

November 29, 2019

Prepared for: Politecnico di Milano

Enhanced PLOS through geo-localized data Data Collection Guidelines

Final Presentation

Systematica Srl
Transport Planning and
Mobility Engineering

Milan
Beirut
Mumbai

Via Lovanio, 8
20121 - Milan
Italy

T + 39 02 62 31 19 1
E milano@systematica.net
www.systematica.net

Enhanced PLOS

PLOS definition and preliminary considerations

The Pedestrian LOS Model is aimed at evaluating walking conditions on road and street corridors in urban environment.

PLOS is a measure of comfort and safety of existing and planned walkways. It allows objective and sound evaluations of pedestrians' perception and response to roadway environment.

Over the last years it has been widely acknowledged as a key and robust methodology in line with US standards of the road engineering industry. In fact the model is based on the proven research documented in **Highway Capacity Manual 2010** [1], published by Transportation Research Boards of National Academies.

It is noteworthy that PLOS focuses primarily on the characteristics of the infrastructure and it does not include pedestrian volumes as variable of the assessment.

PLOS A (≤ 2)

Highly pedestrian oriented environment, ample sidewalk space

PLOS B (>2 and ≤ 2.75)

Streets with many pedestrian safety and comfort features

PLOS C (>2.75 and ≤ 3.5)

Standard sidewalk, some deficiencies in pedestrian facility design and/or higher vehicle traffic

PLOS D (>3.5 and ≤ 4.25)

Streets adequate for pedestrian use but has frequent deficiencies for width and clearance

PLOS E (>4.25 and ≤ 5)

Streets inadequate for pedestrian use, high level of interaction with traffic

PLOS F (>5)

Extremely car-oriented environment, roads preliminary designed for high volumes traffic

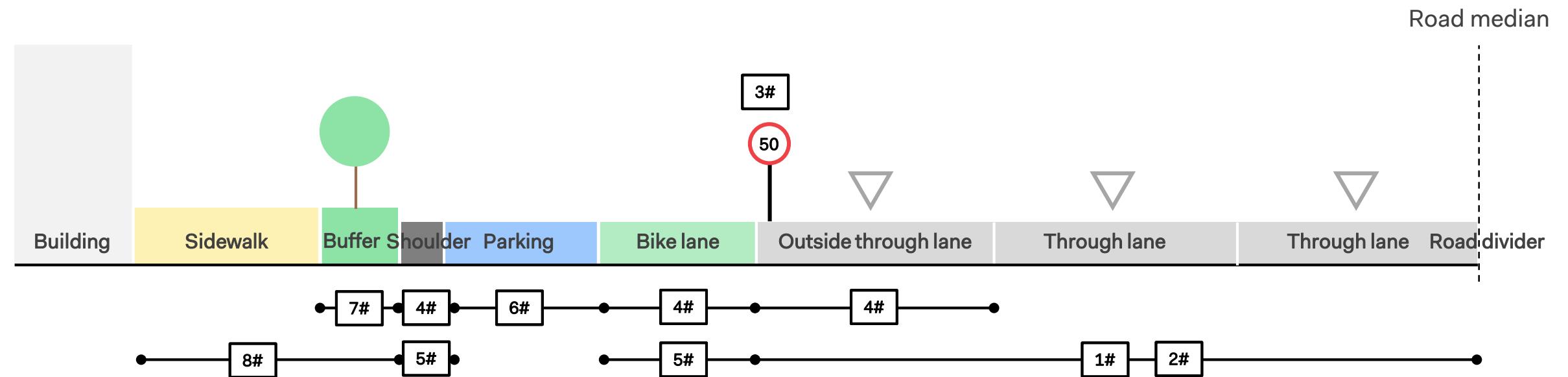
Preliminary considerations:

- The Enhanced PLOS is calculated by using the eight 'Road Network' shp file;
- The Enhanced PLOS is estimated for each road segment, considering road intersections, as level of granularity;
- For those roads comprised within the selected areas, the Enhanced PLOS is calculated on 1 of the 2 sidewalks (namely the sidewalk with better overall characteristics);
- Measurements needed for the Enhanced PLOS are taken with meter or kmh unit and then converted in feet or mph for calculation;
- Enhanced PLOS data to be considered as attributes of road segments are comprised in a buffer of: (No. lanes + 1 lane)*standard width of through lane (corresponding to 3.5 meter).

[1] Highway Capacity Manual (2010). *Highway Capacity Manual*. Transportation Research Board of the National Academies, Washington DC.

Enhanced PLOS PLOS Formula

$$PLOS = 6.0468 + 0.0091 \frac{v_m}{4Nth} + 4 \frac{(S_R)^2}{100} - 1.2276 \ln(W_v + 0.5W_1 + 50ppk + Wbuffb + WaAfsw)$$



	Variable	Description	Unit	Detailed description
1#	v_m	mid-segment analysis-hour directional motorized vehicle demand flow rate nearest to the subject sidewalk	No. veh/h	The mid-segment flow rate is defined as the count of vehicles traveling along the segment. It is expressed as an hourly rate. This volume is specified separately for each direction of travel along the segment.
2#	N_{th}	number of through lanes in the subject direction of travel	No. lanes	The number of through lanes on the segment represents the count of lanes that extend for the length of the segment and serve through vehicles. This count is specified separately for each direction of travel. A lane provided for the exclusive use of turning vehicles is not included in this count.
3#	S_R	motorized vehicle running speed	km/h to be converted to mph	Posted maximum speed on the segment.
4#	W_v	width of the outside lane + width of bike lane + width of shoulder	meter to be converted to feet	Use 3.5 m as the standard width of outside lane that serves vehicles traveling along the segment (to be converted in feet for calculation). In case of two or more lanes, consider only the width of the outside lane adjacent to sidewalk. Bike lane width, 0 if bike lane is not provided. Shoulder width, 0 if bike lane is not provided.
5#	W_1	Width bike lane + width shoulder	meter to be converted to feet	Bike lane width, 0 if bike lane is not provided. Shoulder width, 0 if bike lane is not provided. Do not consider width of parking.
6#	p_{pk}	parking occupancy = proportion of parallel on-street parking occupied in the analyzed period	decimal	Sum of the curb-line length occupied by parked vehicles / link length: e.g. if parking is not allowed = 0, if parking is allowed along the full length of the segment, but only one half is occupied during the analyzed period = 0.50, if it is allowed and fully occupied = 1
7#	W_{buf}	buffer width between roadway and sidewalk	meter to be converted to feet	Buffer between sidewalk and roadway such as greenery, bollards, trees, etc.
	f_b	buffer continuity coefficient	-	$f_b = 5.37$ if buffer is continuous, $f_b = 1$ if buffer is discontinuous.
8#	W_{aA}	sidewalk width	meter to be converted to feet	sidewalk width (this value includes buffer area, not the curb).
	fsw	sidewalk adjusted with coefficient	-	If sidewalk width > 10 feet, then $fsw = 6 - 0.3 \times 10$. If sidewalk width < 10 feet, then $fsw = 6 - 0.3 \times$ actual width of sidewalk.

Enhanced PLOS

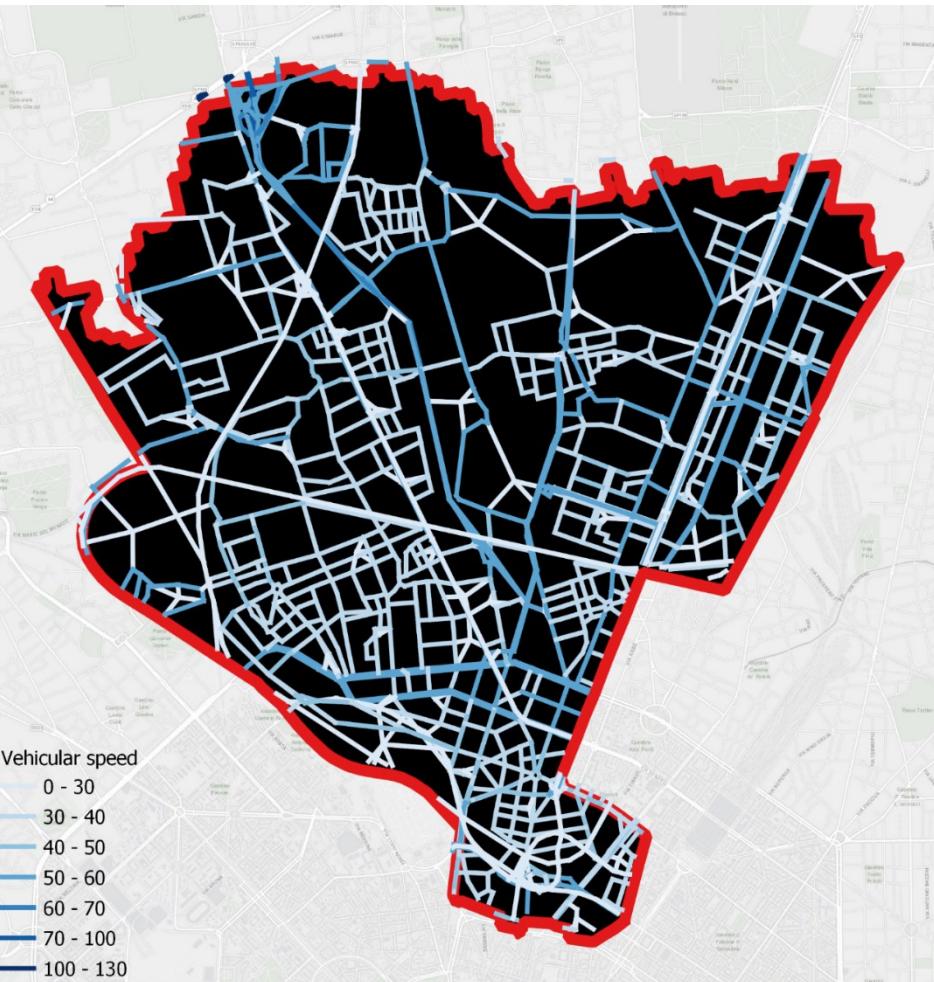
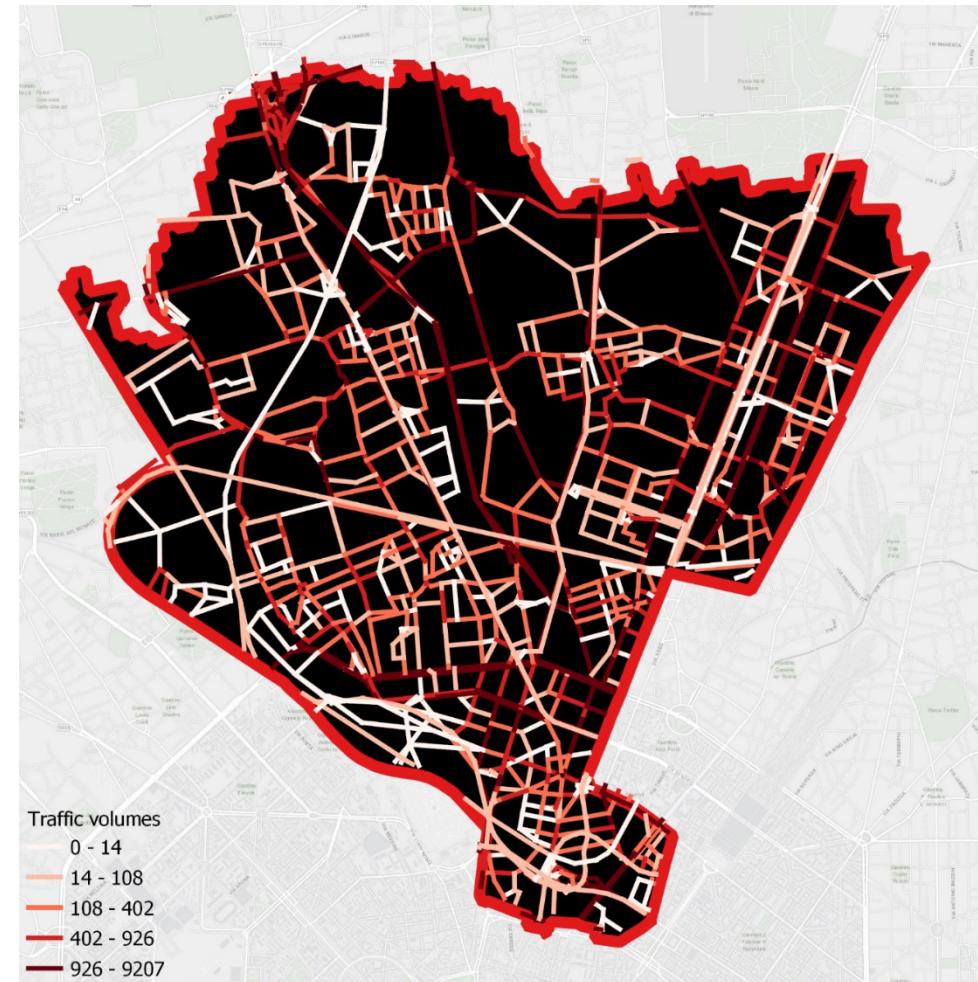
E-PLOS list of data sets (1/4)

#	Parameter	PLOS elements	Influence in PLOS evaluation	Description	Data status	Data Source	Data Collector
1#	v_m	Traffic volume	Major changes	Mid-segment analysis hour directional motorized vehicle demand flow rate nearest to the subject sidewalk	AVAILABLE	Traffic model already available	Systematica DB
2#	s_R	Vehicular speed	Major changes	Motorized vehicle running speed	AVAILABLE	Traffic model already available	Systematica DB
3#	N_{th}	Number of lanes	Major changes	Number of through lanes in the subject direction of travel	TO BE COLLECTED	On field assessment (e.g. Epicollect5)	Politecnico di Milano
4#	W_v	Width of lane, width of bike lane and width of shoulder	Major changes	Sum of width of lane and W_1	TO BE COLLECTED	On field assessments (e.g. Epicollect5)	Politecnico di Milano
5#	W_1	Width of bike lane and width of shoulder	Major changes	Sum of width of bike lane and width of shoulder	TO BE COLLECTED	On field assessments (e.g. Epicollect5)	Politecnico di Milano
6#	P_{pk}	On-street parking	Major changes	Parking occupancy (proportion of parallel on street parking occupied in the analysed period)	TO BE COLLECTED	On field assessment (e.g. Epicollect5)	Politecnico di Milano
7#	W_{buff}	Buffer	Major changes	Buffer width between roadway and available sidewalk	TO BE COLLECTED	On field assessment (e.g. Epicollect5)	Politecnico di Milano
8#	W_{aA}	Width of the sidewalk	Minor changes	Sidewalk width	TO BE COLLECTED	On field assessment (e.g. Epicollect5)	Politecnico di Milano

Enhanced PLOS

E-PLOS list of data sets (2/4)

#	Parameter	PLOS elements	Influence in PLOS evaluation	Description	Data status	Data Source	Data Collector
1#	v_m	Traffic volume	Major changes	Mid-segment analysis hour directional motorized vehicle demand flow rate nearest to the subject sidewalk	AVAILABLE	Traffic model already available	Systematica DB
2#	s_R	Vehicular speed	Major changes	Motorized vehicle running speed	AVAILABLE	Traffic model already available	Systematica DB



- The Enhanced PLOS is calculated by using the 'Traffic volumes and speed' shp file, provided in the folder 'Walkability for All_DB';
- 'v_1' attribute reports the traffic volumes as the sum of vehicles per hour for the total number of lanes (both directions);
- 'Speed' attribute reports the allowed speed, data are provided in kmh unit and need to be converted in mph for calculation.

Enhanced PLOS

E-PLOS list of data sets (3/4)

#	Parameter	PLOS elements	Influence in PLOS evaluation	Description	Data status	Data Source	Data Collector
3#	N_{th}	Number of lanes	Major changes	Number of through lanes in the subject direction of travel	TO BE COLLECTED	On field assessment (e.g. Epicollect5)	Politecnico di Milano
4#	W_v	Width of lane, width of bike lane and width of shoulder	Major changes	Sum of width of lane and W_1	TO BE COLLECTED	On field assessments (e.g. Epicollect5)	Politecnico di Milano
5#	W_1	Width of bike lane and width of shoulder	Major changes	Sum of width of bike lane and width of shoulder	TO BE COLLECTED	On field assessments (e.g. Epicollect5)	Politecnico di Milano
6#	P_{pk}	On-street parking	Major changes	Parking occupancy (proportion of parallel on street parking occupied in the analysed period)	TO BE COLLECTED	On field assessment (e.g. Epicollect5)	Politecnico di Milano
7#	W_{buff}	Buffer	Major changes	Buffer width between roadway and available sidewalk	TO BE COLLECTED	On field assessment (e.g. Epicollect5)	Politecnico di Milano
8#	W_{aA}	Width of the sidewalk	Minor changes	Sidewalk width	TO BE COLLECTED	On field assessment (e.g. Epicollect5)	Politecnico di Milano

Enhanced PLOS

E-PLOS list of data sets (4/4)

#	Parameter	PLOS elements	Influence in PLOS evaluation	Walkability for All criteria and description	Data status	Data Source (LINK)	Data Collector
9#	PC	Pedestrian crossings	-	SAFETY	AVAILABLE	OpenStreetMap (Geofabrik or DB)	Systematica
10#	POI	Points of interest	-	ATTRACTIVENESS	AVAILABLE	OpenStreetMap (Geofabrik or DB) To be validated not considering: benches, drinking water, fountain, waste basket, camera surveillance	Systematica
11#	PT	Public transports stops	-	USEFULNESS	AVAILABLE	OpenStreetMap (Geofabrik or DB)	Systematica
12#	PS	Public services	-	USEFULNESS	GEOCODING NEEDED	City of Milan (Excel files)	Politecnico di Milano
13#	CR	Curb ramps	-	COMFORT	TO BE COLLECTED	On field assessment (e.g. Epicollect5)	Politecnico di Milano
14#	L	Lighting	-	SAFETY	TO BE COLLECTED	On field assessment (e.g. Epicollect5) Consider both lighting poles and hung lights	Politecnico di Milano

 Systematica

Data Collection Guidelines – Systematica Srl – November 29, 2019

Enhanced PLOS

EPLOS Formula

PLOS A (≤ 2)
Highly pedestrian oriented environment, ample sidewalk space
PLOS B (>2 and ≤ 2.75)
Streets with many pedestrian safety and comfort features
PLOS C (>2.75 and ≤ 3.5)
Standard sidewalk, some deficiencies in pedestrian facility design and/or higher vehicle traffic
PLOS D (>3.5 and ≤ 4.25)
Streets adequate for pedestrian use but has frequent deficiencies for width and clearance
PLOS E (>4.25 and ≤ 5)
Streets inadequate for pedestrian use, high level of interaction with traffic
PLOS F (>5)
Extremely car-oriented environment, roads preliminary designed for high volumes traffic

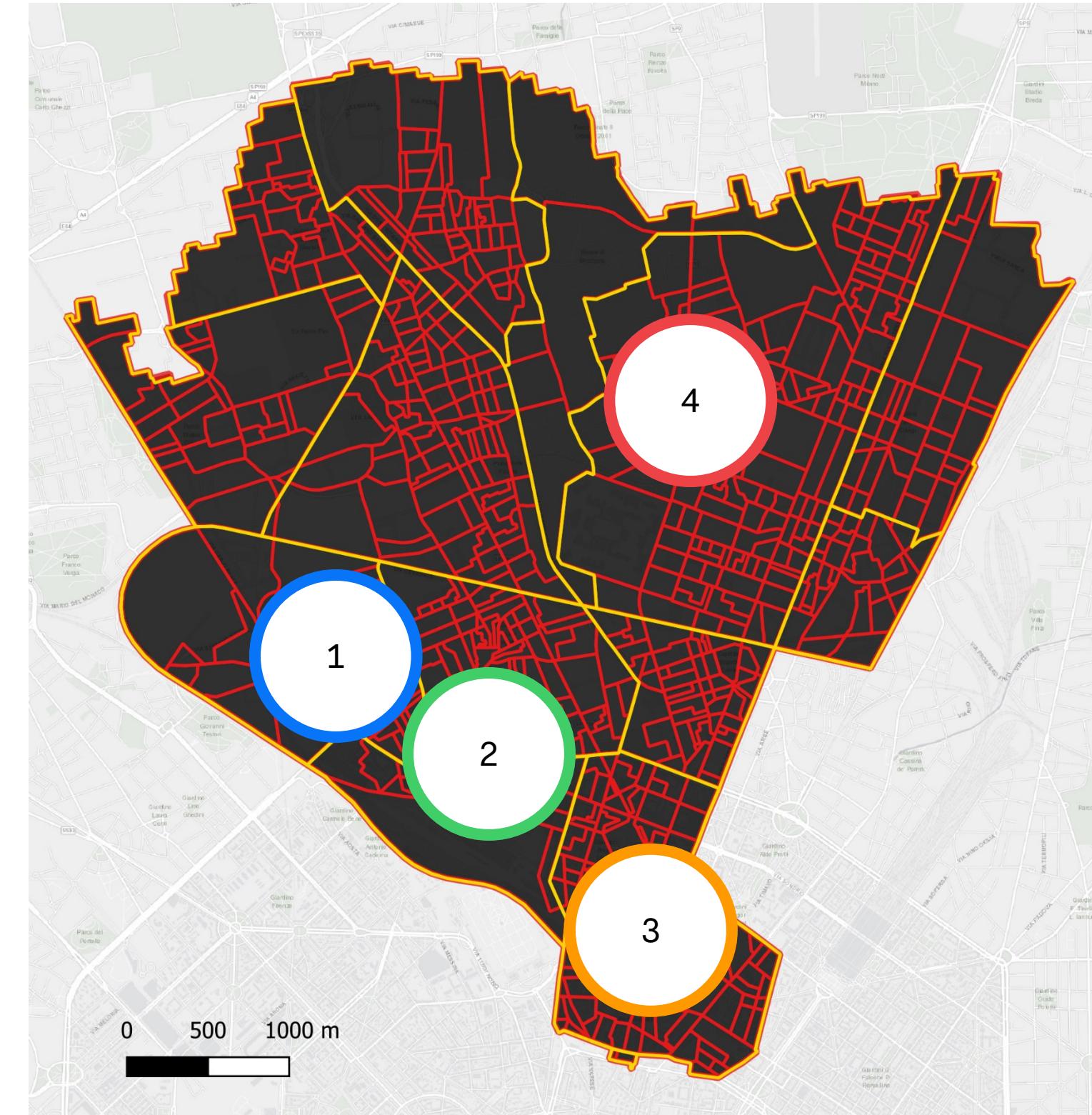
Enhanced PLOS calculation

- The Enhanced PLOS is calculated by using the PLOS and a separated calculation related to the added parameters;
- For each parameter use 0 if not present, 0.125 if present;
- Subtract all parameters to the PLOS (maximum 0.75, minimum 0).

Data collection

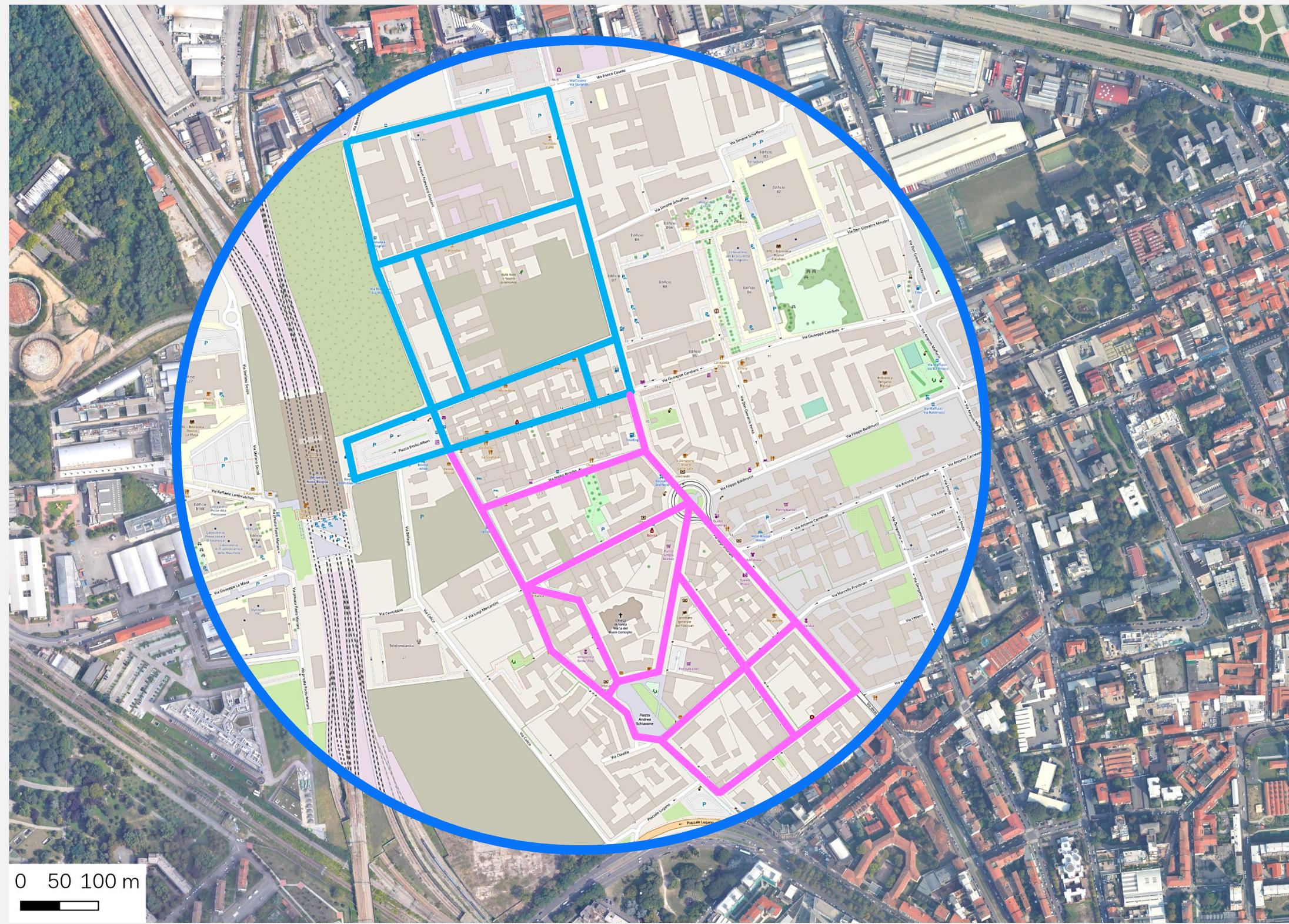
Four areas of the Municipality No.9 of the City of Milan, chosen due to their very different context (e.g. very central, suburban) or peculiar character (e.g. transit hub, student campus);

1. Stazione Milano Nord Bovisa
 2. Stazione Milano Lancetti
 3. Stazione Milano Porta Garibaldi
 4. Niguarda
- Systematica will partially provide the needed data to assess the PLOS results for these areas;
 - Students will collect data regarding pedestrian infrastructure quality and universal accessibility elements;
 - The enhanced version of the PLOS will be developed for the areas, taking into account the collected data.



Enhanced PLOS

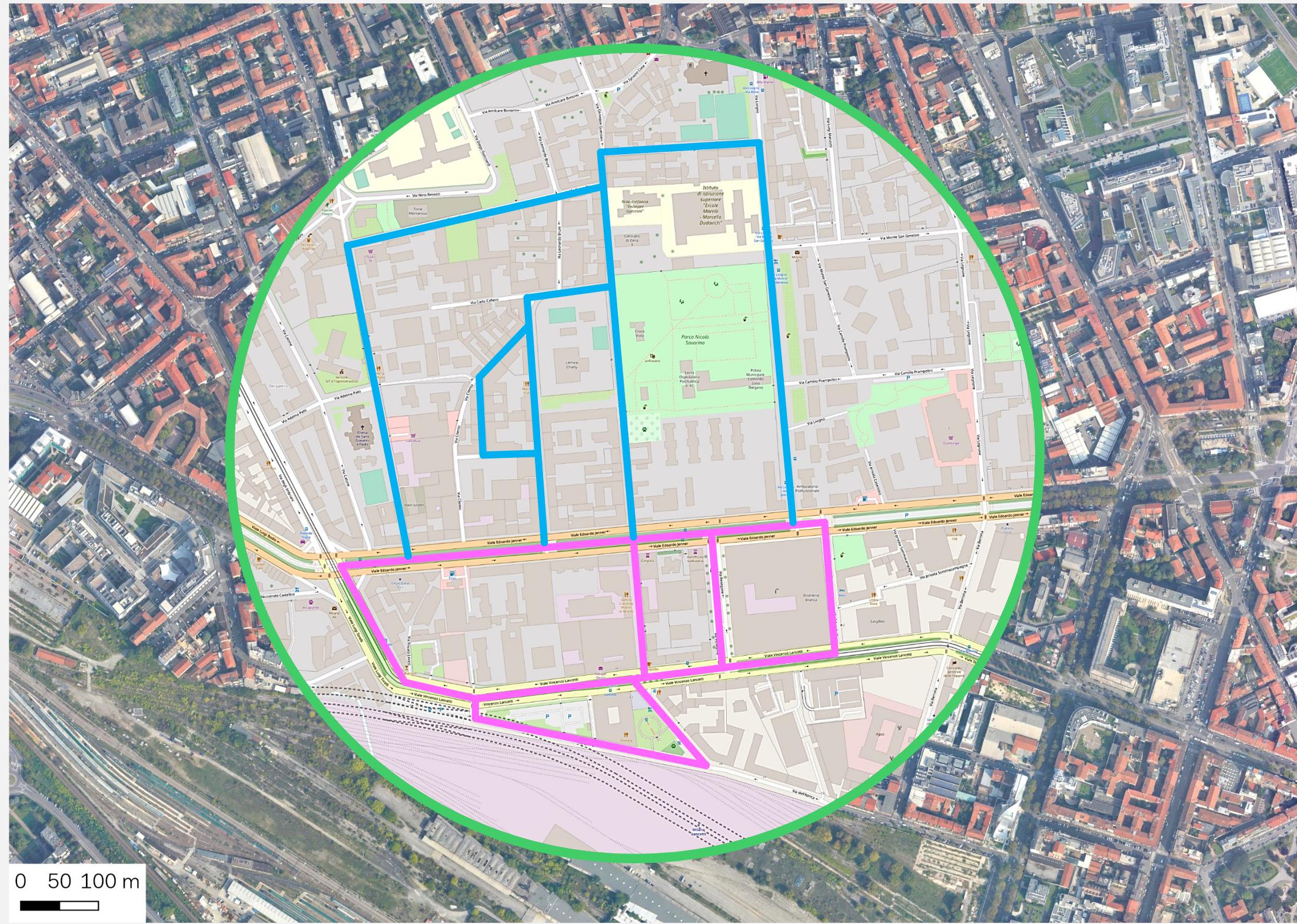
Area of intervention: Stazione Milano Nord Bovisa



1. **Stazione Milano Nord Bovisa:** characterized by the presence of the Campus of Politecnico di Milano.
 - Radius of buffer area: 500 m
 - Length of **PINK** sidewalk network (considering both directions): \approx 5 Km;
 - Time for data collection: \approx 4 h
 - Length of **BLUE** sidewalk network (considering both directions): \approx 5 Km;
 - Time for data collection: \approx 4 h

Enhanced PLOS

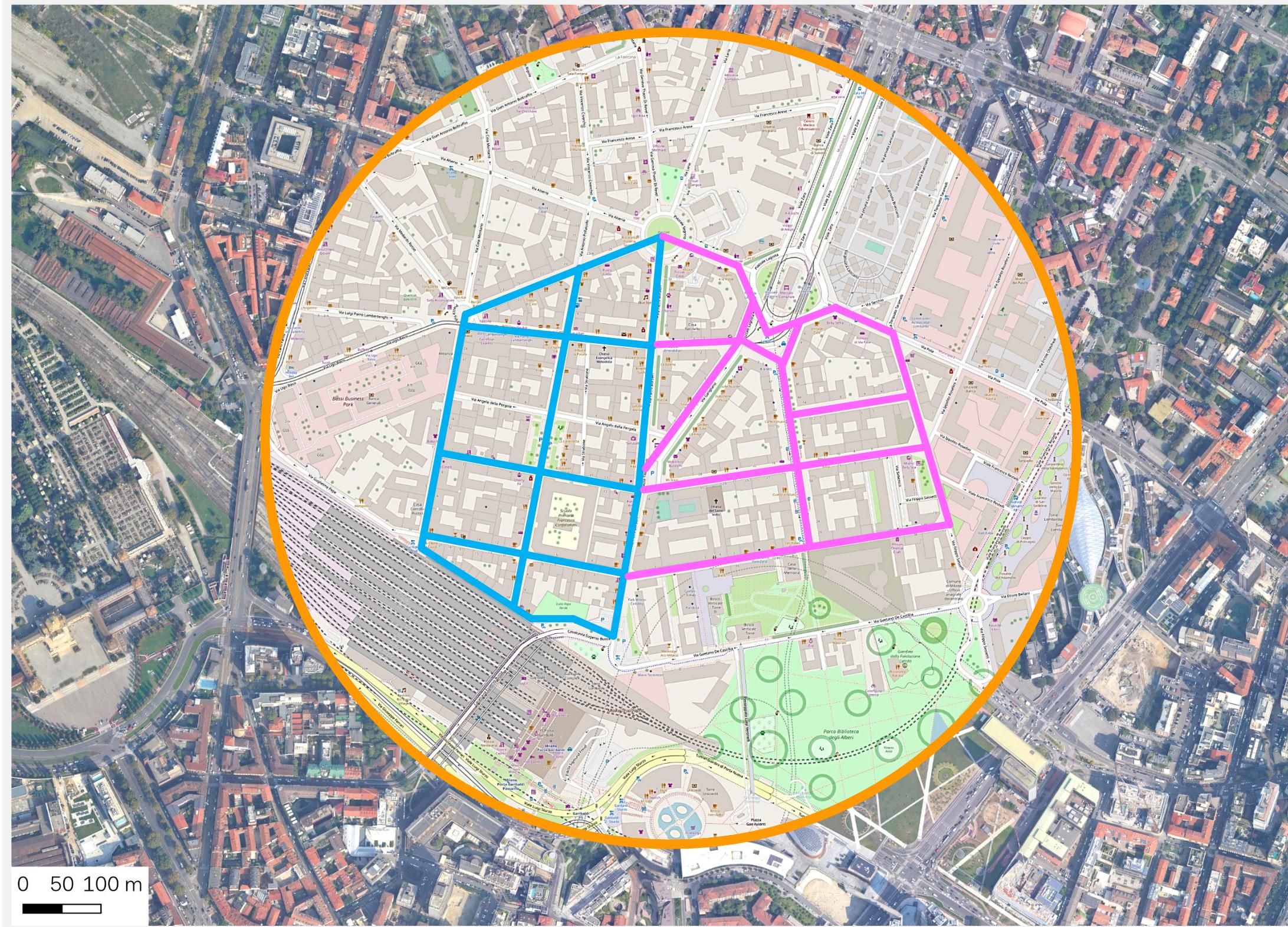
Area of intervention: Stazione Milano Lancetti



2. **Stazione Milano Lancetti:** nearby the Scalo Farini area, included in the Territorial Government Plan of the City of Milan.
 - Radius of buffer area: 500 m
 - Length of **PINK** sidewalk network (considering both directions): \approx 5 Km;
 - Time for data collection: \approx 4 h
 - Length of **BLUE** sidewalk network (considering both directions): \approx 5 Km;
 - Time for data collection: \approx 4 h

Enhanced PLOS

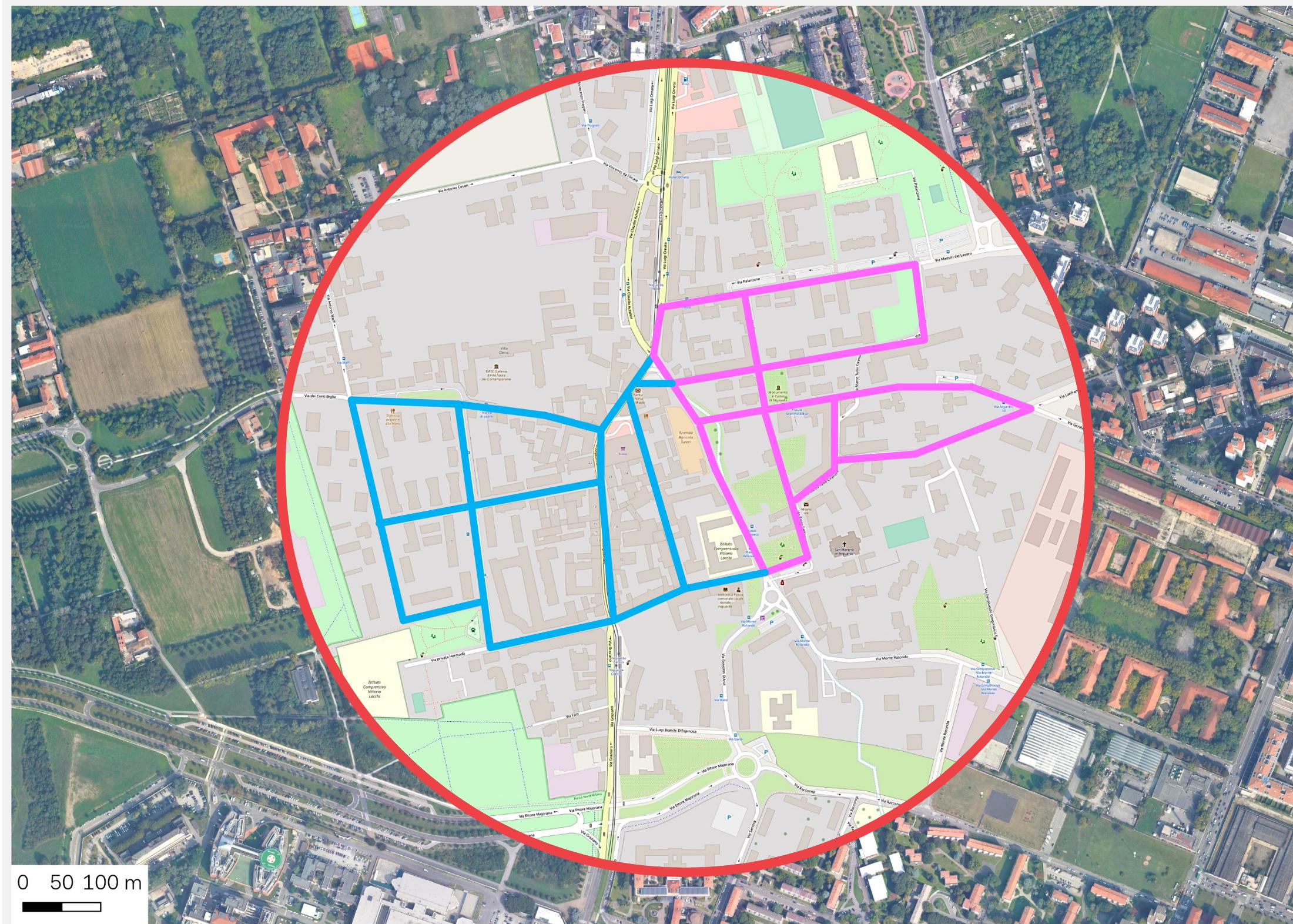
Area of intervention: Stazione Milano Porta Garibaldi



3. **Stazione Milano Porta Garibaldi:** recently renewed area characterized by commuter traffic with 25 million passenger annually.
 - Radius of buffer area: 500 m
 - Length of **PINK** sidewalk network (considering both directions): \approx 5 Km;
 - Time for data collection: \approx 4 h
 - Length of **BLUE** sidewalk network (considering both directions): \approx 5 Km;
 - Time for data collection: \approx 4 h

Enhanced PLOS

Area of intervention: Niguarda



4. **Quartiere Niguarda:** characterized as one of the historical areas of the City of Milan.
 - Radius of buffer area: 500 m
 - Length of PINK sidewalk network (considering both directions): \approx 5 Km;
 - Time for data collection: \approx 4 h
 - Length of BLUE sidewalk network (considering both directions): \approx 5 Km;
 - Time for data collection: \approx 4 h

Thanks!

© 2019 Systematica Srl

All mobility studies presented in this document are developed by Systematica Srl. All rights reserved. Unauthorised use is prohibited.

Systematica Srl
Via Lovanio 8
20121 Milan
+39 02 62 31 19 1
www.systematica.net
milano@systematica.net