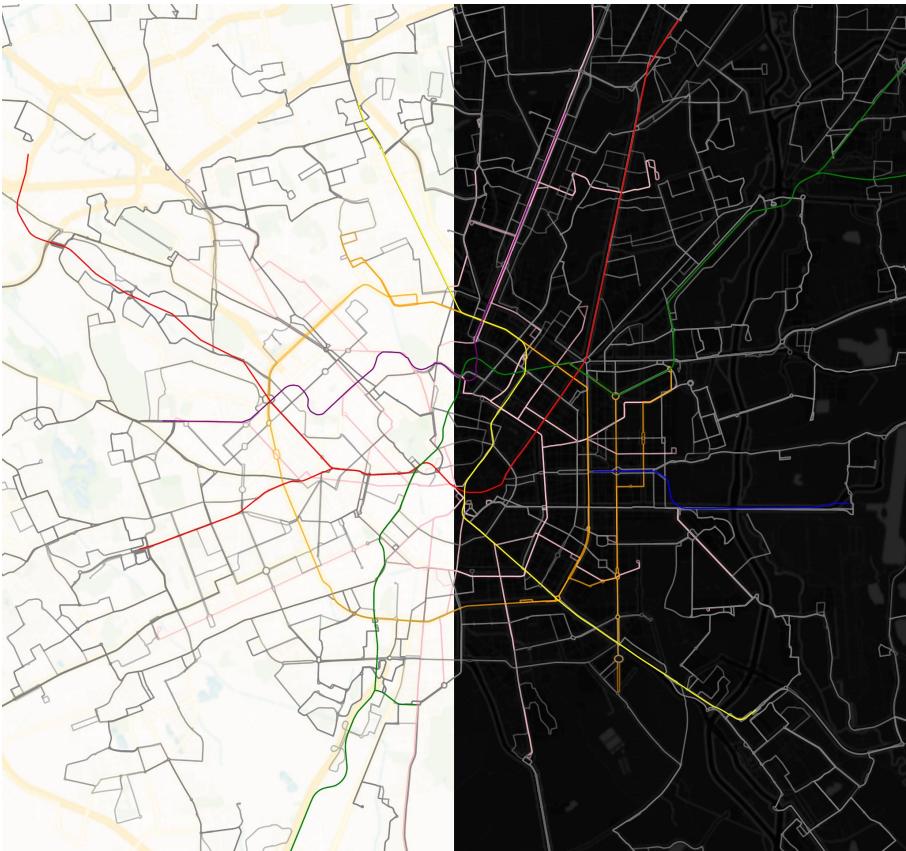


Case study on Milan City

A set of metrics for
evaluating the public
transport system

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01 Problem description

Concerns in planning of public transportation

► Milan's vibrant life attracts locals and visitors due to its diverse venues and hosting global events.

▼ However, the city's perception of criminality has increased, causing insecurity and difficulty finding parking in popular areas.

► This leads to increased traffic and limited parking spaces, affecting nightlife and accessibility.

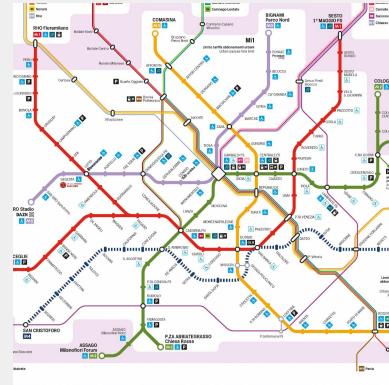


Concerns in planning of public transportation

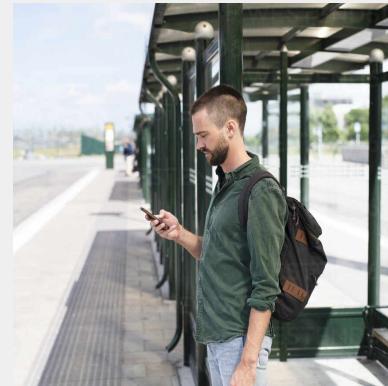
Accessibility



Spatial coverage



Frequency and reliability



Fares and costs



Concerns in planning of public transportation

Sustainability



Integration with
other means of
transport



Safety



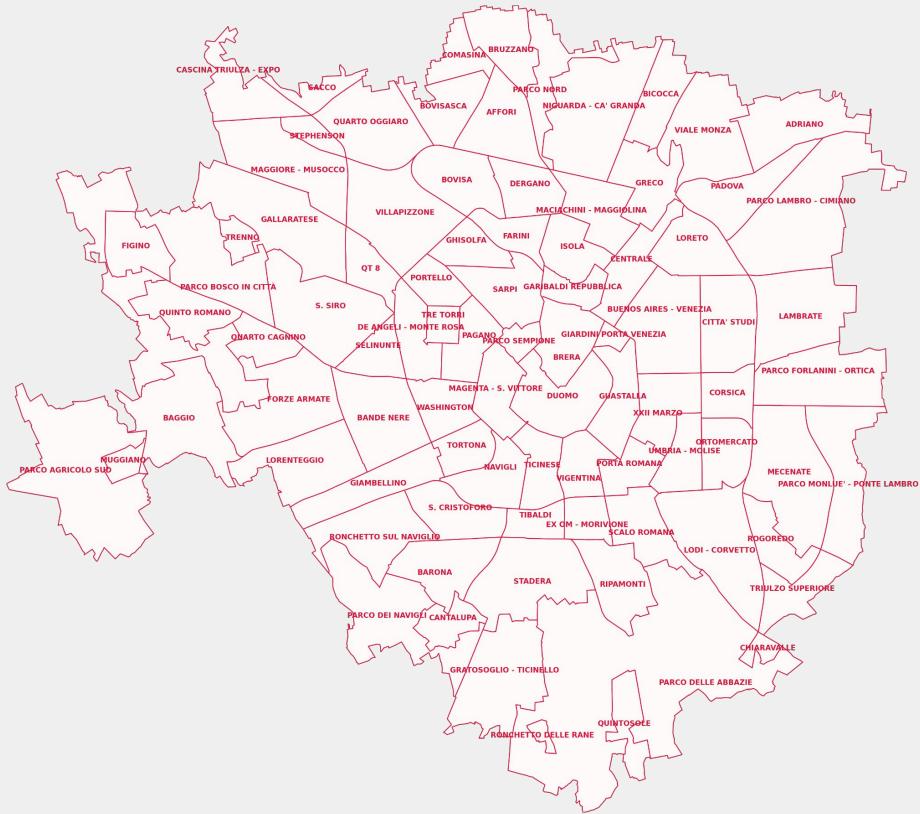
Community
involvement



Milan NIL structure

Being a big city, Milan is divided into 88 NILs (*Nuclei d'Identità Locale*) to better understand the differences between areas within the city.

The metrics will be computed not only for each 2-hour time slot but for each NIL as well in order to better highlight the inequalities in Milan.





02 Milan public transport system



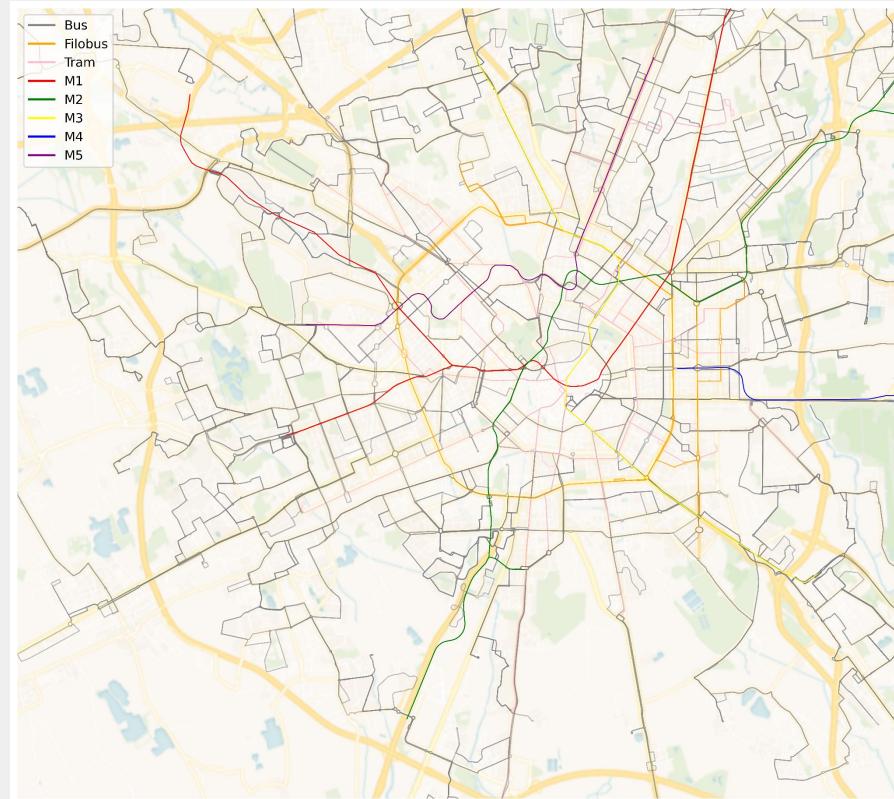
4 metro lines measuring almost 97km, to which adds the new M4 from Linate to Dateo



17 tram lines covering a total of 157km every day



119 bus lines (including trolleybus) granting connections to all parts of the city, with some of them operating also at night





03 Data analysis

Data preprocessing



tpl_fermate



tpl_metroorari



tpl.metropercorsi



tpl_sequenza



tpl_metrosequenza



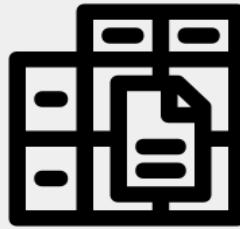
tpl_percorsi



tpl_metrofermate



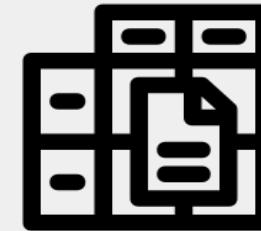
Data preprocessing



Linee



Percorsi



Fermate

Underground and road lines

Separated by time slot

Number of rides per time slot

Line shape geometry

Linking table

Underground and road stops

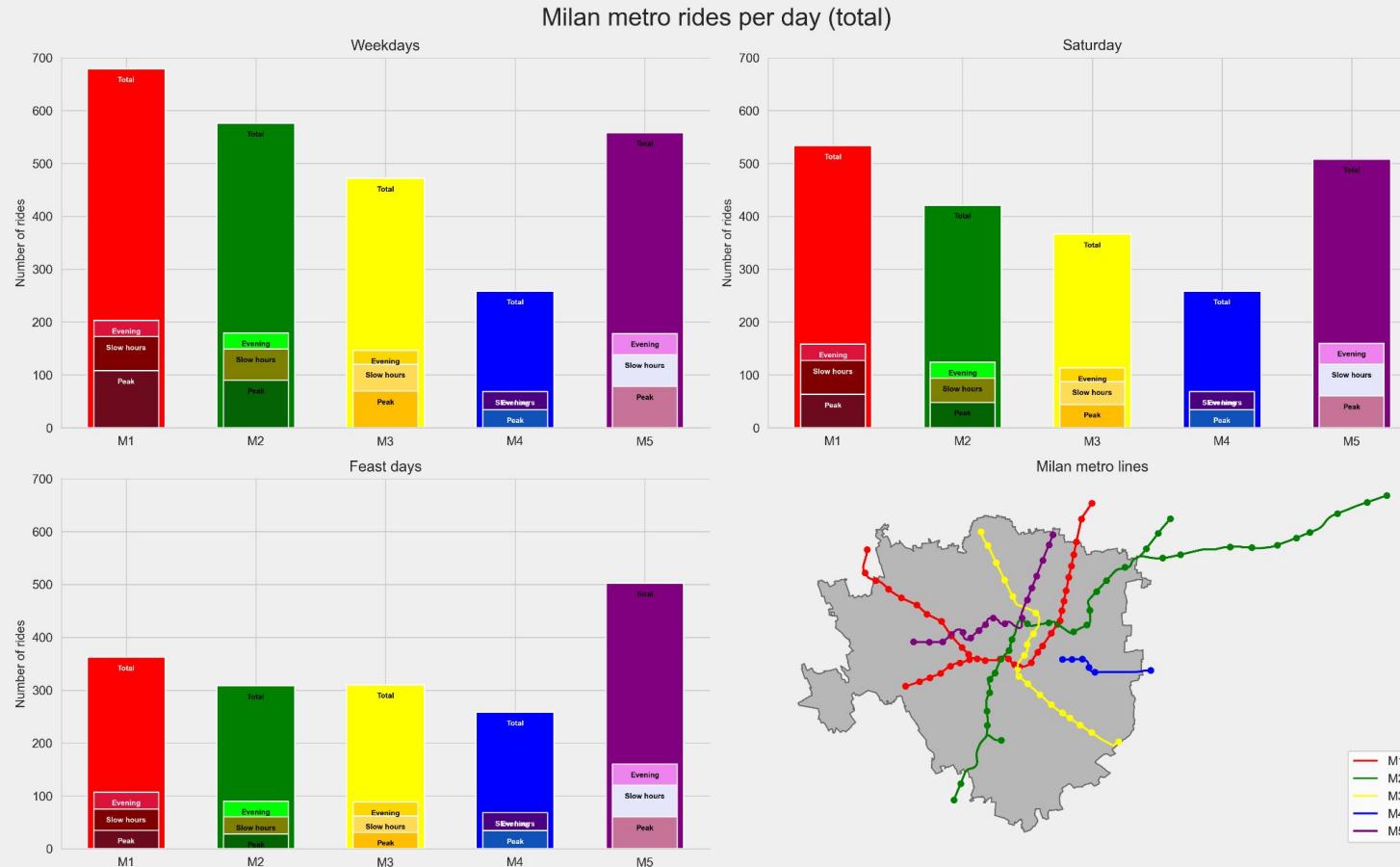
Stops location geometry

Problem description

Milan public transport system

Data analysis

Results and conclusions



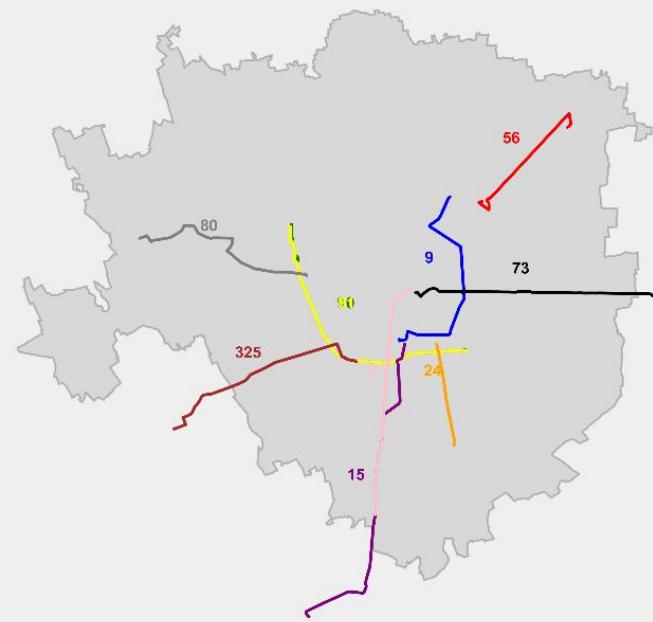
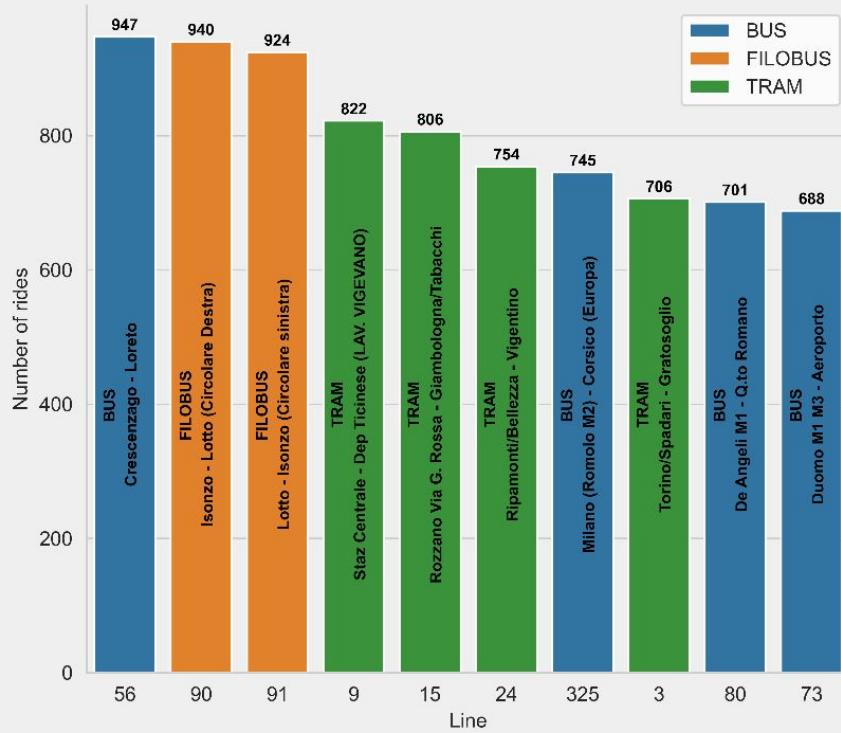
Problem description

Milan public transport system

Data analysis

Results and conclusions

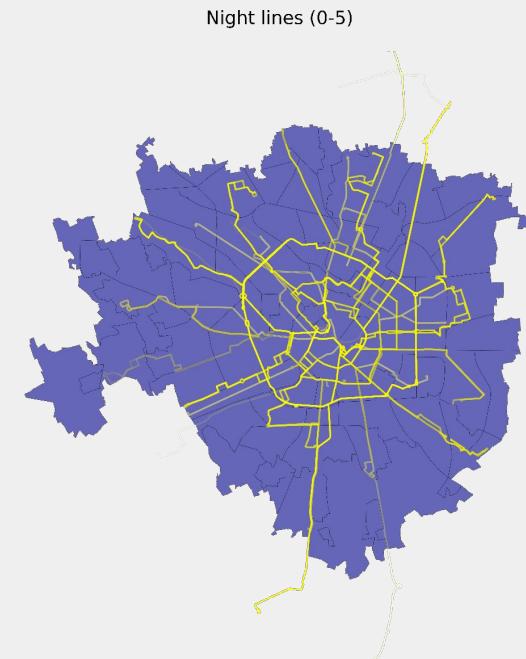
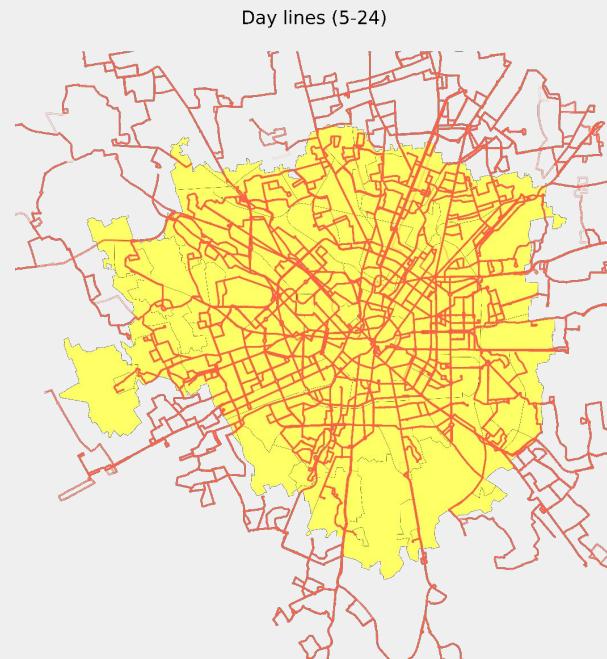
Top 10 lines by number of rides



Developed metrics

Frequency

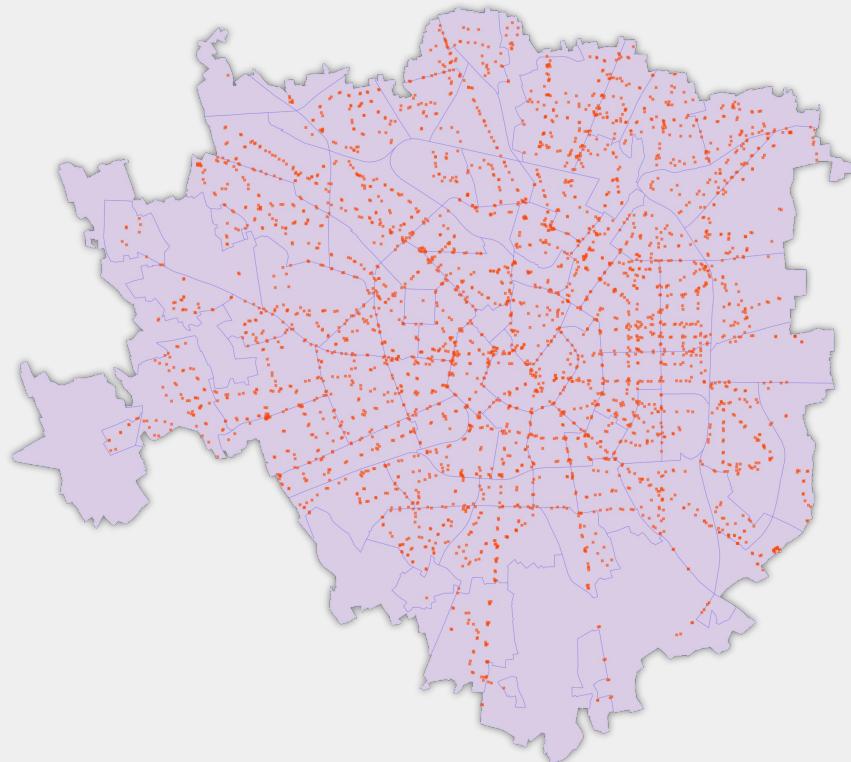
Average number of rides per time slot



Developed metrics

Density

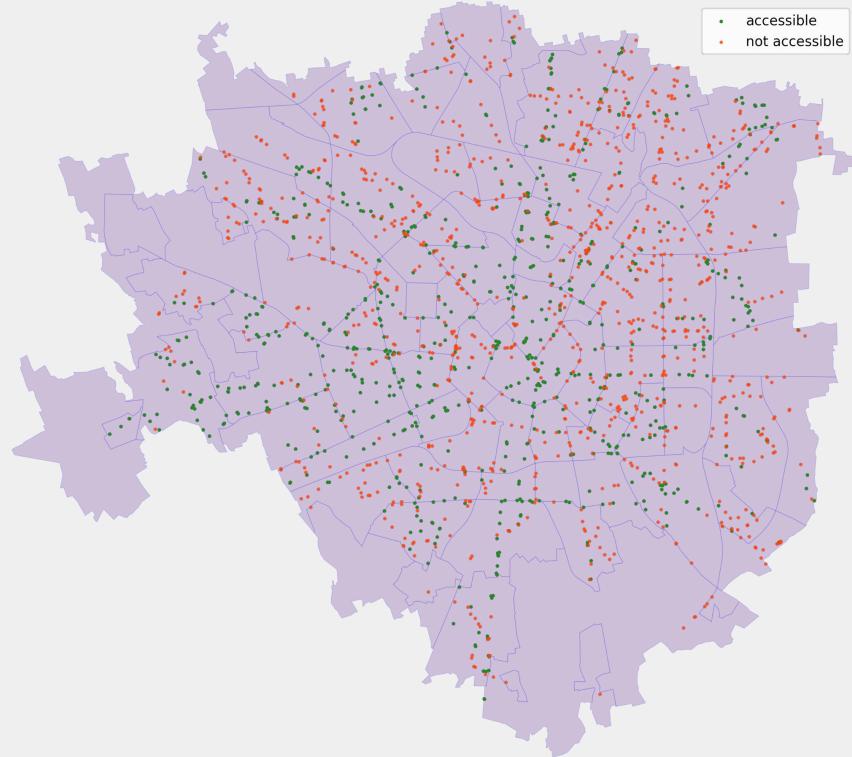
Number of active stops per
 km^2 per time slot



Developed metrics

Accessibility

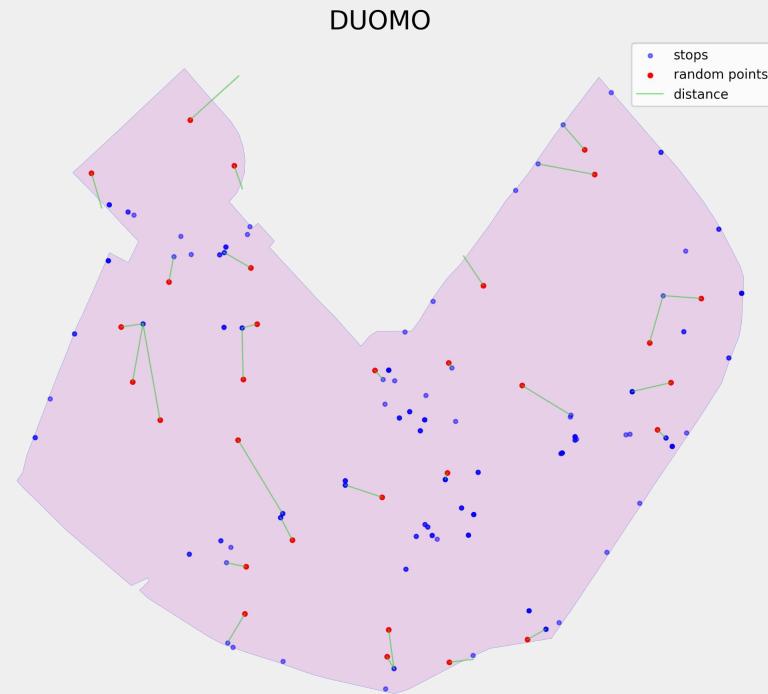
Rate of stops with infrastructure
for people with disabilities



Developed metrics

Proximity

Average distance to the
nearest station per time slot



Developed metrics

Diversity

Number of different travel
means available per time slot

Bus



Filobus



Tram



Metro

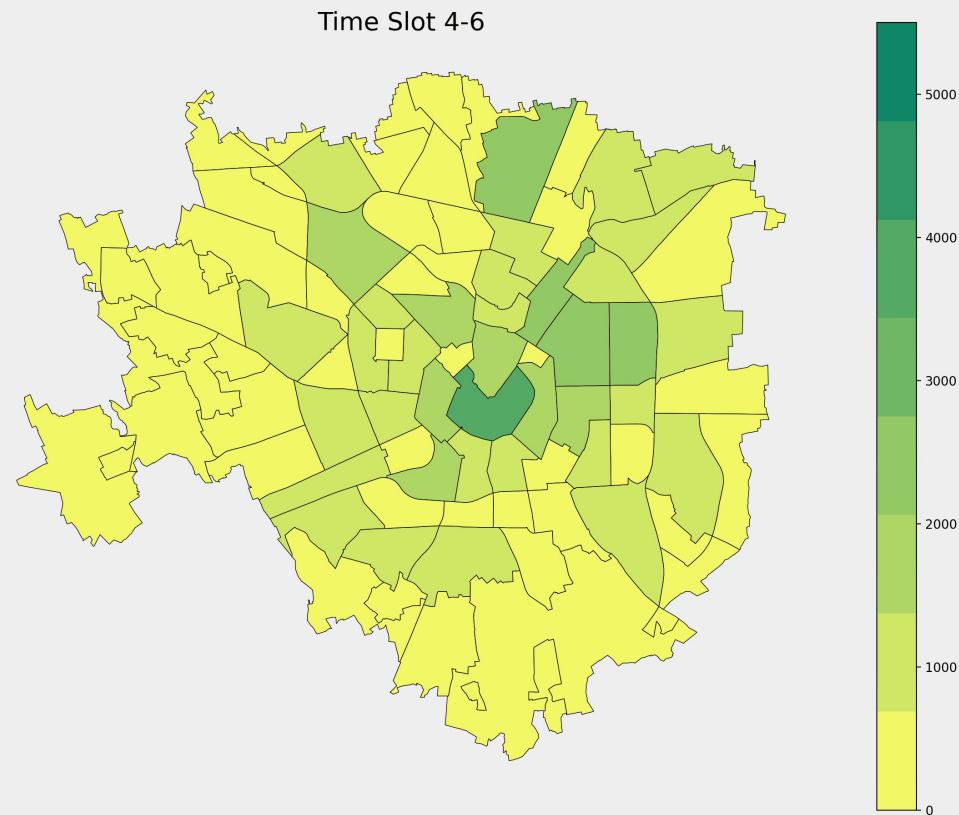




04 **Results and conclusions**

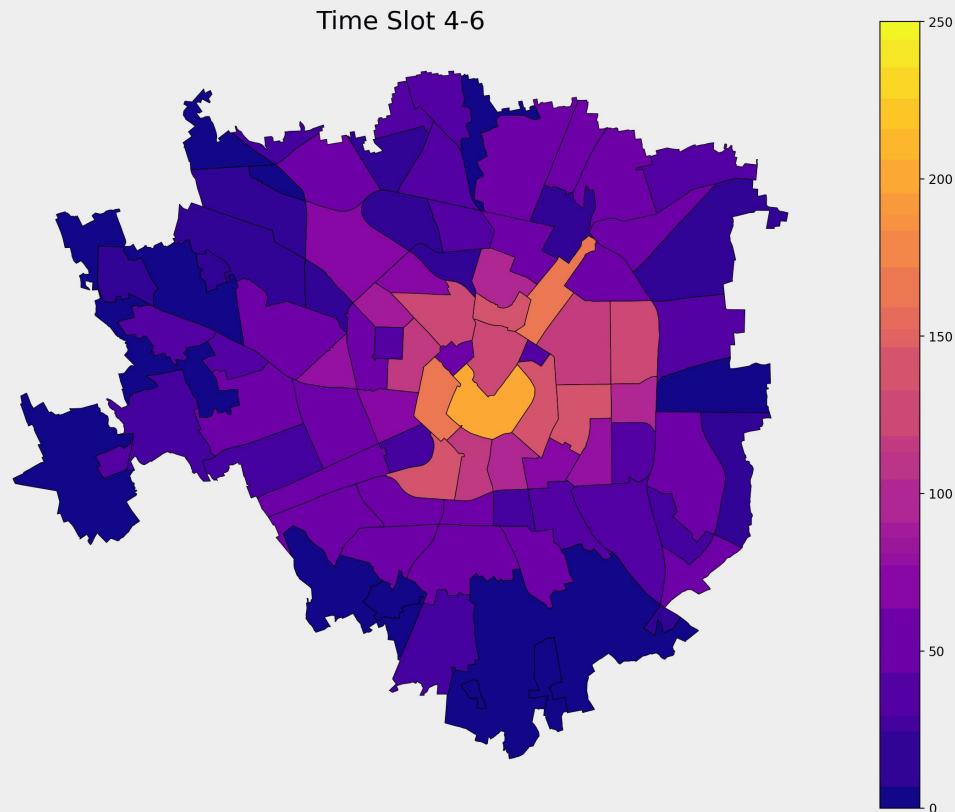
Frequency

The best served NILs in any time slot are Duomo and Buenos Aires. All NILs have at least 2 rides that run every hour from 6 a.m. to 8 p.m.



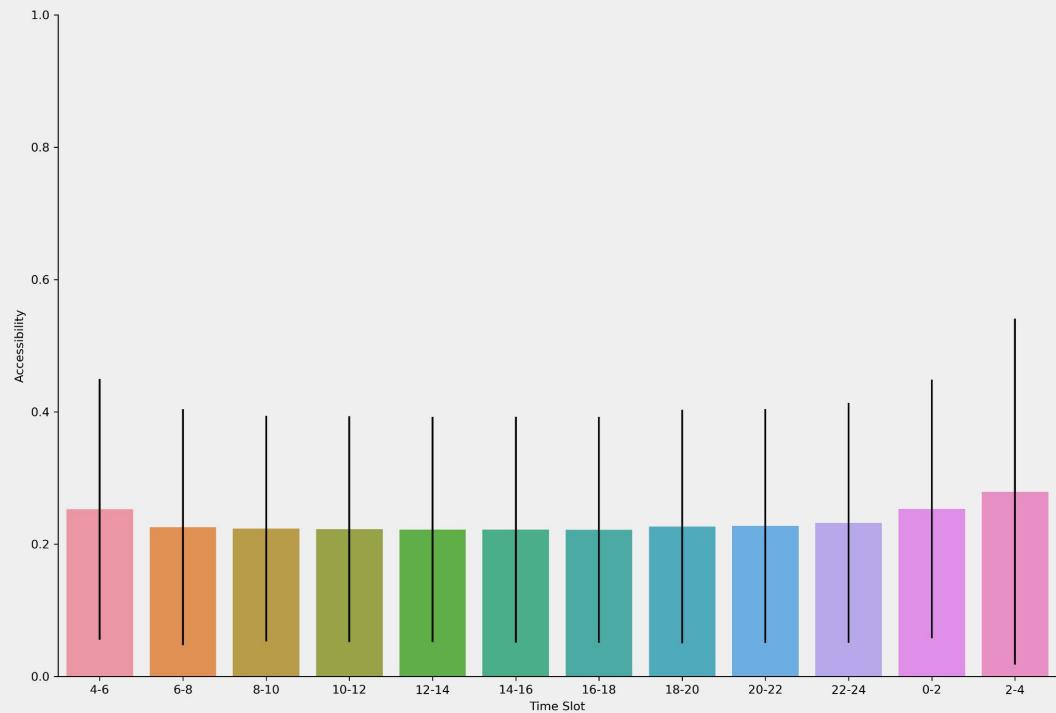
Density

Milan has an average active stops density of $86/\text{km}^2$: NILs like Duomo or Navigli diverge from this value with an average of almost $150 \text{ stops}/\text{km}^2$. On the other hand more than 20 NILs are below $50 \text{ stops}/\text{km}^2$ including Tre Torri.



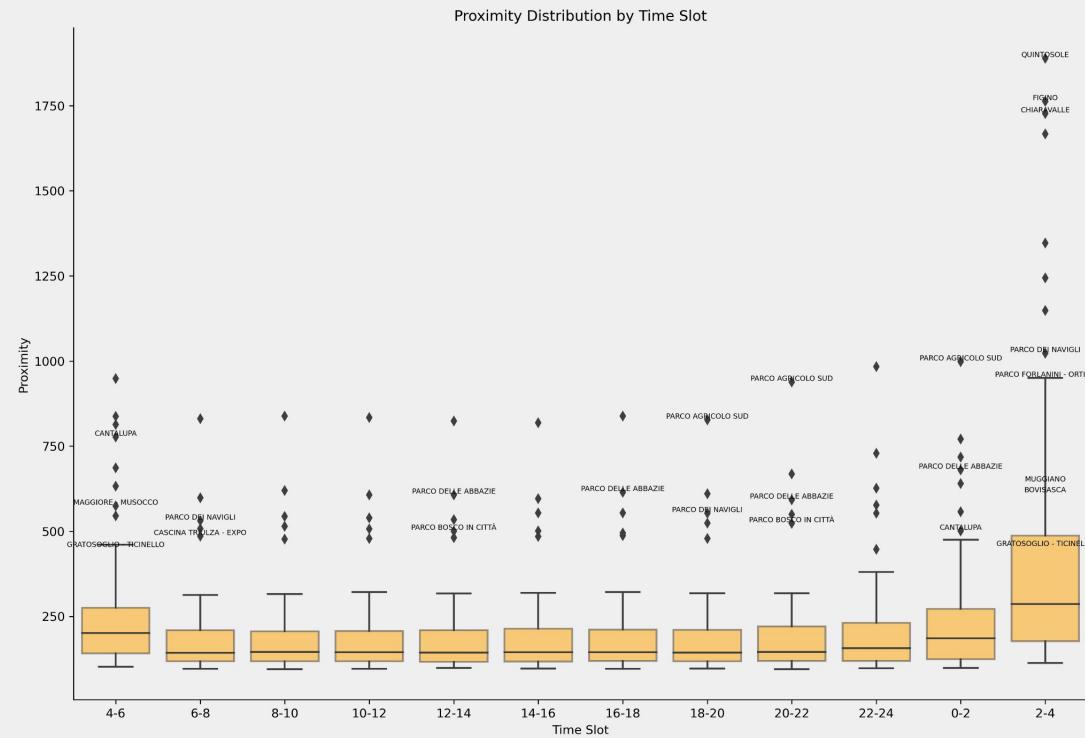
Accessibility

Only 23% of all stops within Milan's municipality have the proper infrastructure for people with disabilities. Giardini Porta Venezia, Navigli and Tre Torri with, respectively, 100%, 0,05% and 0% rate highly influence the mean value.



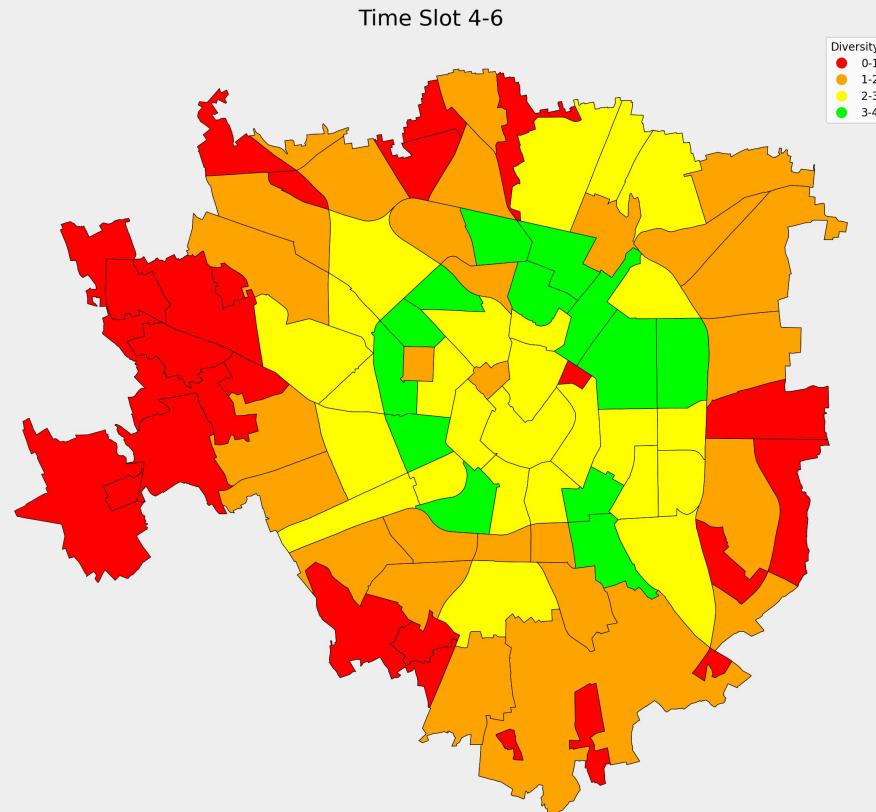
Proximity

Milan as an average distance to the nearest station equal to 220m. The areas with generally higher values are those characterized by large green areas and underpopulated. Furthermore, from 2 a.m. to 4 a.m. many NILs, such as Bovisa and Baggio, exceed 500m.



Diversity

66 NILs out of 88 have at least two means of transportation available. It is possible to identify the differences between the circles of Milan with the westernmost part served by, at most, one line.



Conclusions

The original data format did not facilitate the analysis. Overall Milan meets the requirements although most suburban areas proved to be less covered as might have been expected. It stands out more how some central NILs sometimes fail to reach acceptable values.

Finally it should be noted that this work does not take into account the heterogeneity of the population, the portion of green areas to population centers as well as the flow of people on public transport vehicles.



Thanks for
your
attention