



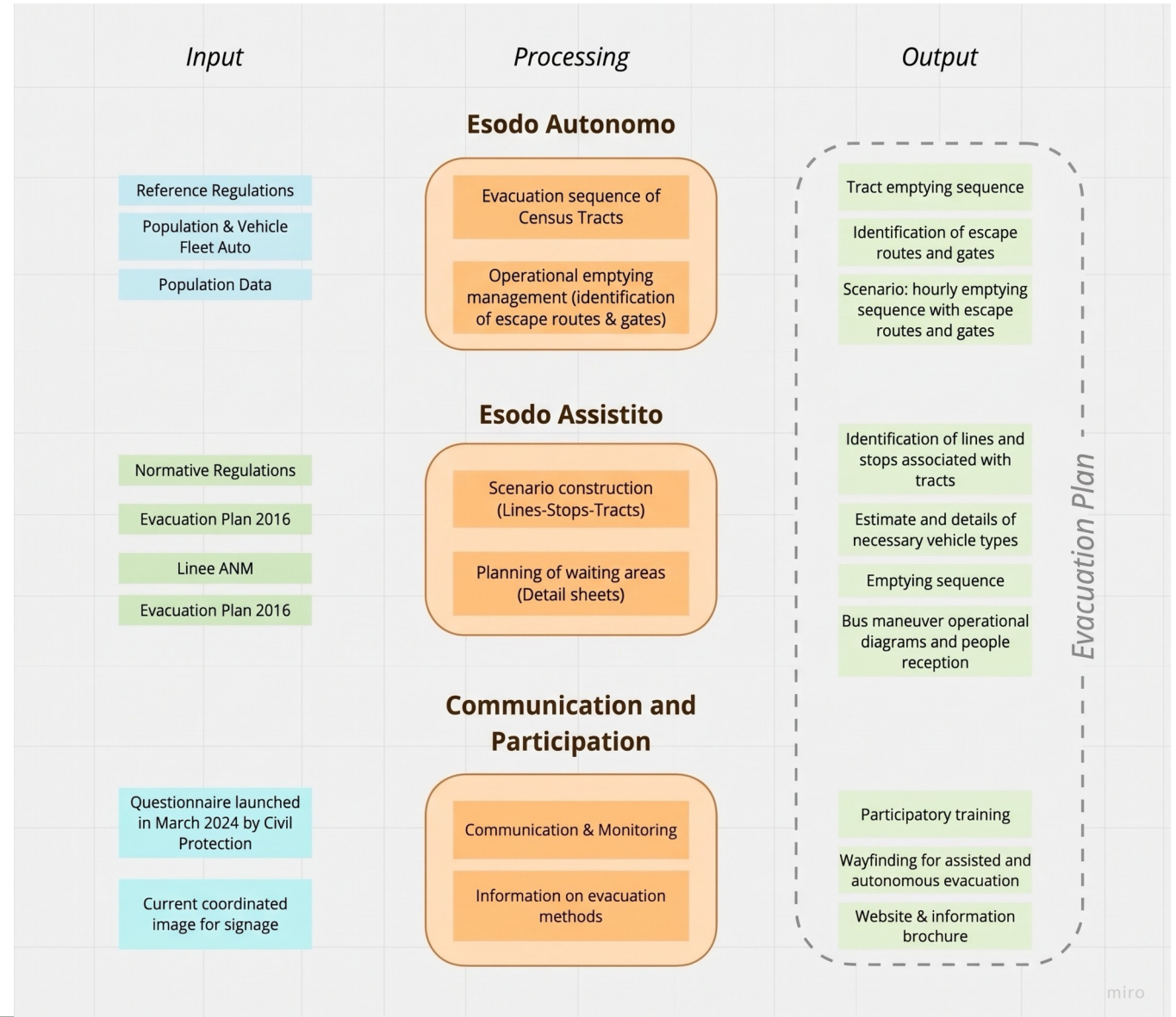
Volcanic Urban Exodus: Analytical flow design for the Vesuvius red zone evacuation

Matteo Scamporrino | TPS Pro

Introduction

Introduction | What: The Plan

- **Objective and Regulatory Transposition** (Input →Output): The Municipal Evacuation Plan for the Vesuvius Red Zone transposes national and regional planning directives to the municipal scale, in alignment with the overarching civil protection regulatory framework (Legislative Decree 1/2018).
- **Operational Purpose:** Ensure a rational, coordinated, and effective clearance of the population, tailored to specific local operational constraints and territorial characteristics.
- **Engineering Scenario Modeling** (Processing): Define both Autonomous Evacuation (Self-Evacuation) and Assisted Evacuation regimes using a specialized engineering approach calibrated to the actual capacity, vulnerability, and operational conditions of the infrastructure network.
- **Communication and Public Participation:** Integrate risk communication and proactive community engagement frameworks, harmonized with multi-tiered operational procedures across institutional levels.



Introduction | Where: the Vesuvio

Territorial Framework and Spatial Orientation:

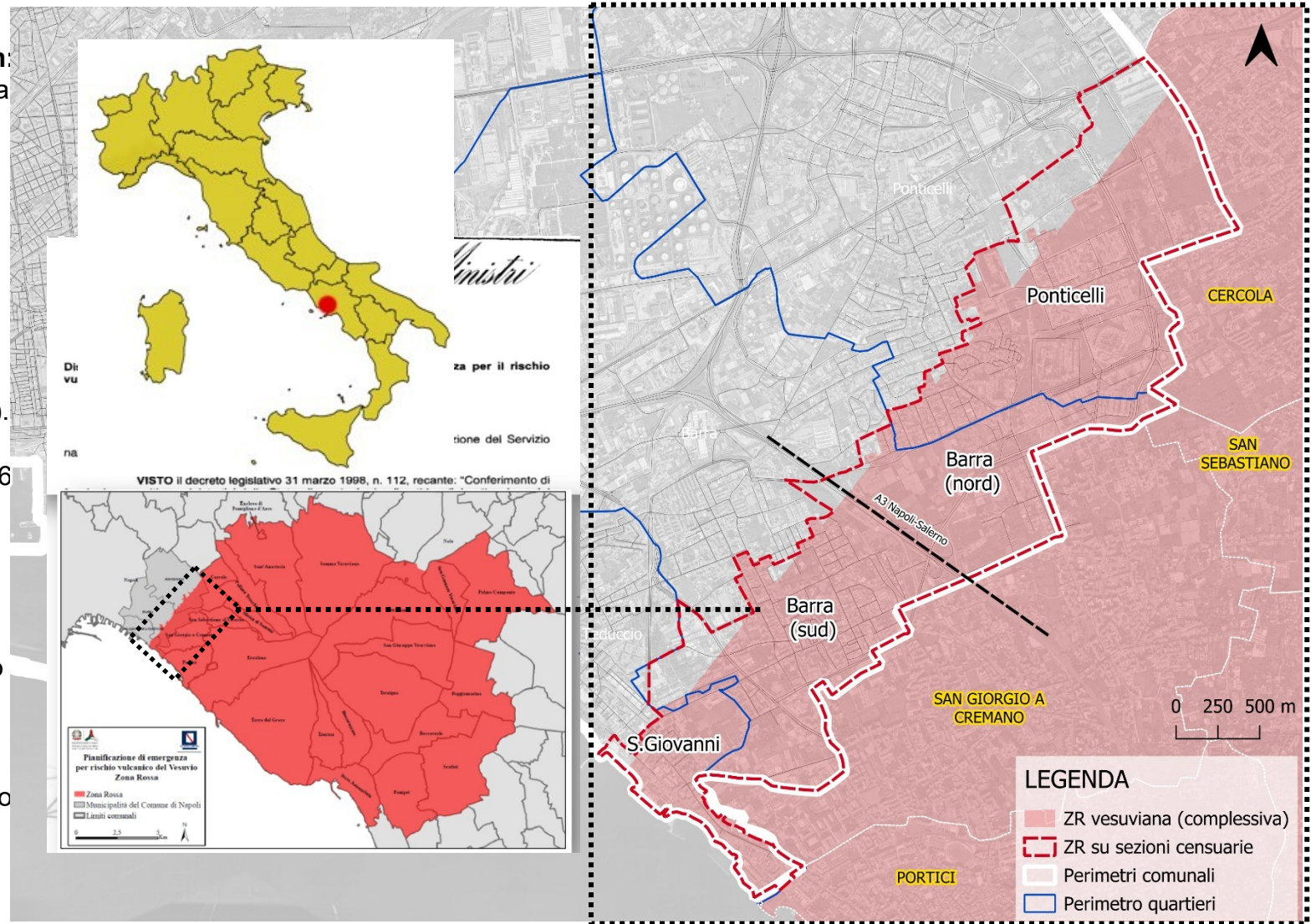
- The Red Zone (RZ) of Naples extends along a NW–SE axis at the western perimeter of the Vesuvius Red Zone (VRZ).
- The area concurrently defines the eastern municipal boundary of the City of Naples.

Boundaries and Local Administrative Subdivision:

- North-East Flank: borders four neighboring municipalities (Cercola, San Sebastiano al Vesuvio, San Giorgio a Cremano, and Portici).
- Internal Districts: partially encompasses the three neighborhoods comprising Municipality 6 (Ponticelli, Barra, and San Giovanni a Teduccio).

Infrastructure and Operational Compartmentalization:

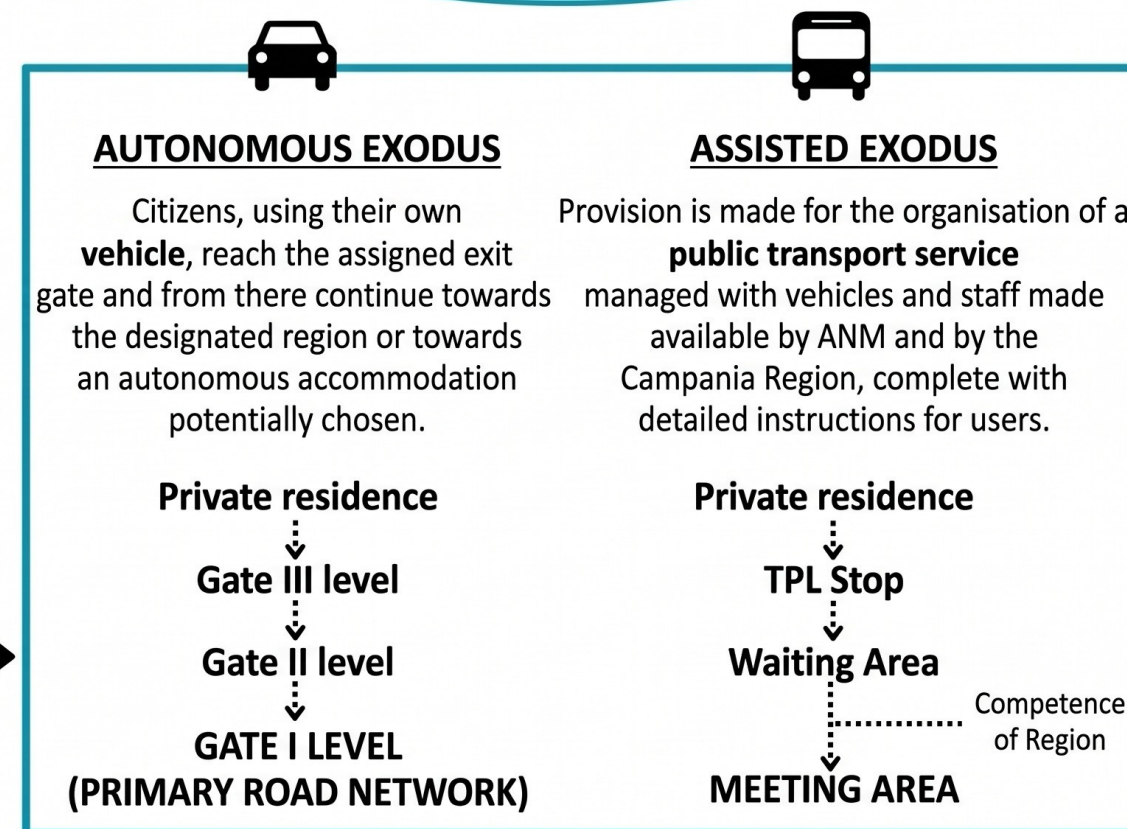
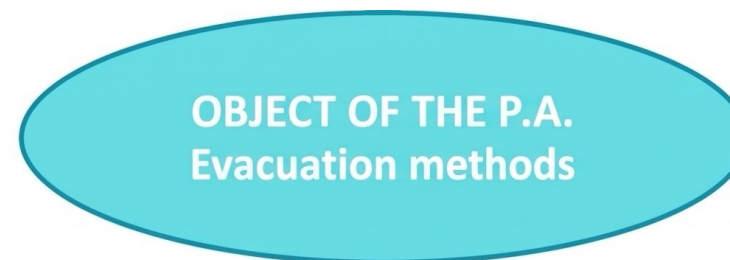
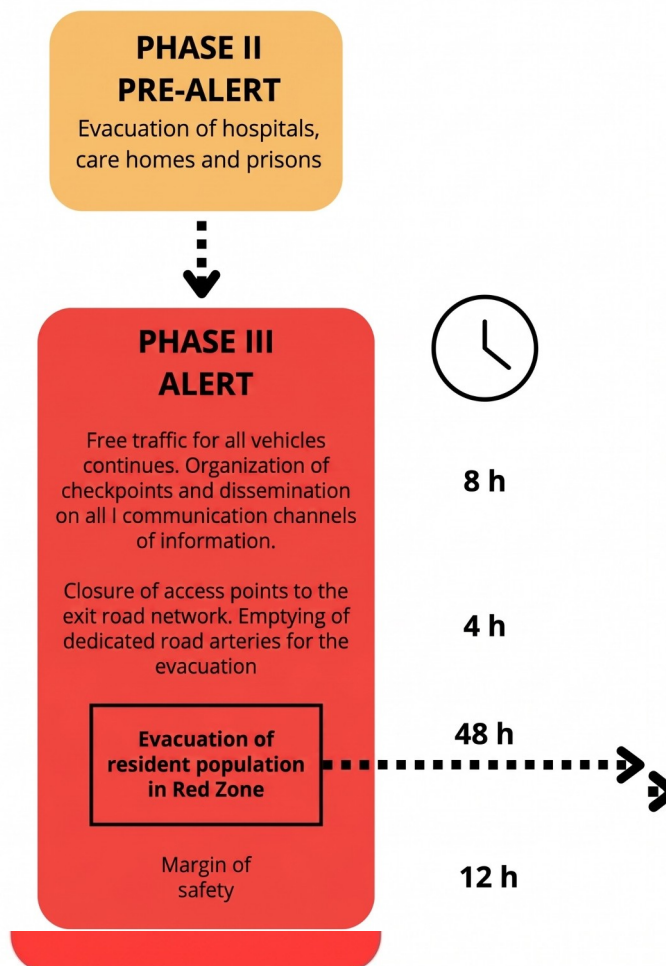
- Centrally traversed by the A3 Naples–Salerno motorway corridor.
- The highway infrastructure bisects the Barra district, establishing two distinct operational sectors situated respectively north and south of the A3 alignment.



Introduction | When: Alerts phases

OPERATIONAL PHASES

Emergency State



BASIC DATA AND PREMISES

Investigations | Source data

BASE DATA 	SOURCES 
1. Minimum unit of analysis:	Census sections (ISTAT 2011);
2. Population of census sections:	Injuries ISTAT 2021;
3. Population of Naples Municipality:	ISTAT as of 01/01/24;
4. Vehicle fleet of Naples Municipality:	ACI - Auto-portrait 2023
5. Ordinary TPL lines and stops (ZR):	ANM vector data

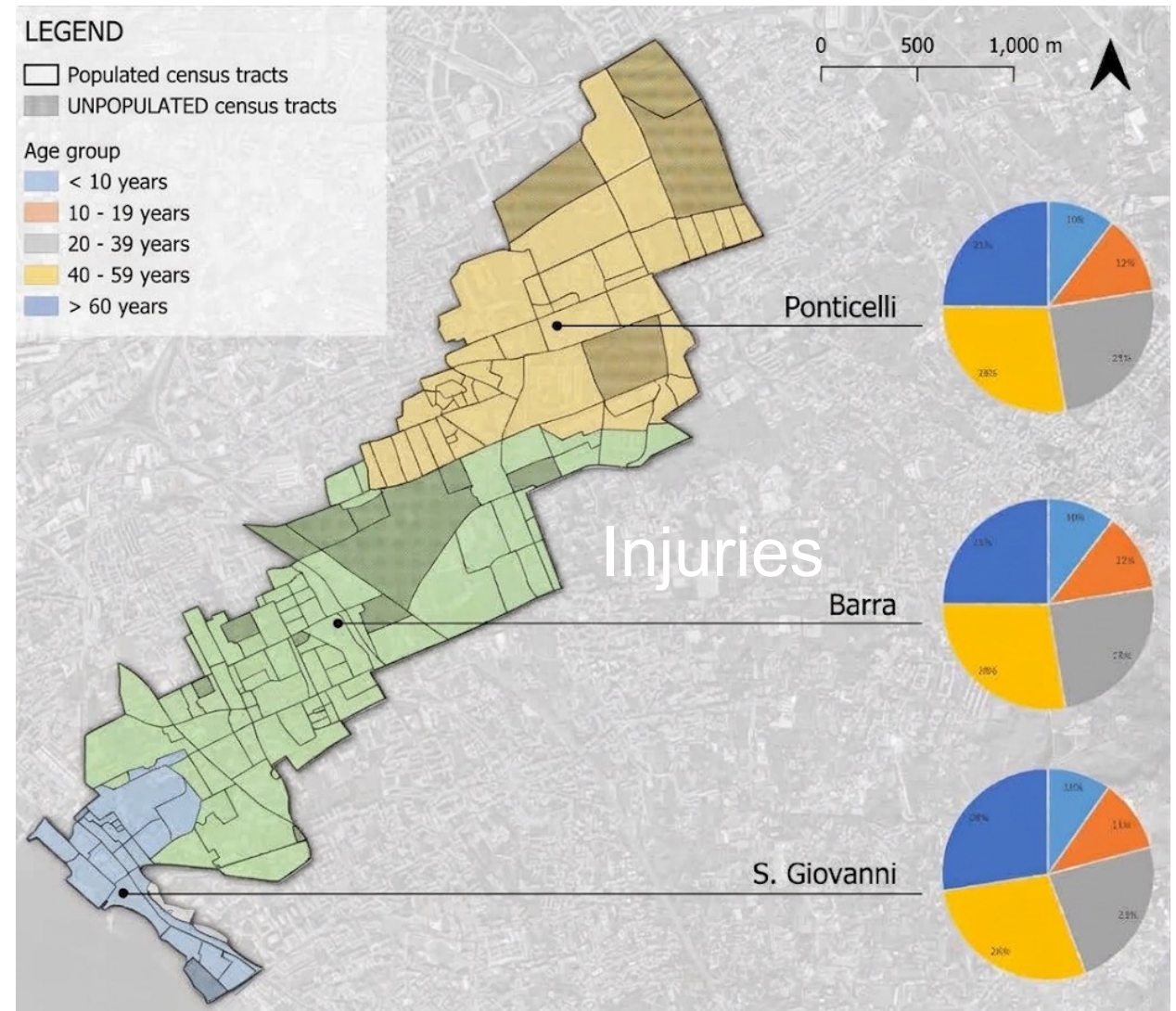
The Red Zone (RZ): basic statistics and population distribution neighbourhood

Census Breakdown and Territorial Extension:

- The Red Zone (RZ) is partitioned into 165 census tracts, comprising 148 populated and 17 uninhabited units.
- The total resident population stands at 36,890 inhabitants, distributed over an overall area of approximately 5 km².

District-Level Demographic and Spatial Distribution:

- District population shares: Barra constitutes the most populated district with over 17,000 inhabitants (48% of the total), followed by Ponticelli (38%) and San Giovanni (14%).
- Spatial footprint and density: While Barra also accounts for the largest spatial footprint (48% of total surface area), the highest population density is recorded in San Giovanni, reaching approximately 11,130 inhabitants/km².

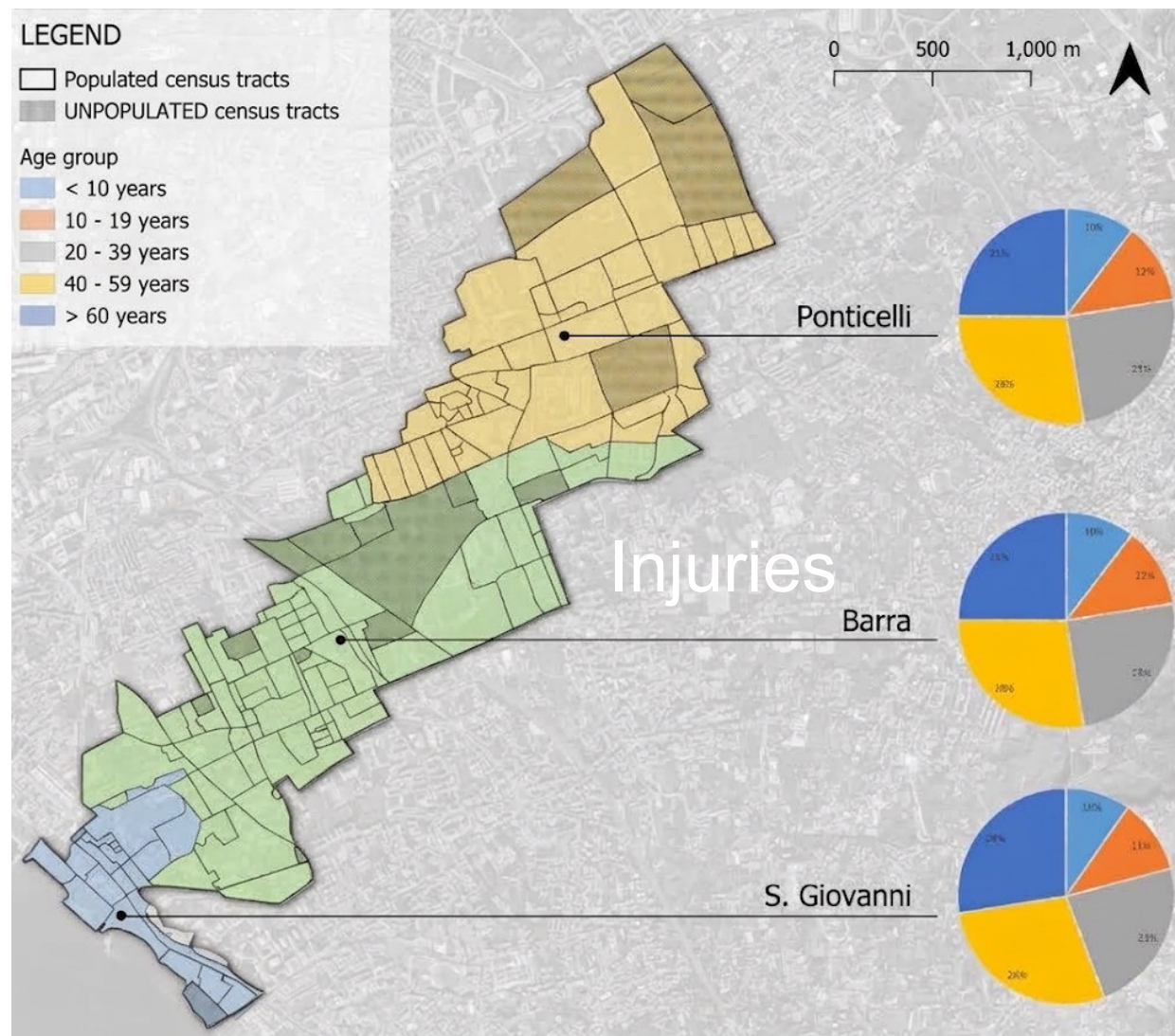


The Red Zone (RZ): basic statistics and population distribution neighbourhood

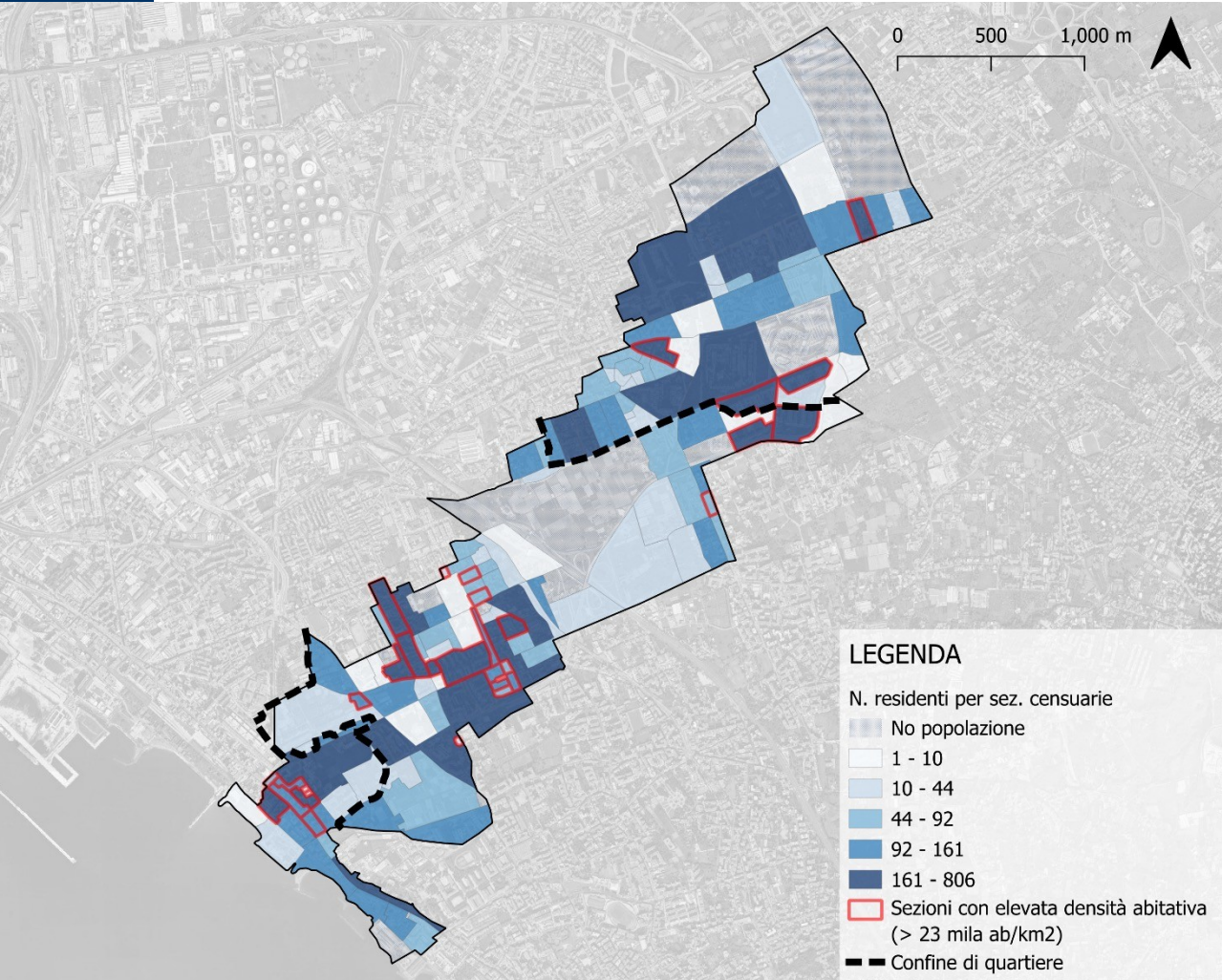
Age Cohort Distribution:

- Age cohort distribution is generally homogeneous across the investigated area.
- A moderately older demographic profile is observed in the San Giovanni district.

NEIGHBORHOOD	No. census tracts	Populat-ion	Surface Area (km2)	Density (pop/km2)
Barra	91	17'585	2.48	7'096
Ponticelli	50	13'929	2.21	6'300
San Giovanni a Teduccio	24	5'376	0.48	11'130
TOT	165	36'890	5.17	7'135



The Red Zone (RZ): population distribution by census tract



Demographic Spatial Analysis:

The population analysis disaggregated by census tracts enables a granular evaluation of demographic load across the area's operational sectors, identifying high-density clusters that require priority intervention in evacuation and emergency management planning.

NUMBER (Absolute Population Load):

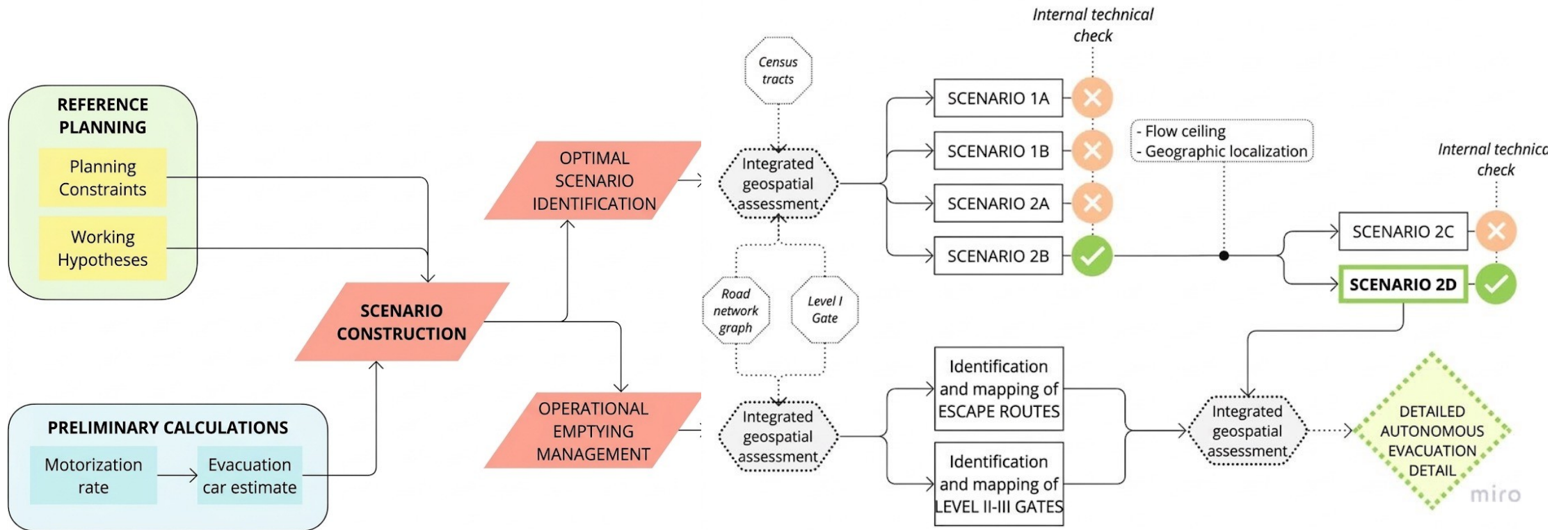
A substantial share of the resident population is concentrated within the southern and north-central sectors of the Red Zone (RZ), where individual census tracts exceed 160 inhabitants.

DENSITY (Spatial Concentration):

The primary cluster of high-density census tracts is located in the southern sector of the Barra district.

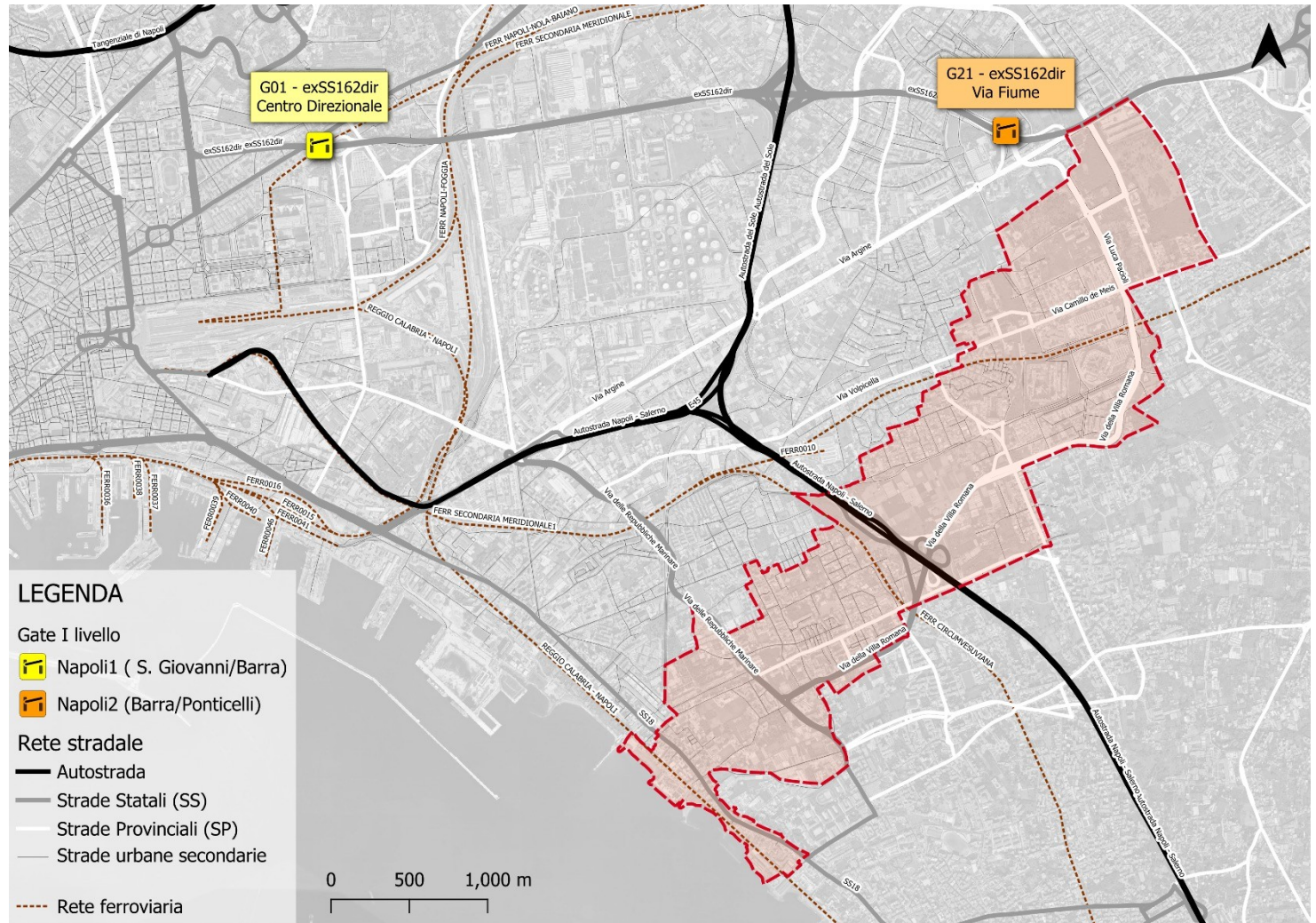
AUTONOMOUS EVACUATION

Autonomous Evacuation: Flowchart and Methodol



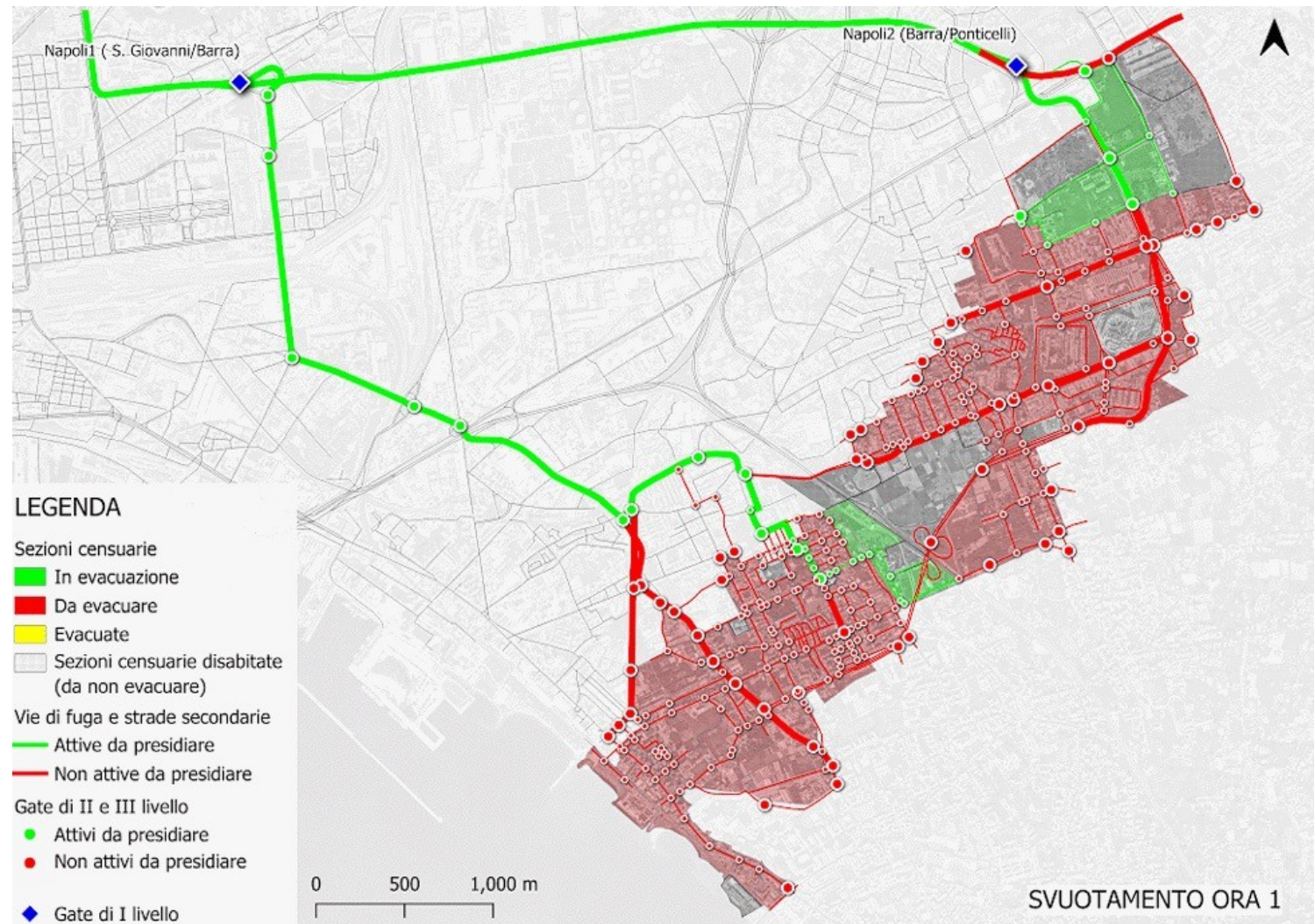
Autonomous Evacuation: Flowchart and Methodol

Plans are in place to
evacuate
22,386 cars through
the **2 gates**
within **48 hours**



Autonomous Evacuation: Flowchart and Methodol

Plans are in place to
evacuate
22,386 cars through
the **2 gates**
within **48 hours**

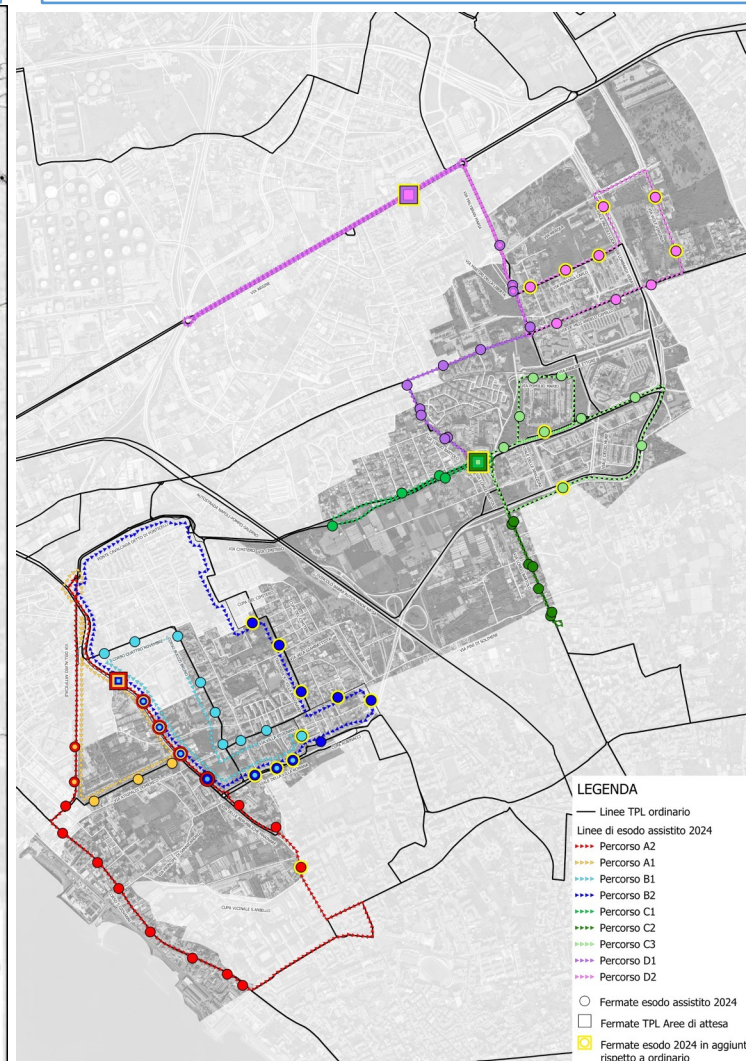
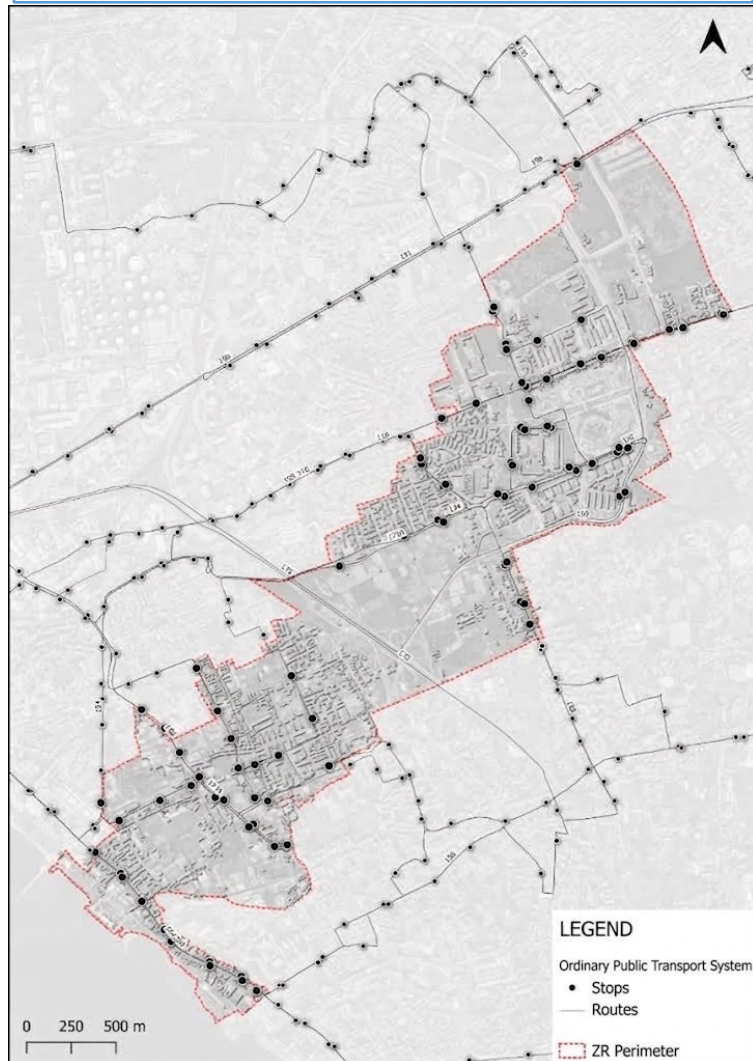


ASSISTED EVACUATION

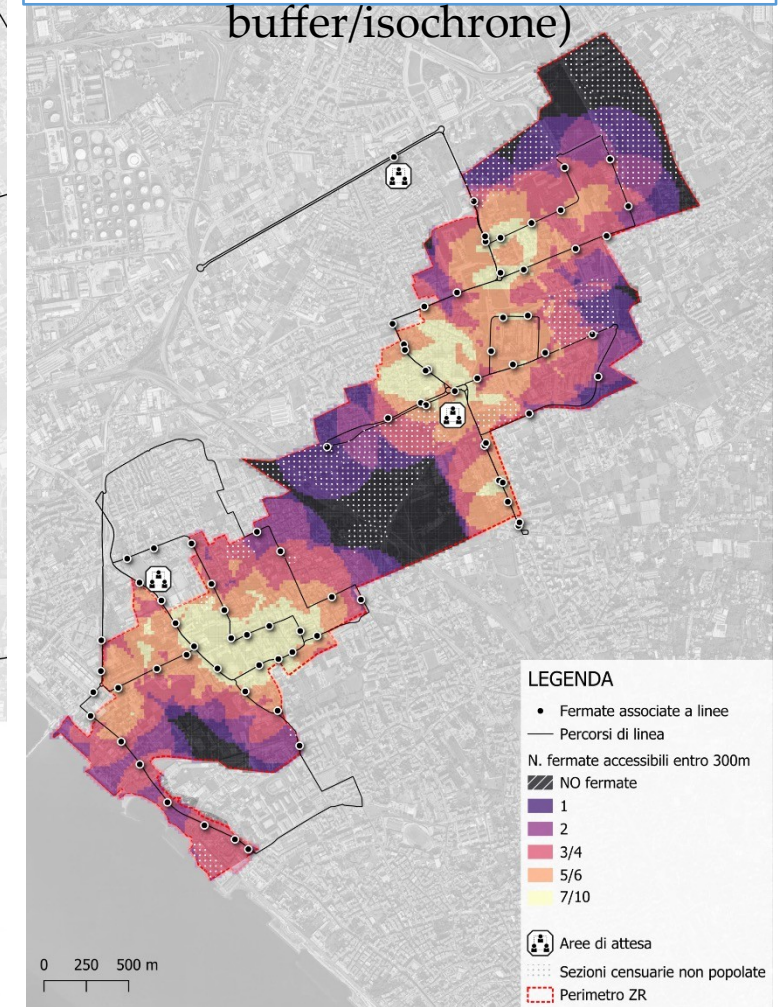


Assisted Evacuation: Construction of the shuttle system

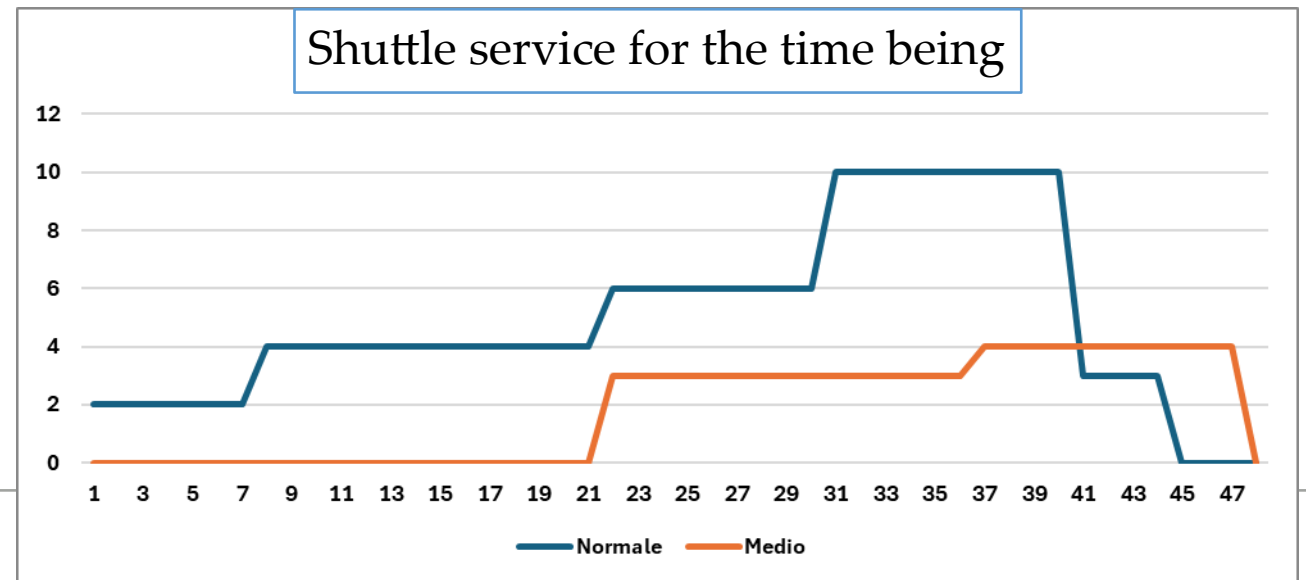
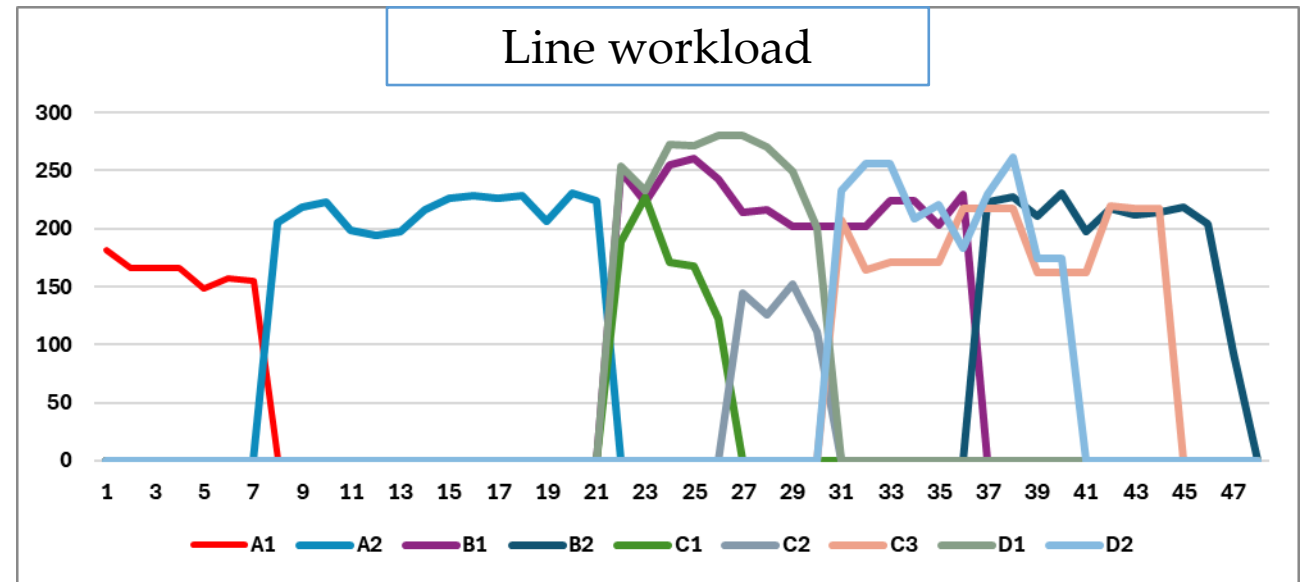
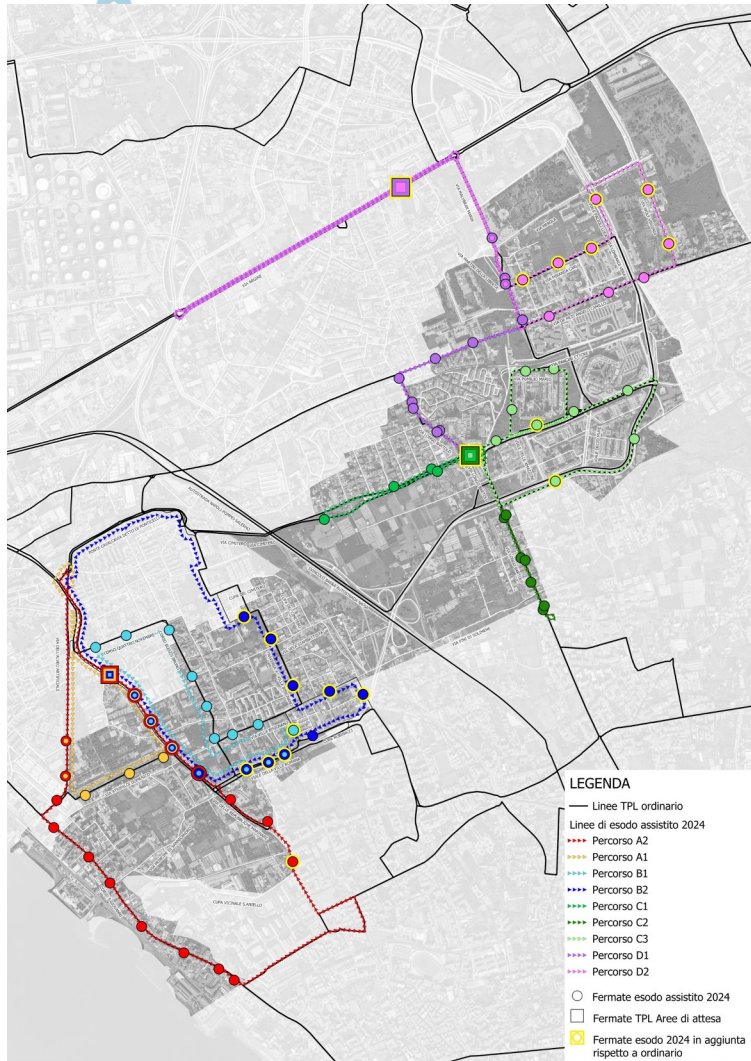
Current public transport lines and stops Emergency shuttle hypothesis



Urban pedestrian accessibility to shuttle stops (300 m buffer/isochrone)



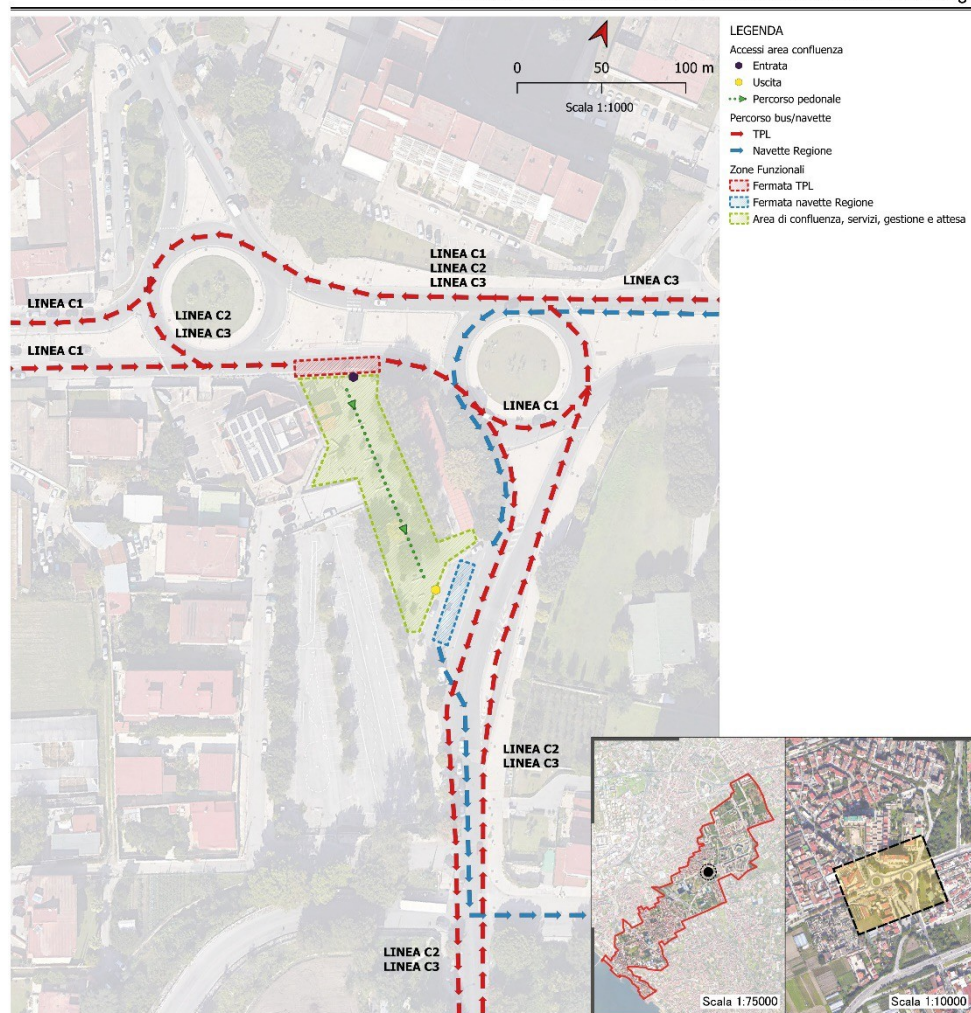
Assisted Evacuation: Construction of the shuttle system



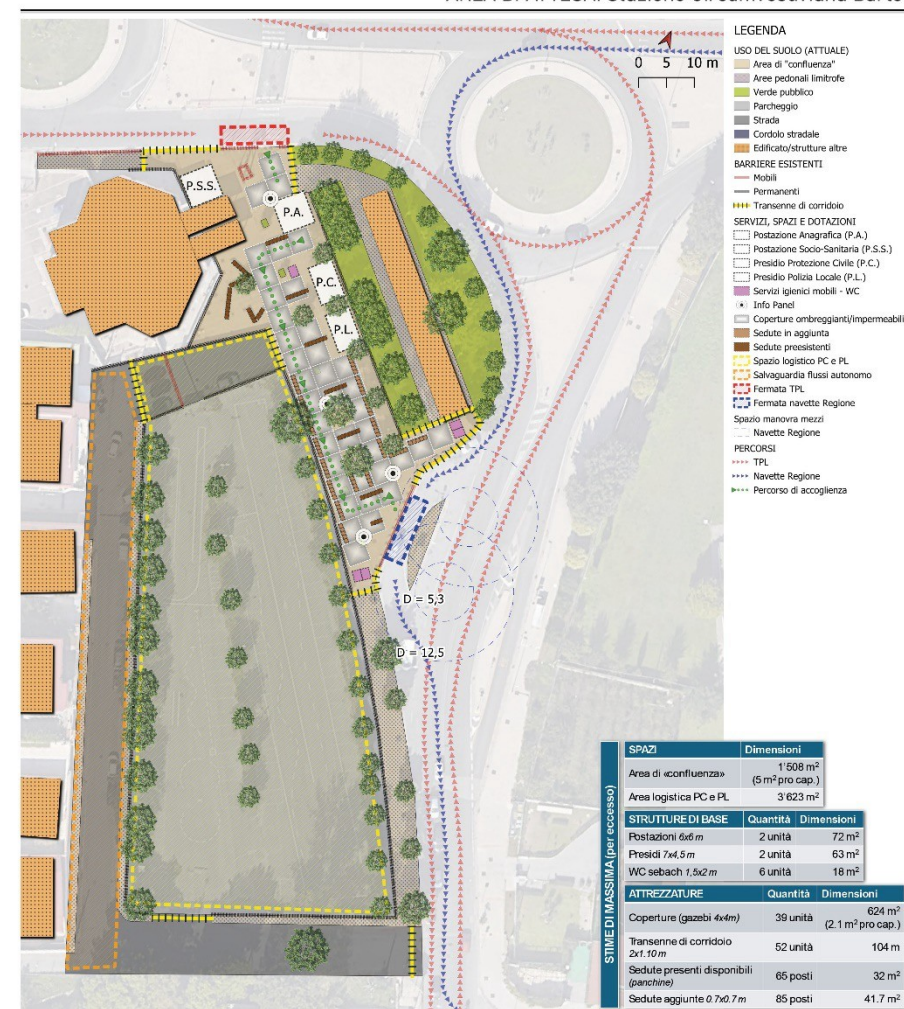
PLANNING OF WAITING AREAS

Planning of Waiting Areas: Bartolo Longo

SCHEMA DI FUNZIONAMENTO - LIVELLO TERRITORIALE
AREA DI ATTESA: Stazione Circumvesuviana Bartolo Longo



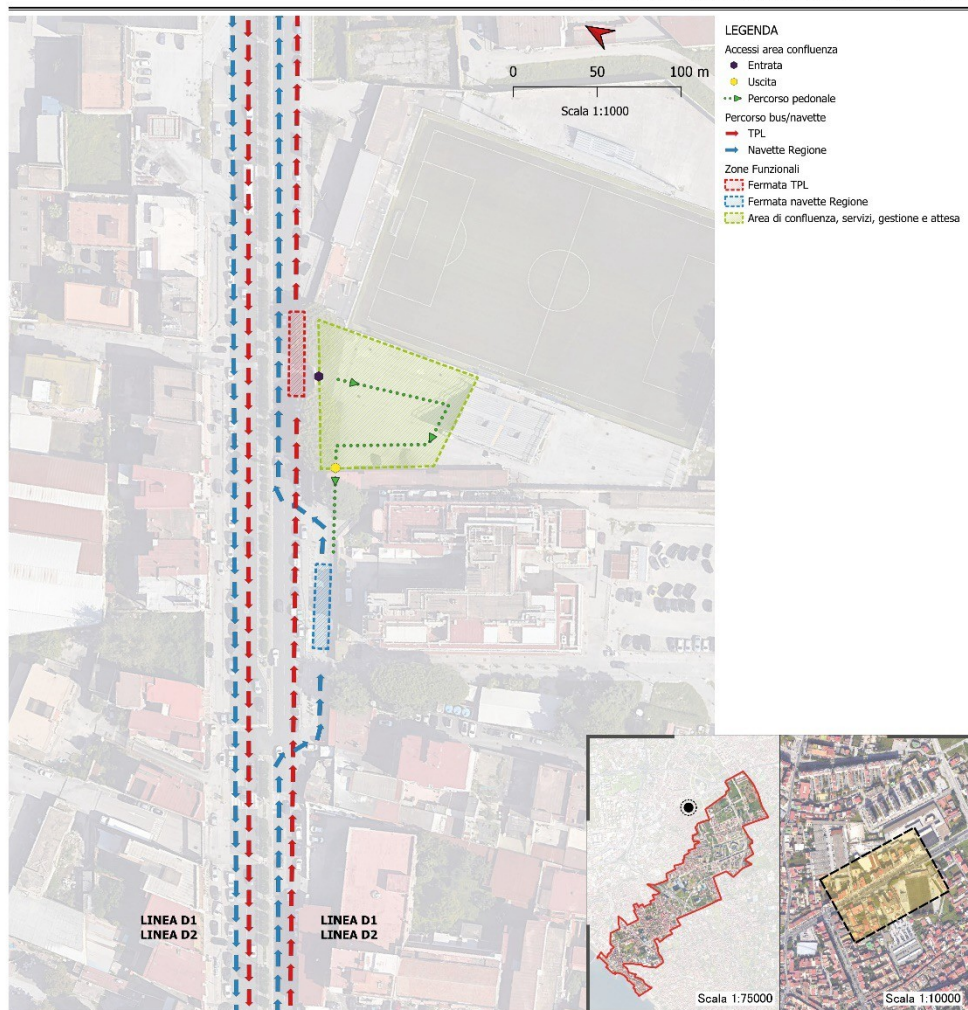
SCHEMA DI FUNZIONAMENTO - LIVELLO URBANO
AREA DI ATTESA: Stazione Circumvesuviana Bartolo Longo



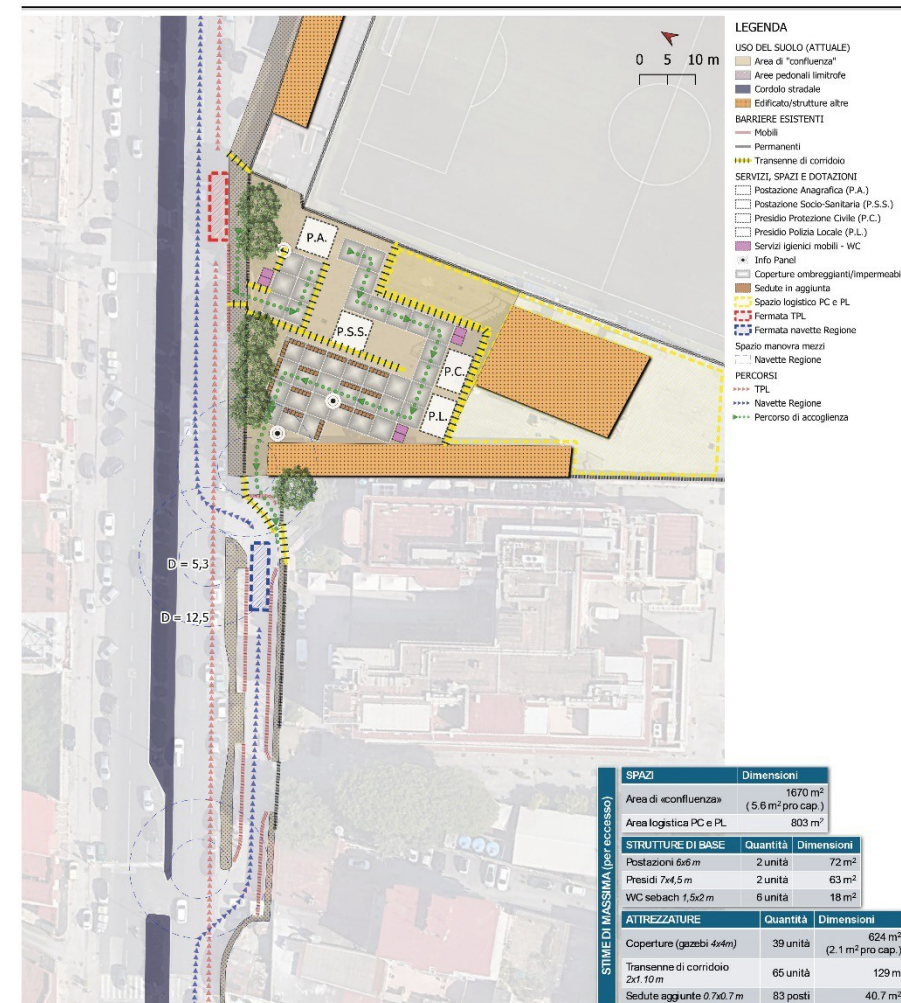
STIMEDI MASSIMA (per eccesso)	SPAZI		Dimensioni	
	Area di «confluenza»		1'608 m ²	
			(5 m ² pro cap.)	
	Area logistica PC e PL		3'623 m ²	
STIMEDI MASSIMA (per eccesso)	STRUTTURE DI BASE		Quantità	
	Postazioni 6x6 m		2 unità	72 m ²
	Presidi 7x4,5 m		2 unità	63 m ²
	WC sebach 1,5x2 m		6 unità	18 m ²
STIMEDI MASSIMA (per eccesso)	ATTREZZATURE		Quantità	
	Coperture (gazebo 4x4m)		39 unità	624 m ²
			(2.1 m ² pro cap.)	
	Trasenne di corridoio 2x1.10 m		52 unità	104 m ²
STIMEDI MASSIMA (per eccesso)	Sedute presenti disponibili (panchine)		65 posti	32 m ²
	Sedute aggiunte 0.7x0.7 m		85 posti	41.7 m ²

Planning of Waiting Areas: Ascarelli

SCHEMA DI FUNZIONAMENTO - LIVELLO TERRITORIALE
AREA DI ATTESA: Stadio Comunale Ascarelli

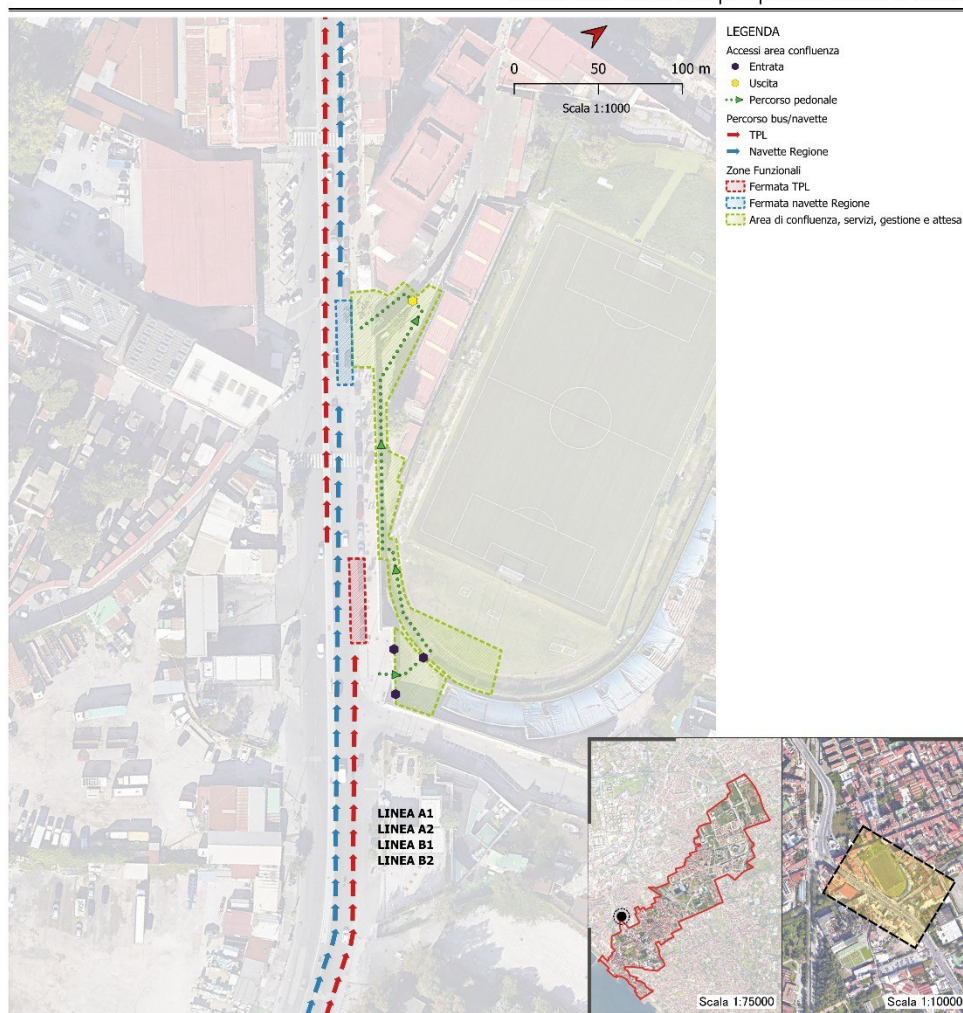


SCHEMA DI FUNZIONAMENTO - LIVELLO URBANO
Area di attesa: Stadio Comunale Ascarelli



Planning of Waiting Areas: Caduti di Brema

SCHEMA DI FUNZIONAMENTO - LIVELLO TERRITORIALE
AREA DI ATTESA: Campo Sportivo Caduti di Brema



SCHEMA DI FUNZIONAMENTO - LIVELLO URBANO
Area di attesa: Campo Sportivo Caduti di Brema

