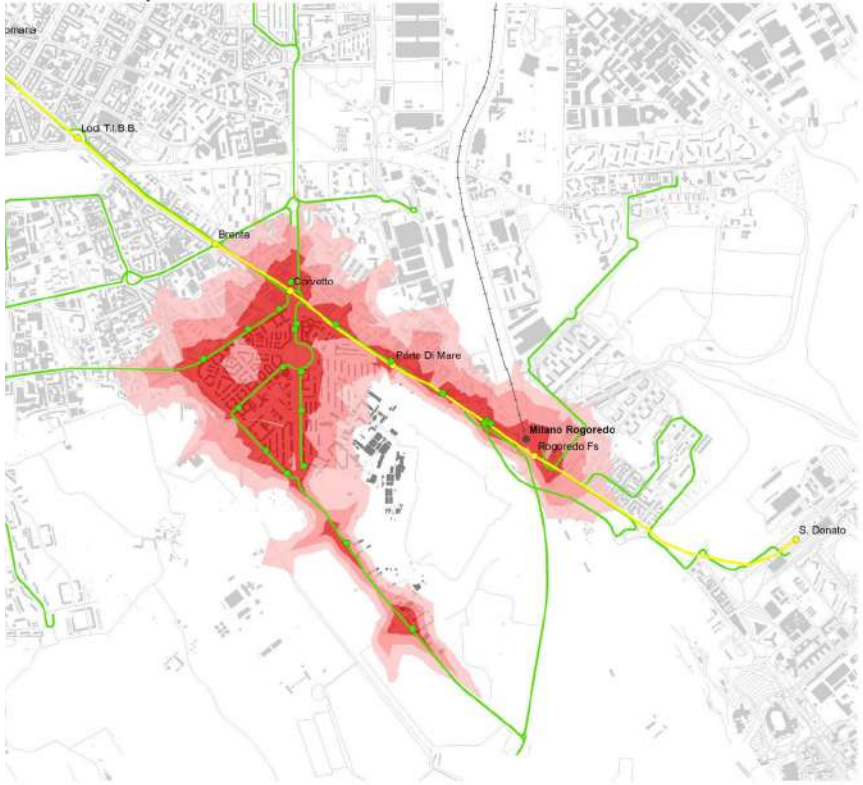


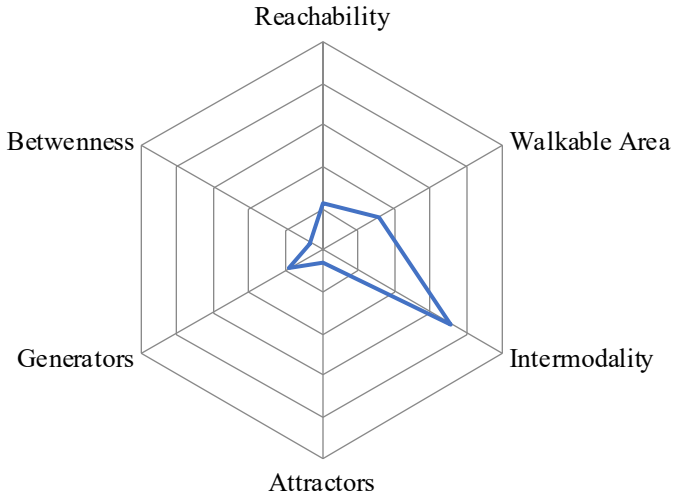


PORTO DI MARE

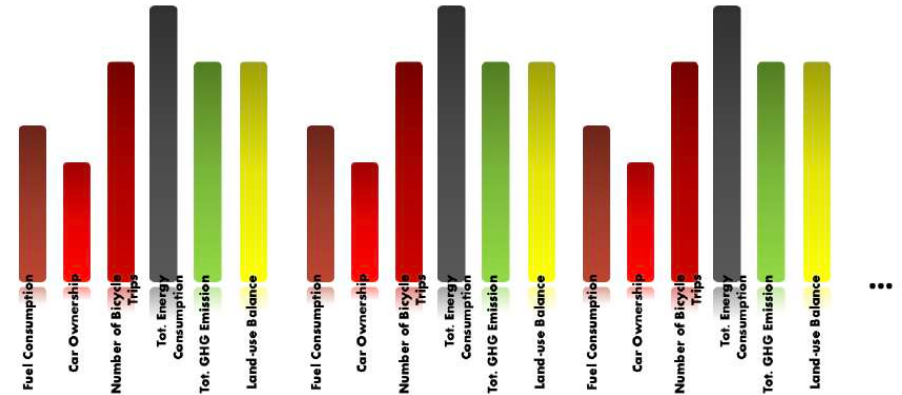


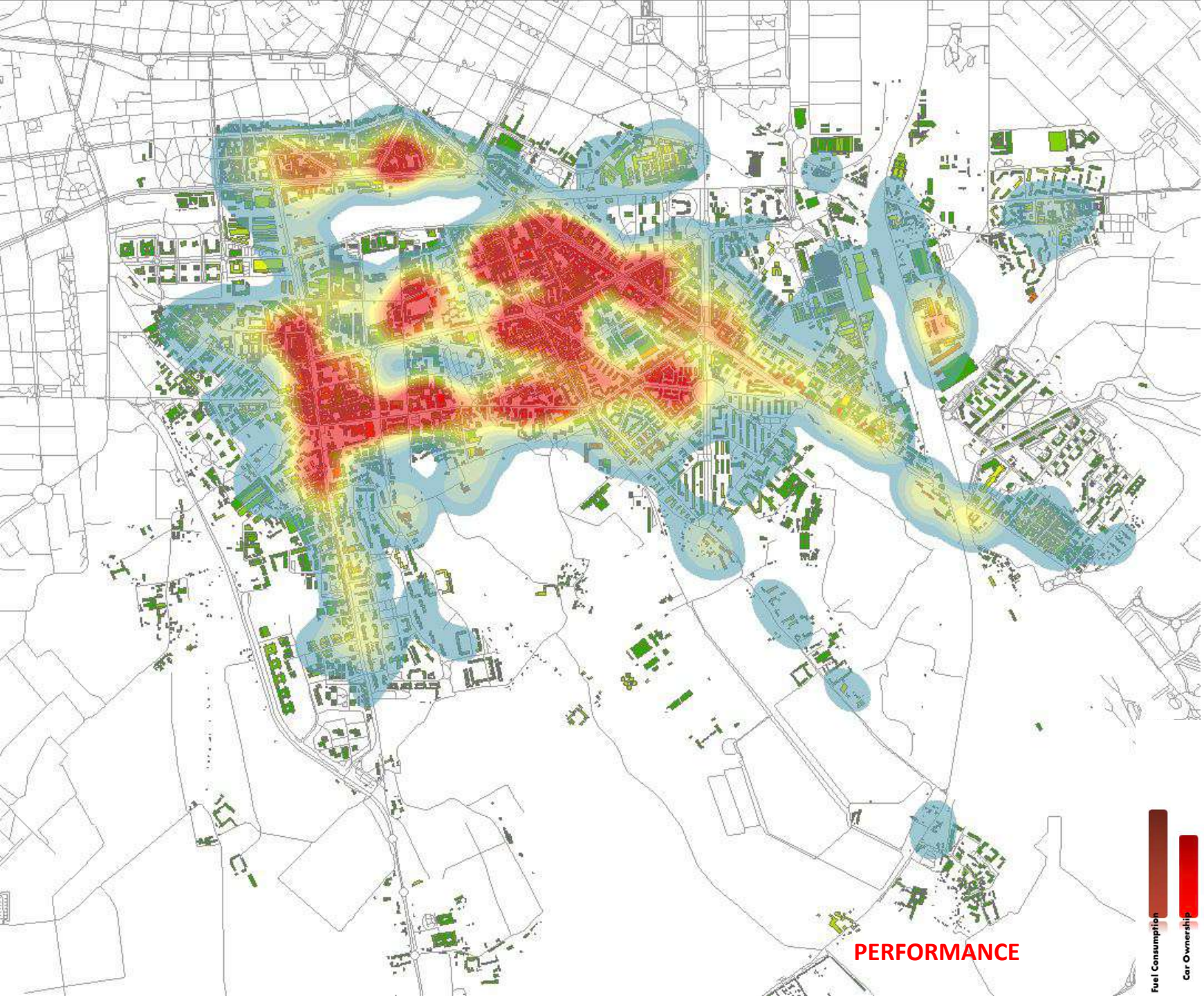


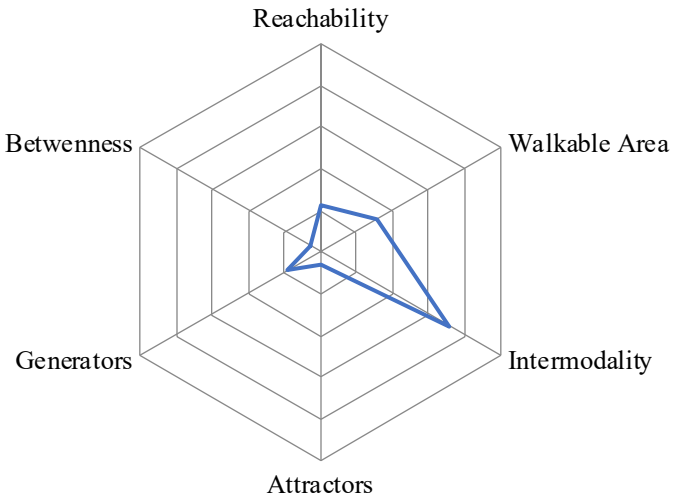




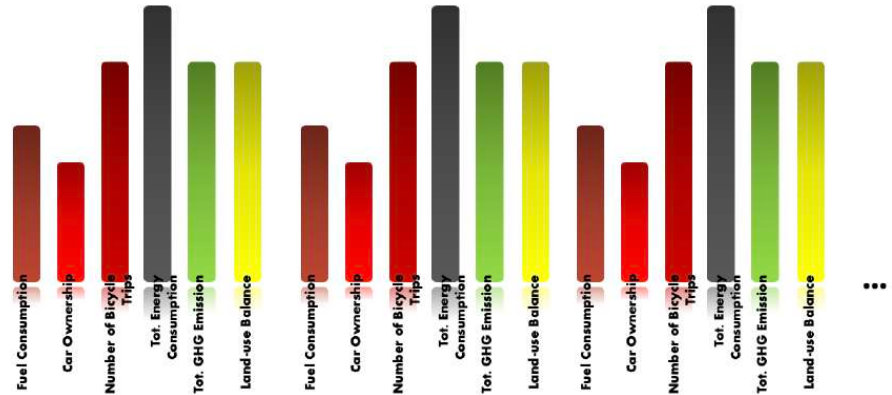
PERFORMANCE







PERFORMANCE



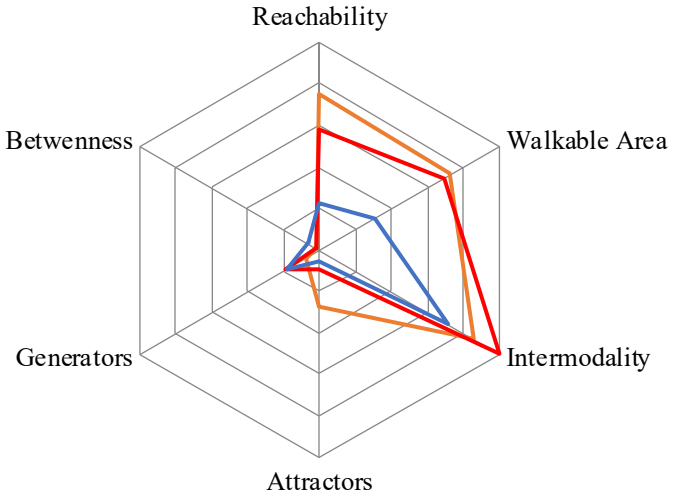
CASE STUDIES OF MILANO NEIGHBORHOODS:

CITY CENTER

CITTA' STUDI

PORTO DI MARE

Accessibility



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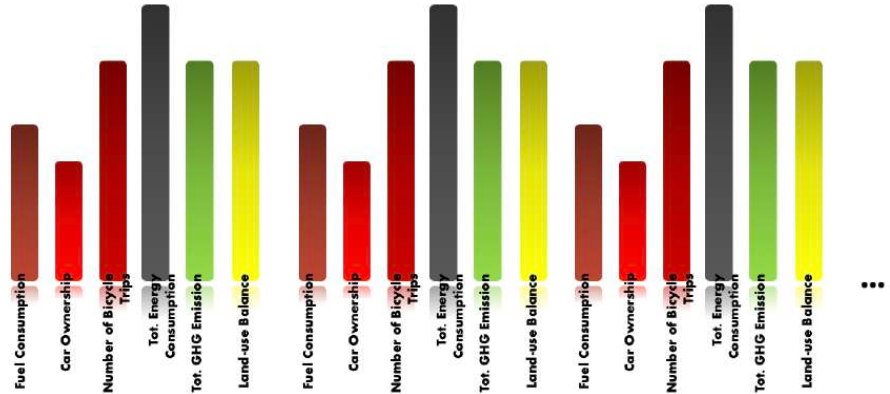
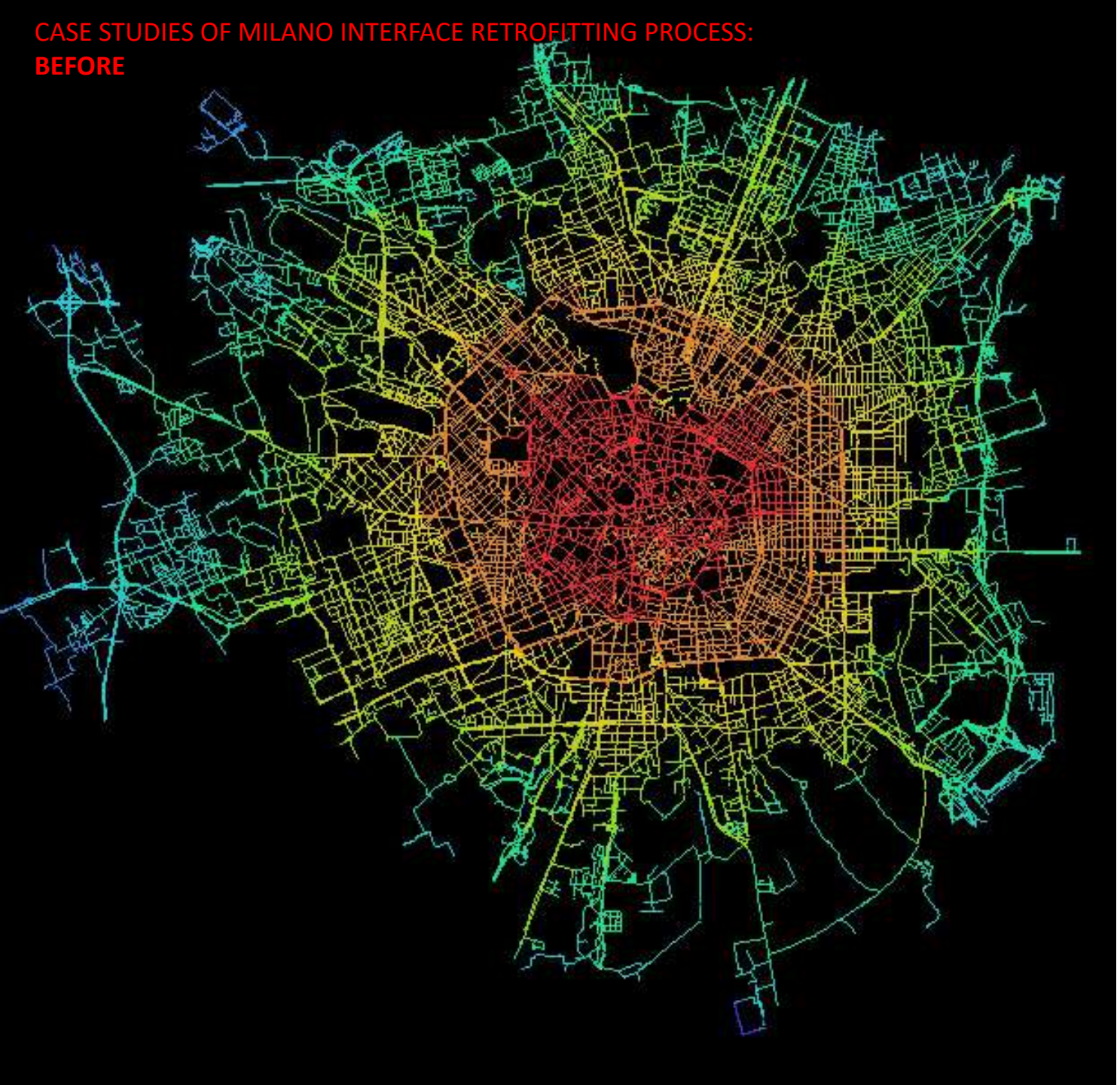


Interface

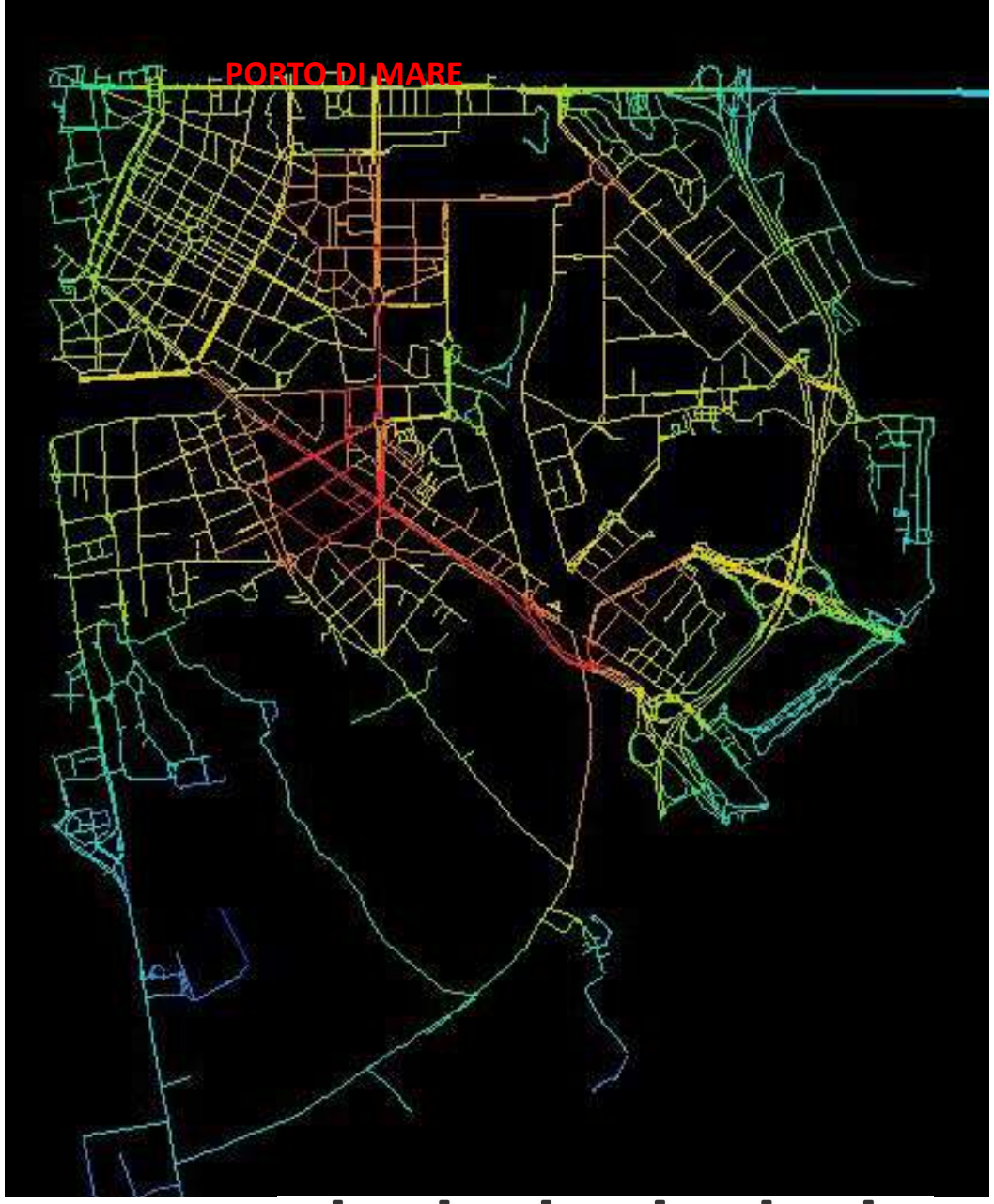
"Interface is a strong indicator of the quality of movement provided by the street network, and hence a very important tool for design of an efficient urban morphology of street networks and their relationship with the voids".

CASE STUDIES OF MILANO INTERFACE RETROFITTING PROCESS:

BEFORE



PORTO DI MARE



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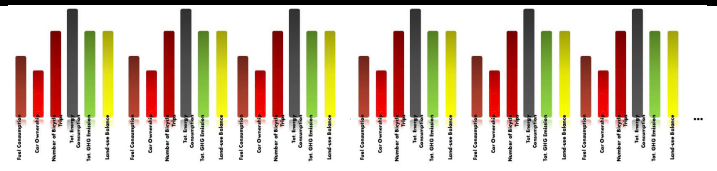
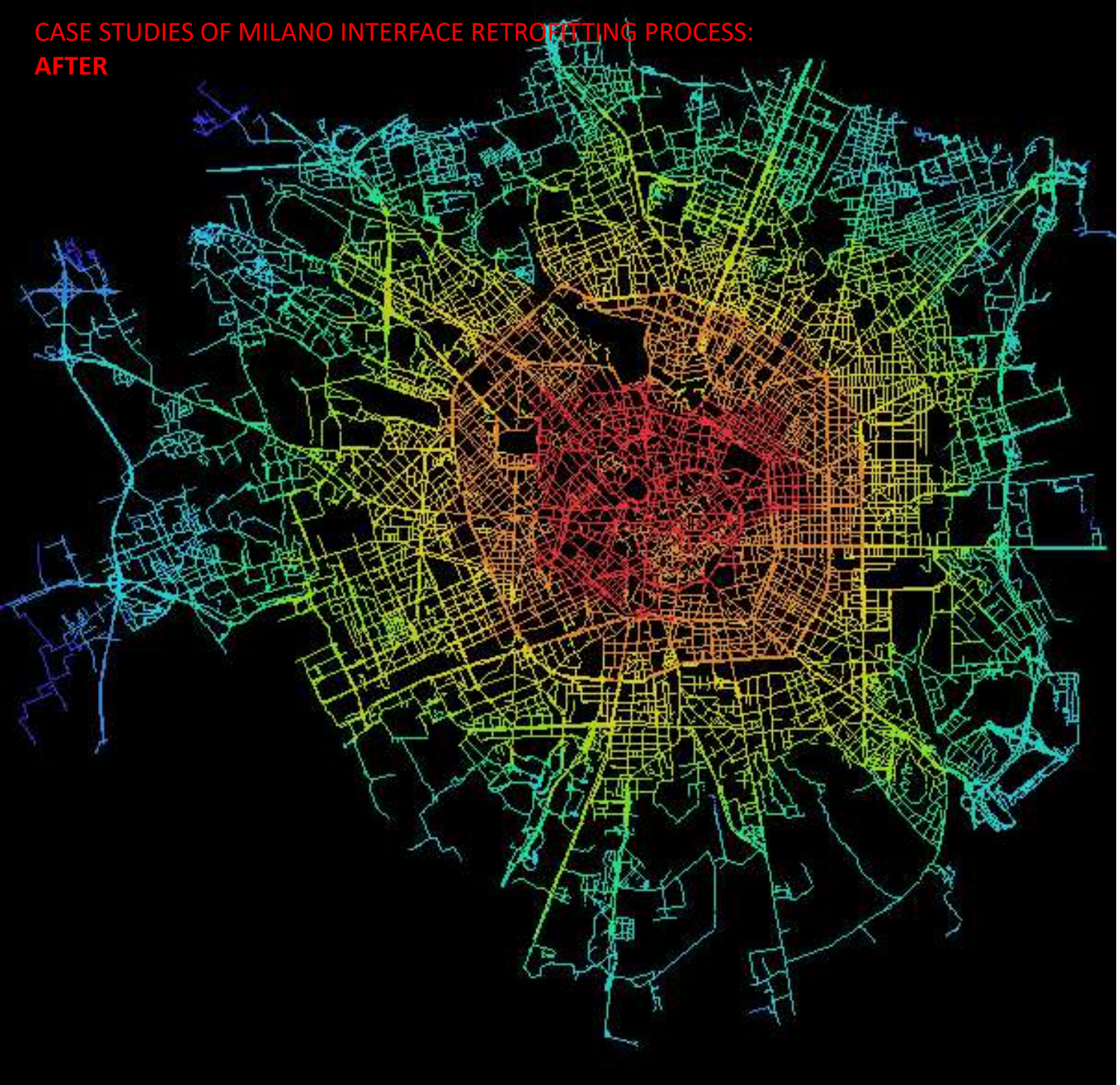


CASE STUDIES OF MILANO INTERFACE RETROFITTING PROCESS:

AFTER



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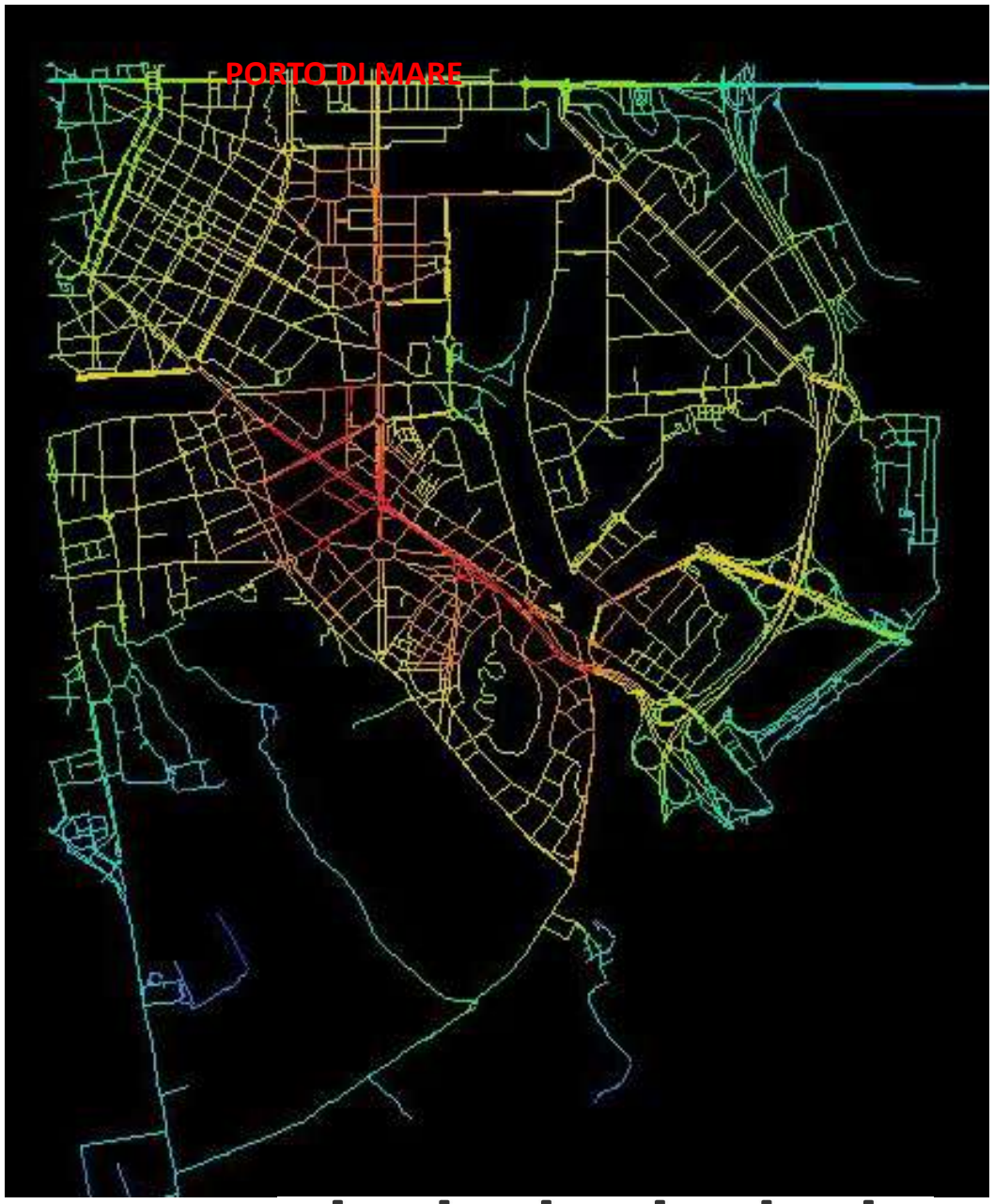

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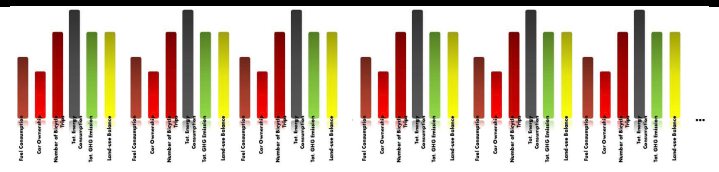
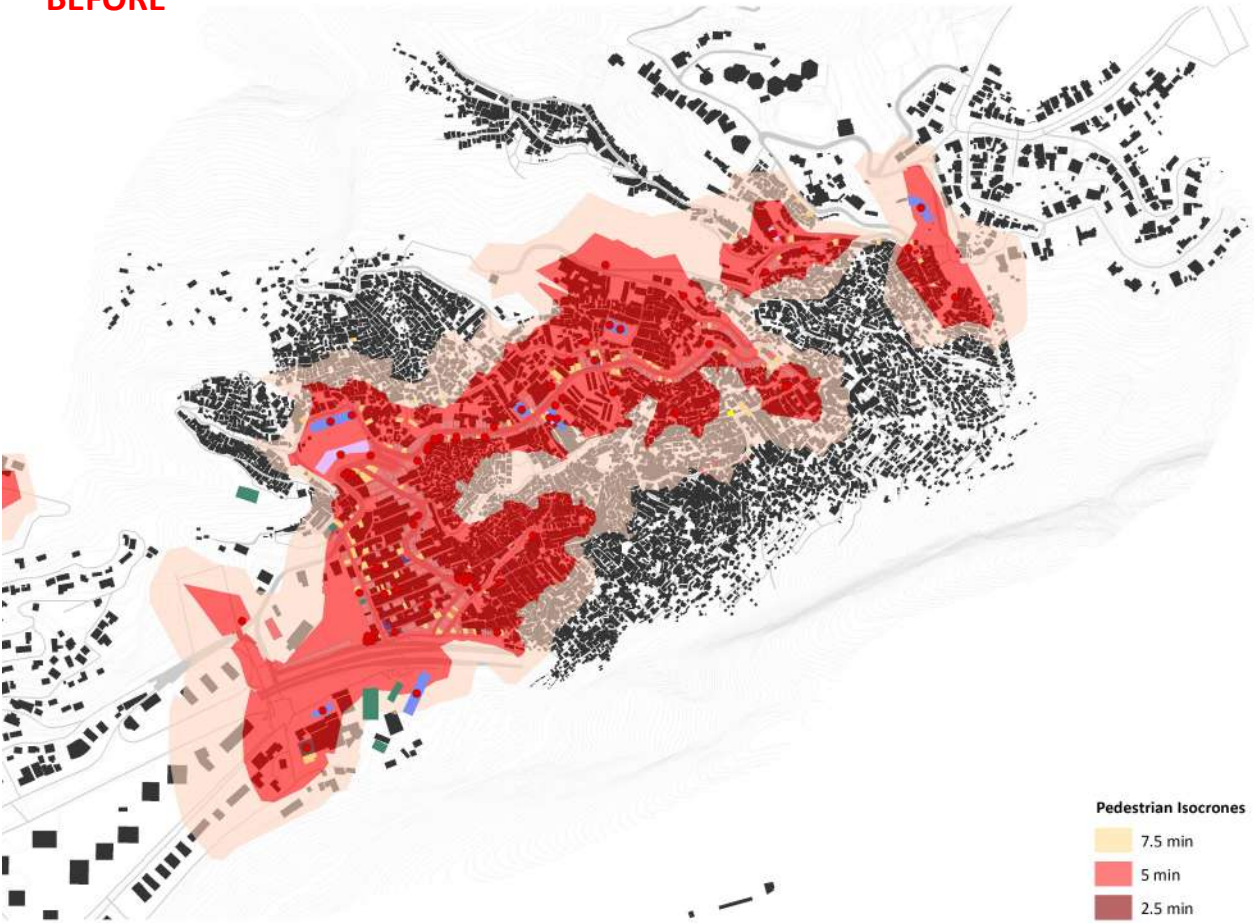


Proximity

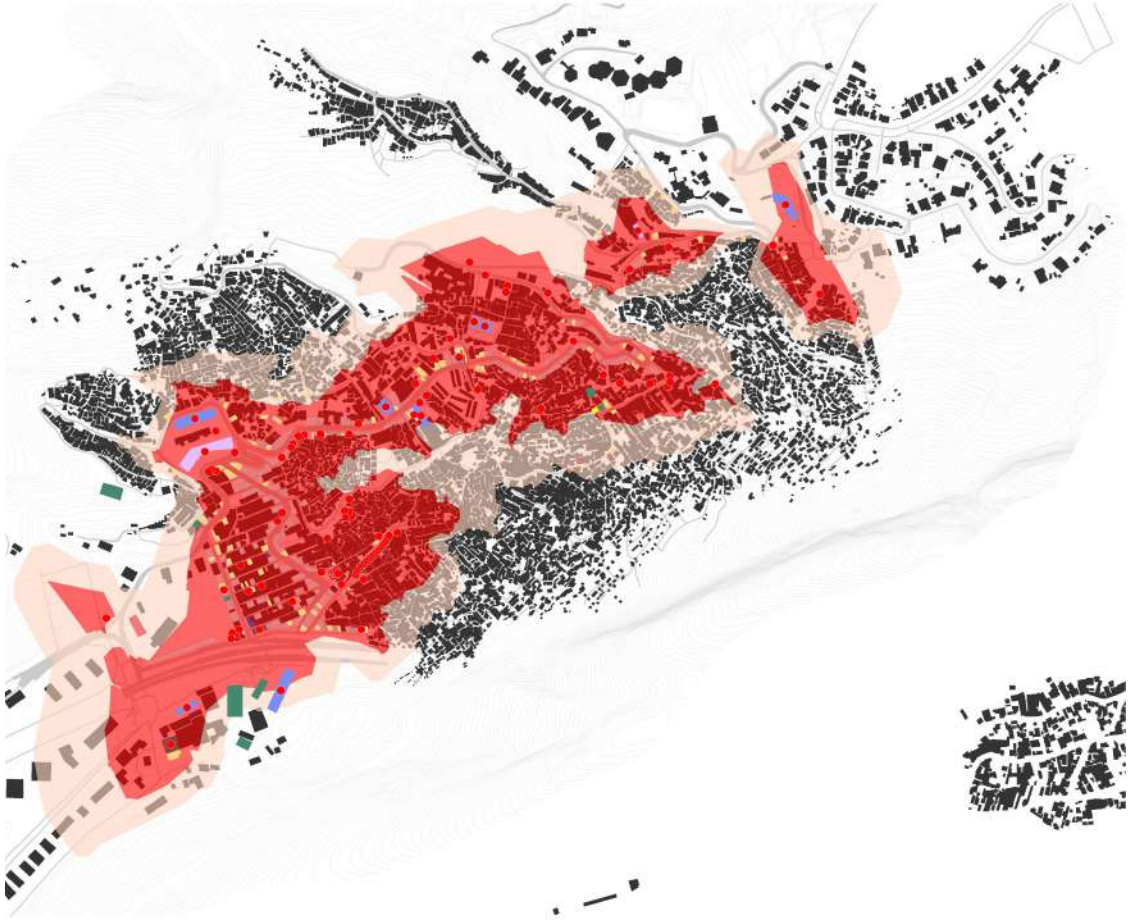
“Proximity indicates how the distribution of different types of uses can easily be reached by the non-motorized traffic in the urban context. It is the number of different type of key functions in a predetermined distance; in fact, the predetermined area is walkable scale”.

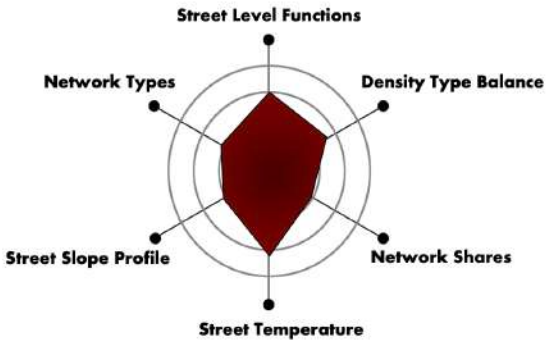
CASE STUDIES OF PROXIMITY IN ROCINHA RETROFITTING PROCESS:

BEFORE

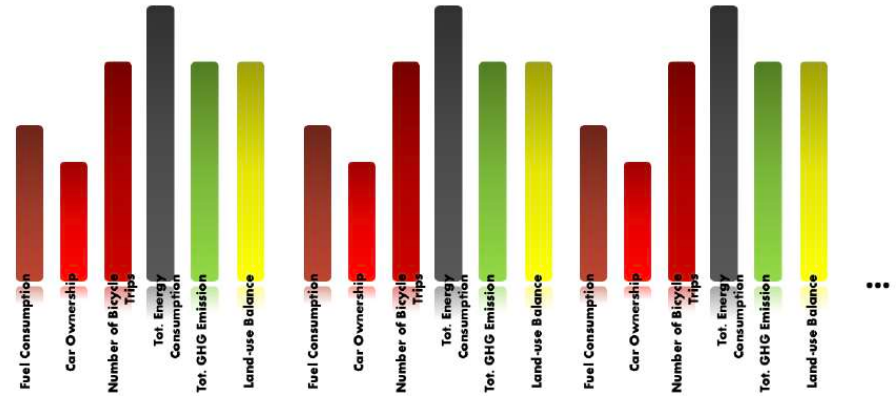


AFTER





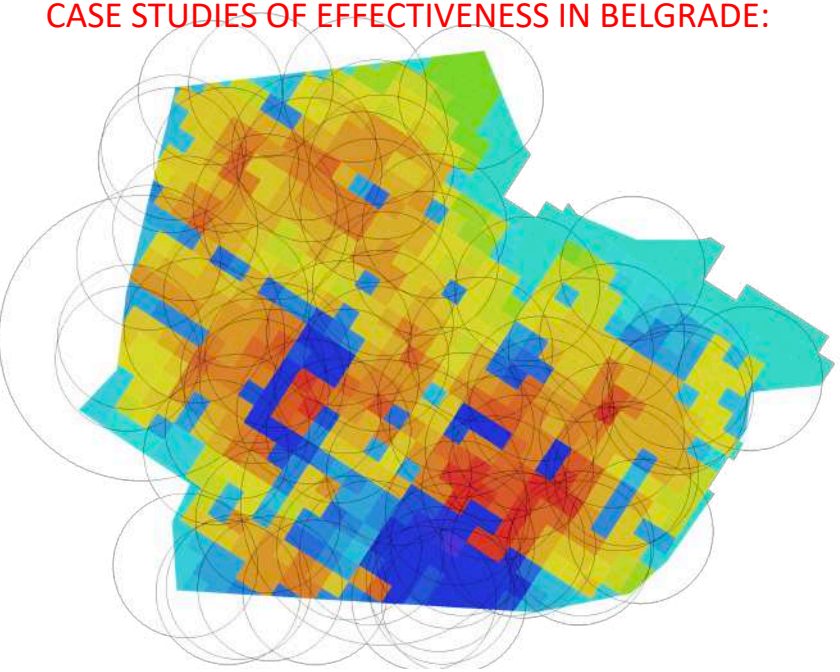
PERFORMANCE

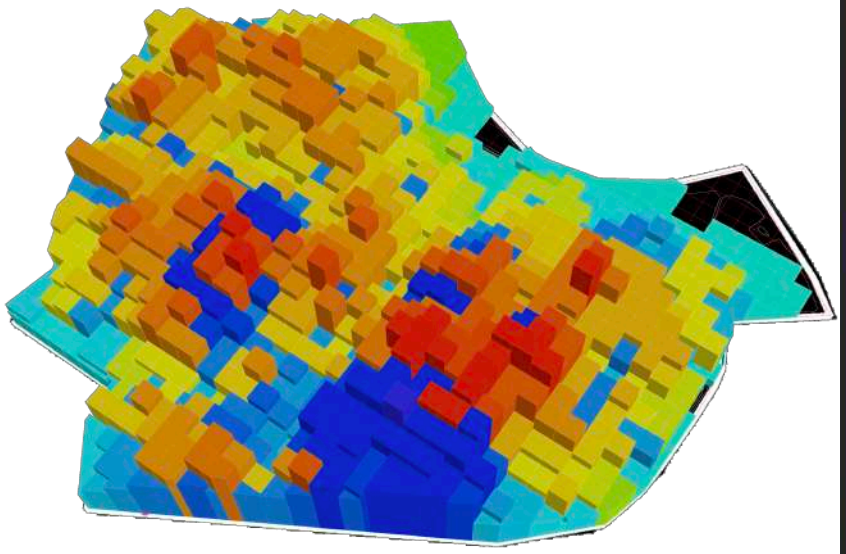


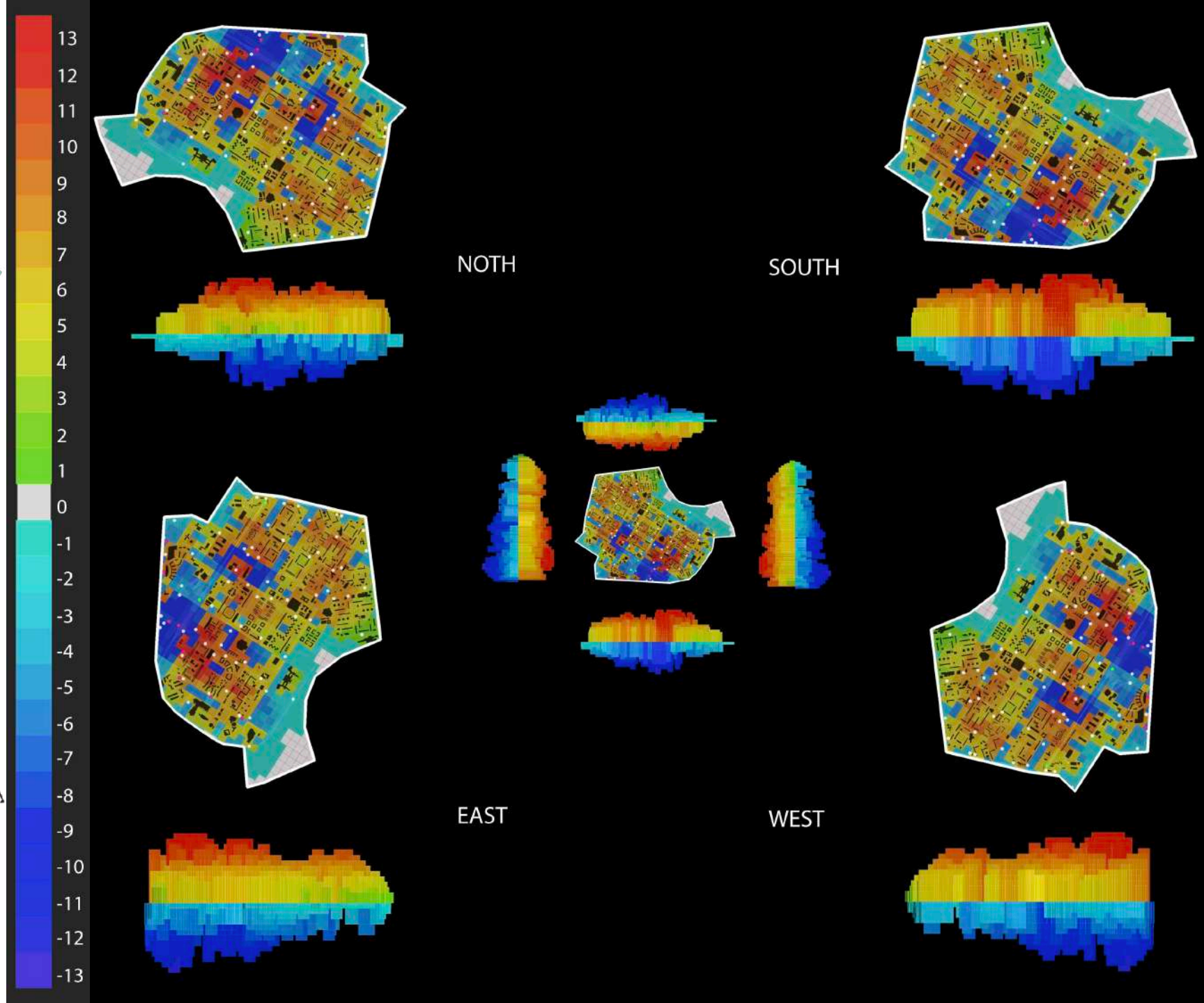
Effectiveness

“Effectiveness defines the capability of producing a desired result in term of the transportation to cover built volumes around it”.

CASE STUDIES OF EFFECTIVENESS IN BELGRADE:

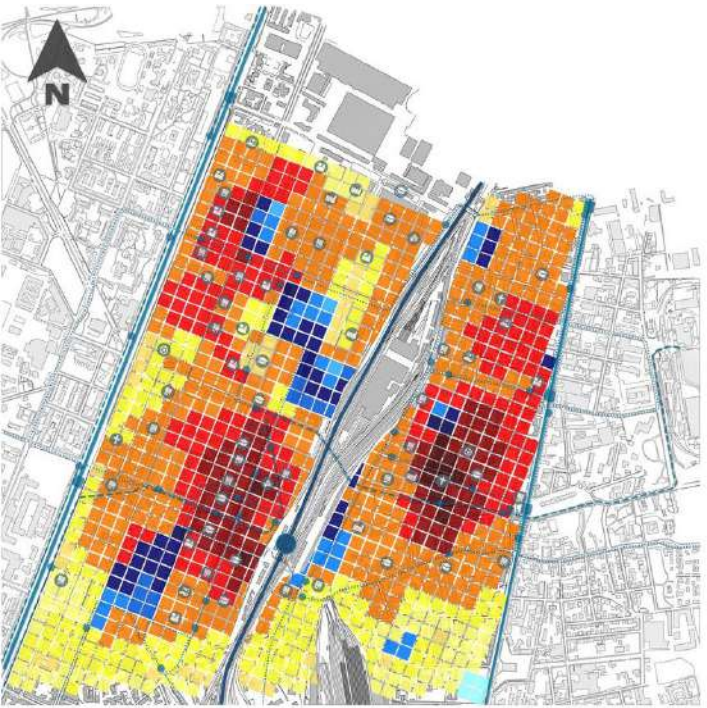


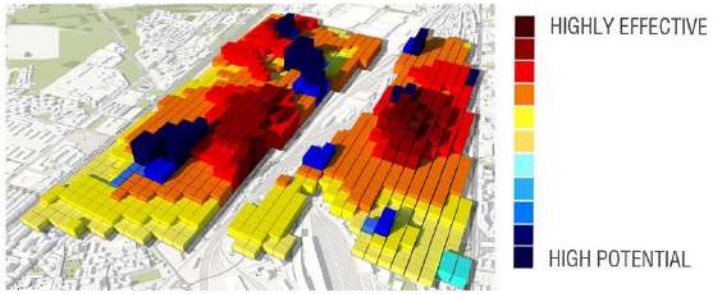




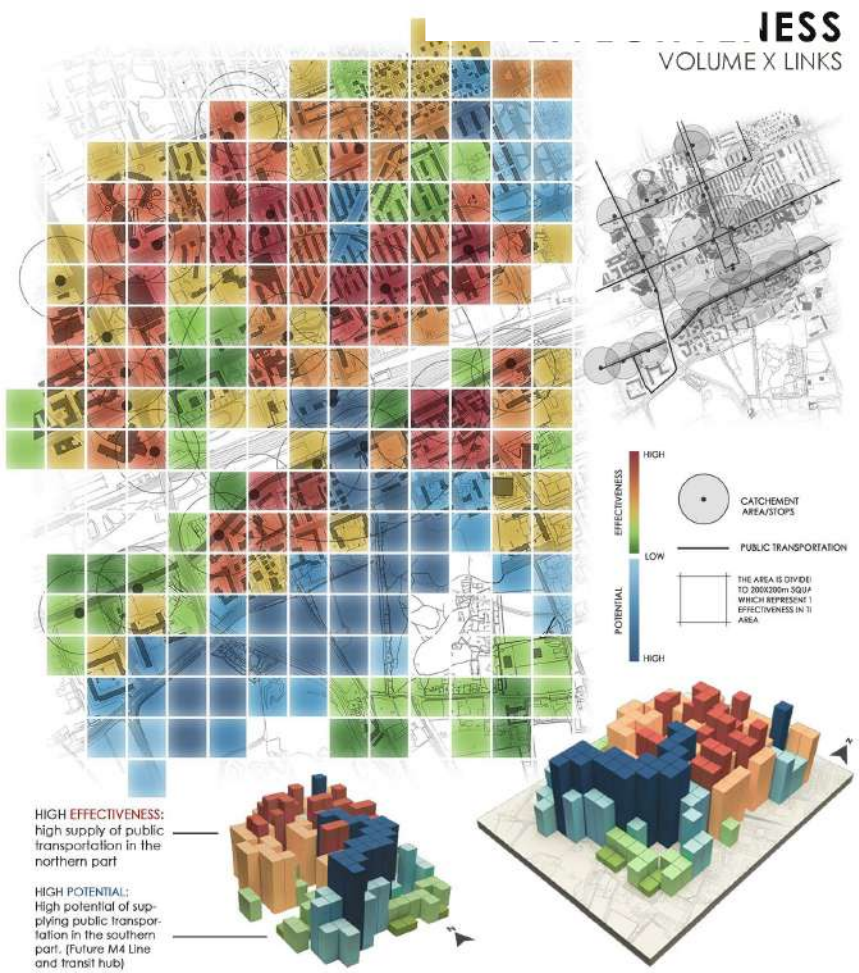
CASE STUDIES OF PROXIMITY IN MILAN:

GRECO PIRELLI

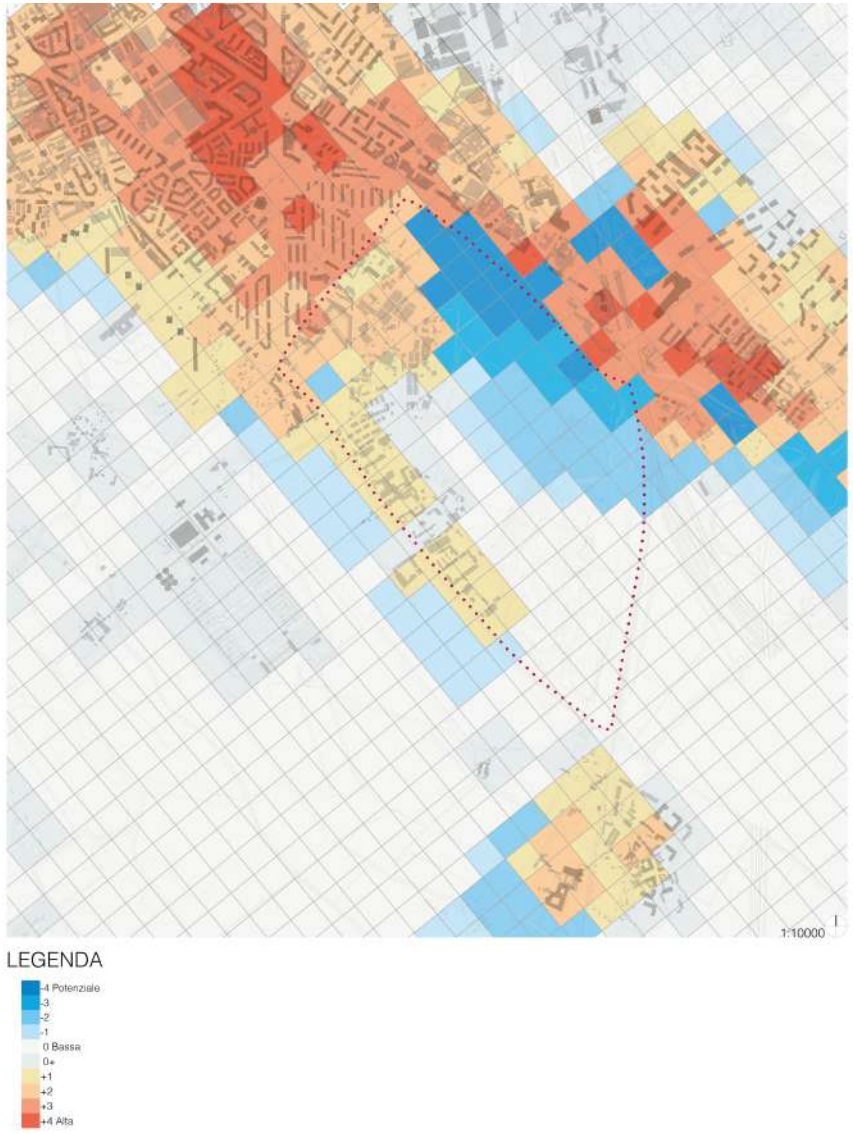




LORENTEGGIO –RONCHETTO DEL NAVIGLIO



PORTO DI MARE



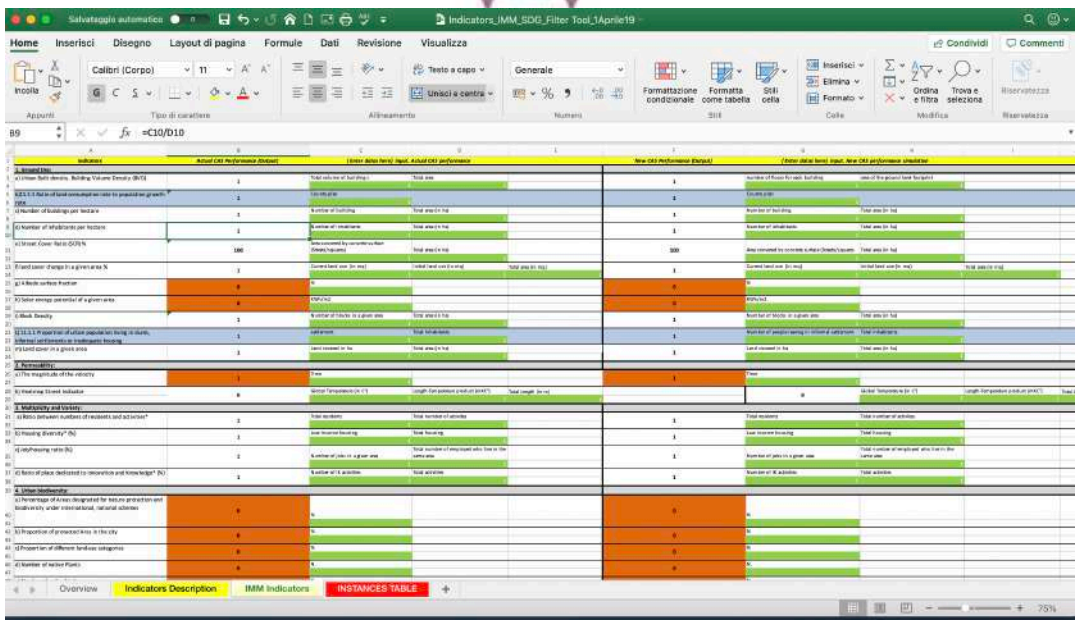
CASE STUDIES OF EFFECTIVENESS IN BELGRADE RETROFITTING PROCESS:

BEFORE

AFTER

31% IMPROVEMENT

Performance Indicators



NEW CAS INDICATORS (INTERVENTION AREAS)

IMM INDICATORS

Indicators	AREA 1			AREA 2			AREA 3.1			AREA 2.2			AREA 6			AREA 4			AREA 5		
	Actual CAS Performance (Output)	New CAS Performance (Output)	Variance	Actual CAS Performance (Output)	New CAS Performance (Output)	Variance	Actual CAS Performance (Output)	New CAS Performance (Output)	Variance	Actual CAS Performance (Output)	New CAS Performance (Output)	Variance	Actual CAS Performance (Output)	New CAS Performance (Output)	Variance	Actual CAS Performance (Output)	New CAS Performance (Output)	Variance	Actual CAS Performance (Output)	New CAS Performance (Output)	Variance
1. Ground Use:																					
a) Urban Built density. Building Volume Density (BVD)	3,87	3,81	-0,61%	0,00	0,04	1,09%	6,53	6,53	-0,03%	5,83	5,79	-0,66%	7,62	7,61	-0,04%	12,335	12,335	0,09%	14,1407	14,1408	0,09%
c) Number of buildings per hectare (n°)	121,11	118,37	-273,89%	91,79	91,90	0,12%	156,04	142,78	-8,50%	94,60	97,86	3,33%	187,44	188,80	0,72%	402,60	377,75	-6,17%	471,02	471,02	0,00%
d) Number of inhabitants per hectare (n°)	2460,35	2460,35	-0,30%	1855,25	1855,81	0,03%	3134,12	3134,12	0,00%	4079,08	4052,99	-0,64%	3142,32	3142,32	0,00%	7167,13	7167,13	-0,15%	10116,81	10116,66	-0,15%
e) Street Cover Ratio (SCR) (%)	12,94%	10,02%	-2,92%	28,38%	28,32%	-0,06%	27,30%	32,65%	5,34%	2,86%	2,23%	-0,64%	28,32%	28,32%	0,00%	21,72%	18,30%	-3,41%	21,72%	22,88%	1,16%
h) Solar energy potential of a given area (kWh/m2)	1700,00	1700,00	0,00%	1700,00	1700,00	0,00%	1700,00	1700,00	0,00%	1700,00	1700,00	0,00%	1700,00	1700,00	0,00%	1700,00	1700,00	0,00%	1700,00	1700,00	0,00%
m) Land cover in a given area (%)	44,99%	43,55%	-1,04%	2,05%	1,99%	-0,11%	0,00%	0,00%	0,00%	0,15%	0,93%	0,78%	0,15%	0,93%	0,78%	0,60%	0,96%	0,36%	0,60%	0,96%	0,36%
3. Multiplicity and Variety:			0,00%																		
c) Job/housing ratio (%)			0,00%	15,67%	16,84%	1,18%	15,06%	20,89%	1,18%	1,12%	5,50%	4,38%	6,65%	7,32%	0,68%	9,62%	12,64%	3,01%	9,62%	12,64%	3,01%
4. Urban biodiversity:			0,00%																		
i) Proportion of the resident living 300m of a park (%)	0,00%	0,00%	0,00%	0,00%	35%	35,39%	0,00%	93,17%	93,17%	0,00%	0,00%	0,00%	0,00%	29,39%	29,39%	0,00%	39,49%	39,49%	0,00%	39,49%	39,49%
n) Indication of vegetation cover in overall area (%)	2,09%	2,09%	0,00%	2,09%	2,09%	0,00%	2,09%	2,09%	0,00%	4,20%	4,20%	0,00%	0,00%	0,78%	100,00%	2,10%	2,29%	8,55%	2,10%	2,29%	8,55%
5. Green Spaces:			0,00%																		
a) Lawn Cover Ratio (LCR)	0,00%	6,22%	6,22%	0,00%	5,48%	5,48%	0,00%	15,28%	15,28%	13,82%	13,82%	0,00%	0,00%	2,76%	2,76%	3,45%	9,34%	5,88%	3,45%	9,34%	5,88%
b) Extent and number of parks (%)	0,00%	21,94%	21,94%	0,00%	16,0%	16,04%	0,00%	101,99%	101,99%	0,00%	0,00%	0,00%	0,00%	8,00%	8,00%	0,00%	31,51%	31,51%	0,00%	31,51%	31,51%
f) Percentage of Residents within Walking Distance of a Recreation Area (%)	0,00%	100,0%	100,00%	22,26%	85,37%	63,11%	0,00%	100,00%	100,00%	0,00%	100,0%	100,00%	20,31%	55,37%	35,06%	96,60%	96,60%	0,00%	89,97%	89,97%	0,00%
5a. Cyclability:			0,00%																		
a) Length of biking roads (km)	0,00	0,01%	0,01%	0,00	0,00	0,02%	0,00	0,00	0,00%	0,00	0,00	0,01%	0,00	0,00	0,01%	0,00	0,0001	0,01%	0,00	0,00	0,01%
b) Population with walkable access to bike trails	0%	100,00%	100,00%	0,00%	47,90%	47,90%	0%	100,00%	100,00%	0%	65,93%	65,93%	0,00%	65,93%	65,93%	0,00%	69,94%	69,94%	0,00%	69,94%	69,94%
c) Number of bike parking spots	0,00	0,11%	0,00%	0,00	0,00	0,01%	0,00	0,001	0,10%	0,00	0,01	0,00%	0,00	0,01	0,01%	0,00	0,00	0,38%	0,00	0,00	0,38%
d) Bike Sharing	0,00	0,10%	0,10%	0,00%	0,09%	0,09%	0,00	0,98%	0,98%	0,00	0,60%	0,60%	0,00%	0,46%	0,46%	0,00	0,01	0,53%	0,00	0,01	0,53%
e) Percentage of daily trips by bicycle	1,82%	1,82%	0,00%	0,02	4%	2,18%	1,82%	4,00%	2,18%	1,82%	4,00%	2,18%	1,82%	4,00%	2,18%	1,82%	4,00%	2,18%	1,82%	4,00%	2,18%
5b. Walkability:			0,00%																		
a) Number of key function in a walking distance from residential buildings	21,00	115,00	9400,00%	107,00	115,00	6,56%	12,00	19,00	36,84%	8,00	12,00	33,33%	210,00	235,00	10,64%	0,00	0,00	0,00%	0,00	0,00	0,00%
b) Car free or minimal car traffic streets	2,026	2,32	29,41%	6,57	6,57	0,04%	0,897	0,90	0,00%	0,039	0,039	0,00%	5,71	5,71	0,00%	0,207	0,215	3,55%	0,10	0,12	17,08%
c) Percentage of daily trips on foot	56,70%	57,70%	1,00%	56,70%	56,70%	0,00%	56,70%	56,70%	0,00%	56,70%	56,70%	0,00%	56,70%	56,70%	0,00%	56,70%	56,70%	0,00%	56,70%	56,70%	0,00%
d) Pedestrian street paths (%)	47,66%	54,70%	7,04%	78,04%	88,76%	10,72%	100,00%	100,00%	0,00%	97,45%	97,70%	0,24%	69,04%	69,04%	0,00%	86,13%	88,87%	2,74%	86,13%	88,87%	2,74%
e) Number of people within walkable distance to frequent transit stops	67,92%	49,60%	-18,32%	69,74%	69,74%	0,00%	33,94%	33,94%	0,00%	100,00%	100,00%	0,00%	100,00%	100,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
i) Sidewalks that are lined with continuous ground-floor activity in a given area (%)	21,53%	24,10%	2,57%	36,87%	39,72%	2,84%	0,00%	50,16%	50,16%	20,49%	41,92%	17,44%	36,87%	38,09%	1,22%	24,56%	42,47%	17,92%	24,56%	42,47%	17,92%
7a. Urban flow (people)			0,00%																		
c) Inhabitants living within 300m from public transport,%	44,16%	36,30%	-7,86%	77,28%	80,63%	3,35%	64,24%	64,24%	0,00%	58,42%	88,72%	30,30%	42,58%	71,92%	28,94%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
d) Length of roads per capita. Road Ratio	0,19	0,19	0,05%	0,36	0,36	0,00%	0,29	0,31	0,09	0,61	0,68	10,17%	0,21	0,21	0,00%	0,33	0,39	15,30%	0,33	0,39	15,30%
h) Number of cars owned by urban residents	20,98%	21,00%	0,02%	20,34%	20,34%	0,00%	12,04%	12,04%	0,00%	11,56%	11,63%	0,64%	11,98%	11,98%	0,00%	13,98%	14,00%	0,13%	13,98%	14,00%	0,13%
i) Motorcycles per thousand inhabitants	58,00	58,00%	-5742,00%	58,00	58,00	0,00%	58,00	58,00	0,00	58,00	58,00	0,00%	58,00	58,00	0,00%	58,00	58,00	0,00%	58,00	58,00	0,00%
l) Total number of journeys by public transport	38,8%	38,80%	0,00%	38,8%	38,8%	0,00%	38,8%	38,80%	0,00%	38,8%	38,8%	0,00%	38,8%	38,8%	0,00%	38,80%	38,80%	0,00%	38,80%	38,80%	0,00%
p) Average duration of a public motorised trip	44,00	44,00	0,00%	44,00	44,00	0,00%	44,00	44,00	0,00%	44,00	44,00	0,00%	44,00	44,00	0,00%	44,00	44,00	0,00%	44,00	44,00	0,00%
q) Average duration of a private motorised trip	22,00	22,00	0,00%	22,00	22,00	0,00%	22,00	22,00	0,00%	22,00	22,00	0,00%	22,00	22,00	0,00%	22,00	22,00	0,00%	22,00	22,00	0,00%
r) Length of reserved public transport routes per urban hectare--road modes	0,00	0,00	0,00%	0,00	0,33	32,64%	0,00	0,00	0,00%	0,00	0,33	32,64%	0,00	0,33	32,64%	0,00	0,24	24,48%	0,00	0,24	24,48%
t) Length of road per urban hectare	0,66	0,66	-0,19%	0,66	0,70	-5,44%	0,00	0,00	#DIV/0!	0,25	0,28	-9,59%	0,66	0,66	0,00%	0,39	0,41	-3,94%	0,39	0,41	-3,94%
9. Energy management:			0,00%																		
a) Consumption per capita	156,20	156,20	-0,22%	151,38	151,38	0,00%	606,00	606,00	0,00%	756,00	756,00	0,00%	756,00	756,00	0,00%	567,35	567,35	0,00%	567,35	567,35	0,00%
p) Primary Energy for public lighting	0,00	5804,91	580491,00%	0,00	5212,20	521226,00%	0,00	5212,20	5212,20	0,00	1260,00	126000,00%	0,00	4204,80	420480,00%	0,00	3972,30	397230,00%	0,00	3972,30	397230,00%
r) Renewables: Renewables electricity production	0,00%	60,00%	60,00%	0,00%	60,00%	60,00%	0,00%	60,00%	60,00%	0,00%	3,45%	3,45%	0,00%	0,33%	0,33%	0,00%	31%	30,95%	0,00%	30,95%	30,95%
s) Renewables: Renewable energy on site	0,00%	60,00%	60,00%	0,00%	60,00%	60,00%	0,00%	60,00%	60,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	30%	30,00%	0,00%	30,00%	30,00%
u) PV-power plant	0,00	140039,00	14003900,00%	0,00	140039	14003900,00%	0,00	140039,00	14003900%	0,00	64865,00	6486500,00%	0,00	68486,00	6848600,00%	0,00	103357,25	10335725,00%	0,00	103357,25	10335725,00%
10. Food management			0,00%																		
a) Food needed daily	5898,56	5898,54	-2,40%	6086,35	6086,35	0,00%	808,20	808,20	0,00%	657,76	653,56	-0,64%	10330,38	10330,38	0,00%	4470,67	4469,62	-0,02%	4470,67	4469,62	-0,02%
b) Amount of urban farm production per person	0,00	21,520	2151,00%	0,00	0,09	9,40%	0,00	0,54	53,72%	0,00	0,195	19,51%	0,00	0,025	2,51%	0,00	0,21	21,28%	0,00	0,21	21,28%
c) Extent of municipally organised plots for cultivation	0,00	1899,49	189949,00%	0,00	7,04	704,25%	0,00	0,46	0,46	0,00	0,026	2,56%	0,00	0,020	2,05%	0,00	1,89	188,61%	0,00	1,89	188,61%
g)Access to stores that provide healthy foods and/or that accept government food assistances programs	0,00%	64,15%	64,15%	0,00%	50,64%	50,64%	0,00%	73,35%	73,35%	0,00%	100,00%	100,00%	0,00%	29,83%	29,83%	0,00%	63,45%	63,45%	0,00%	63,45%	63,45%
L) Access to community gardens	0,00%	100,00%	100,00%	0,00%	26,87%	26,87%	0,00%	100,00%	100,00%	0,00%	0,04%	0,04%	0,00%	21,15%	21,15%	0,00%	37,02%	37,02%	0,00%	37,02%	37,02%
11. Waste management:			0,00%																		
a) Amount of solid waste produced	63,00	63,000	0,00%	63,00	63,00	0,00%	8,37	8,37	0,00	17,51	17,395	-11,20%	63,00	63,00	0,00%	37,97	37,94	-2,69%	37,97	37,94	-2,69%
b) Rate of waste recycled	33,70%	36,25%	2,55%	33,70%	49,33%	15,63%	33,70%	33,70%	0,00%	30,05%	48,86%	18,82%	33,70%	49,33%	15,63%	32,75%	36,25%	3,46%	32,75%	36,25%	3,46%
c)Rate of materials coming from re-cycling	0,00%	0,00%	0,00%	0,00%	4,76%	4,76%	0,00%	35,84%	35,84%	0,00%	17,25%	17,25%	0,00%	4,76%	4,76%	0,00%	12,52%	12,52%	0,00%	12,52%	12,52%
12. Water management:			0,00%																		
c) Runoff coefficient	0,70	0,81	12,00%	0,70	0,55	-21,43%	0,70	0,55	-21,43%	0,86	0,79	-8,14%	0,86	0,79	-8,14%	0,78	0,67	-14,10%	0,78	0,67	-14,10%
a) Concentration of Chloroform (µg/l)	60	30,00	-3000,00%	60	30,00	-50,00%	60	30,00	-50,00%	60	30,00	-50,00%	60	30,00	-50,00%	60,00	30,00	-50,00%	60,00	30,00	-50,00%
a) Concentration of Anionic Surfactact (µg/l)	4,7	0,05	-465,00%	4,7	0,05	-98,94%	4,7	0,05	-98,94%	4,7	0,05	-98,94%	4,7	0,05	-98,94%	4,70	0,05	-98,94%	4,70	0,05	-98,94%
a) Daily coverage of potable water (%)	21	100,00	7900,00%	21	100,00	79,00%	21	100,00	79,00%	21	100,00	79,00%	21	100,00	79,00%	21,00	100,00	79,00%	21,00	100,00	79,00%
e) Number of inhabitants supplied with a new sewage network	0		0,00%	0	1855,81	100,00%	0	3134,12	100,00%	0	4052,99	100,00%	0	3142,32	100,00%	0,00	3046,31	100,00%	0,00	3046,31	100,00%

This tutorial contributes to the implementation of the following Sustainable Development Goals:

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