SUITS

Data management and exploitation for sustainable urban mobility

Application in Torino

Webinar

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Urban freight logistics

"in Europe urban freight is responsible for 25% of urban transport related CO_2 emissions and 30 to 50% of other transport related pollutants"

"deliveries have a significant impact in terms of traffic congestions in urban areas, since they account for around 10-15% of the overall kilometres travelled"

"approximately 25-30% of all urban deliveries are carried out through light vans in Europe"

Meyer A, Meyer D (2013) City Logistics Research: A Transatlantic Perspective. National Academy of Sciences., Washington, D.C.
CIVITAS WIKI consortium (2015) Smart choices for cities - Making urban freight logistics more sustainable
ALICE, ERTRAC (2015) Urban Freight research roadmap

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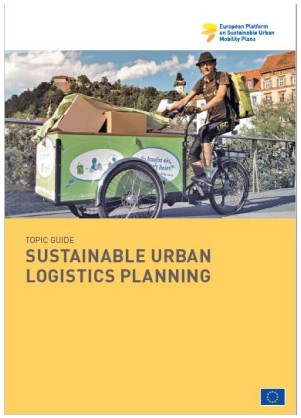
Which data? Which method?

All local authorities are in a position to determine and describe passenger mobility issues in both a quantifiable and a qualitative way. However, only a relatively small number are in a position to do the same for urban freight transport, i.e. to describe the size and characteristics of these transport activities. The majority of the existing data is private, and dedicated surveys need to be executed regularly. Additionally, cities are wondering which data and with which method this data should be collected and analysed for supporting the planning process for sustainable city logistics.



GUIDELINES FOR
DEVELOPING AND IMPLEMENTING A SUSTAINABLE URBAN MOBILITY PLAN
SECOND EDITION

https://urbact.eu

Trip details and patterns of goods vehicles in the urban area Trip details and patterns of service vehicles in the urban area Loading/unloading activity of goods vehicles in the urban area Parking activity of service vehicles in the urban area
+ Can provide information about vehicle trips and rounds without placing additional work on the driver or company—can give a detailed insight into speeds and travel times on different roads and routes + Can provide detailed routing information - Automatically captured data does not usually provide the same level of detail possible through vehicle trip diaries about type of goods, reason for stopping, quantity delivered unless the driver manually inputs data = Can be cheaper to analyse than data collected by a vehicle trip diary (as manual data input not required) but obtaining permission to access data (and potential purchase costs) can be problematic and prohibitive

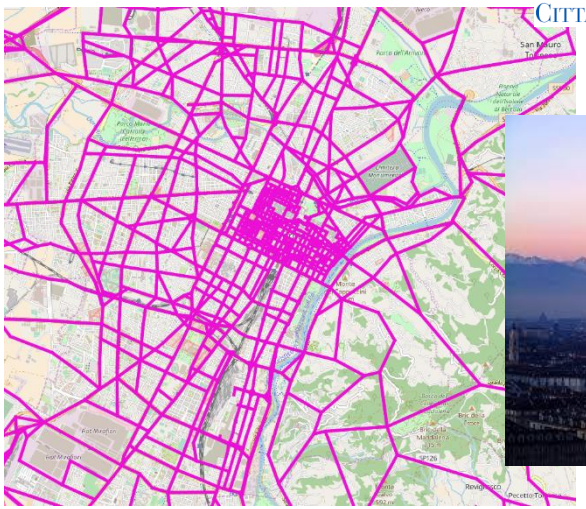
Test field and datasets – Torino (Italy)

- **GPS traces** of logistics vehicles fleet, delivery vans dataset
  - 360,820 positions recorded in a month period
  - 28 vehicles (vans) of various express couriers operators
  - Data available: position (lat, lon), time of acquisition, average speed, course
- **Traffic flows** on the city network
  - 5,980 arcs (roads) of Torino and its surroundings
  - Average vehicles flow (veh/h)
  - Travel time on the arc (sec)

May 2017

data provided by 5T

CITTA' DI TORINO



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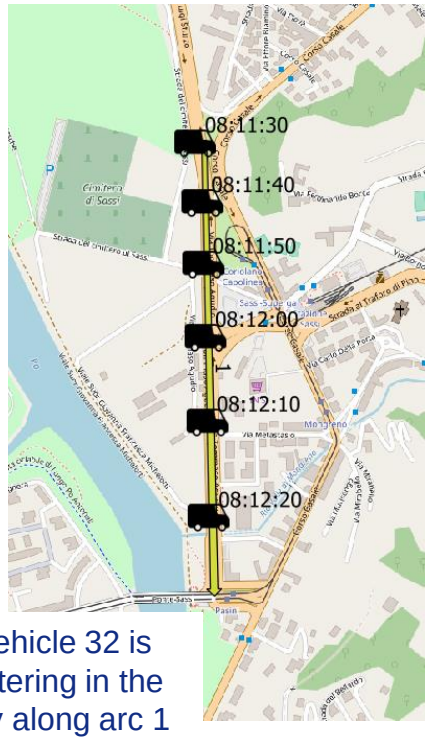
Methodology (I)

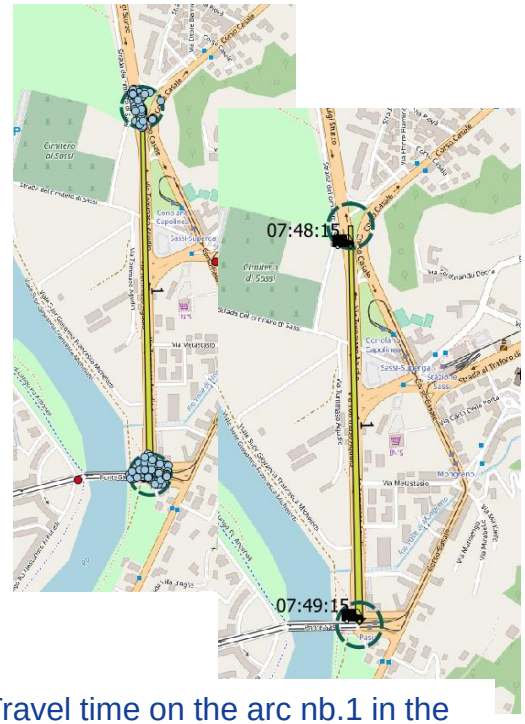
1. Spatial **join** of GPS positions and network arcs



Vehicle 32 is entering in the city along arc 1

Course are angular direction from North computed in degrees.

2. Travel **time** computation from GPS traces



Travel time on the arc nb.1 in the range hour 7.00-8.00 AM is 74 sec.

Estimation of travel time from GPS data: 60 sec.

3. Identification and analysis of **service stops** (> 2 min)

deviceid	data	fixtime	speed
20	03/05/2017	08:06:32	3.556911
20	03/05/2017	08:06:42	0.000000
20	03/05/2017	08:06:52	0.000000
20	03/05/2017	08:07:02	0.000000
20	03/05/2017	08:07:12	0.000000
20	03/05/2017	08:07:23	0.000000
20	03/05/2017	08:07:33	0.000000
20	03/05/2017	08:07:43	1.016260
20	03/05/2017	08:07:53	7.621951
20	03/05/2017	08:08:03	23.373984
20	03/05/2017	08:08:12	0.000000
20	03/05/2017	08:08:32	0.000000
20	03/05/2017	08:10:00	0.000000
20	03/05/2017	08:10:09	0.000000
20	03/05/2017	08:10:19	0.000000
20	03/05/2017	08:10:29	3.048780

Stop 1: 51 seconds → NO
Stop 2: 127 seconds → YES!

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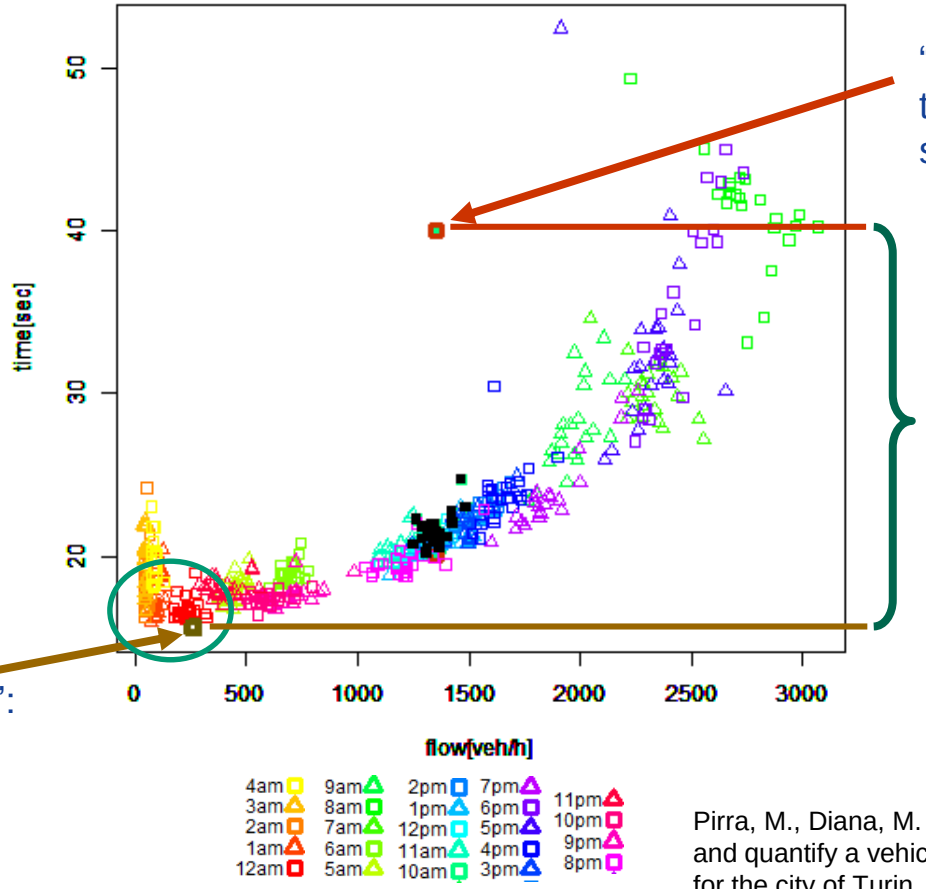
Methodology (II)

4. Evaluation of the directional **free-flow travel time**

relation between the **travel times** on arc (average time to travel along the corresponding road in a certain hour range) & **number of vehicles** that have travelled along the same arc in the same hour range



"**free flow travel time**": measures referring to uncongested road conditions

"**net GPS travel time**": travel time along arc - stopping time

time lost in congestion
KPI =
free flow travel time
–
net GPS travel time

KPI < 0 → wasted time in congestion

KPI > 0 → saving time without congestion

5. Calculation of the **KPI**

Pirra, M., Diana, M. Integrating mobility data sources to define and quantify a vehicle-level congestion indicator: an application for the city of Turin. Eur. Transp. Res. Rev. 11, 41 (2019)

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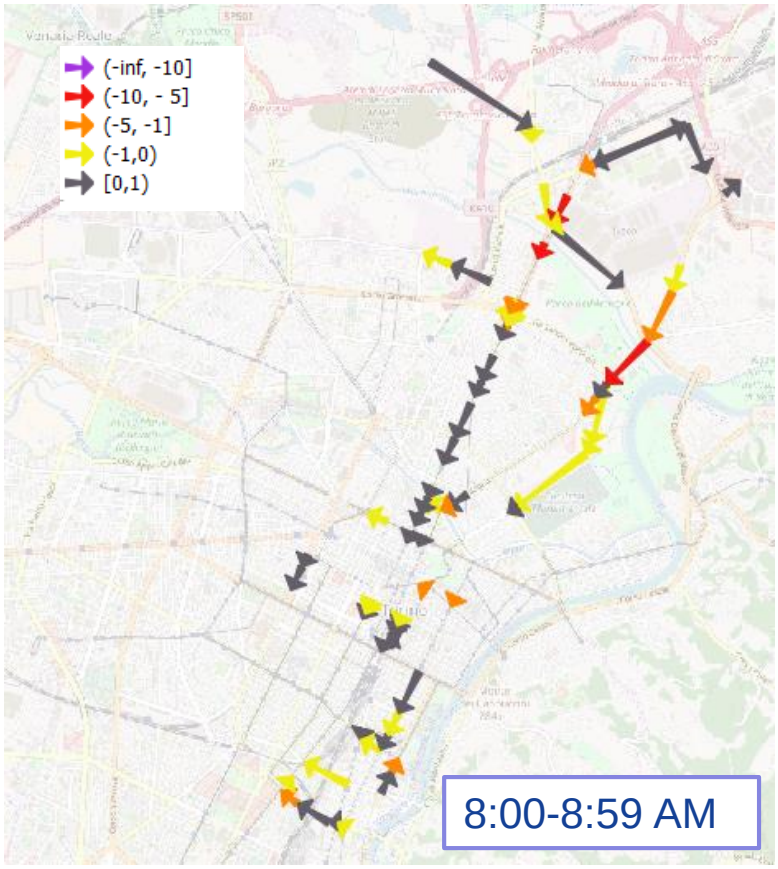
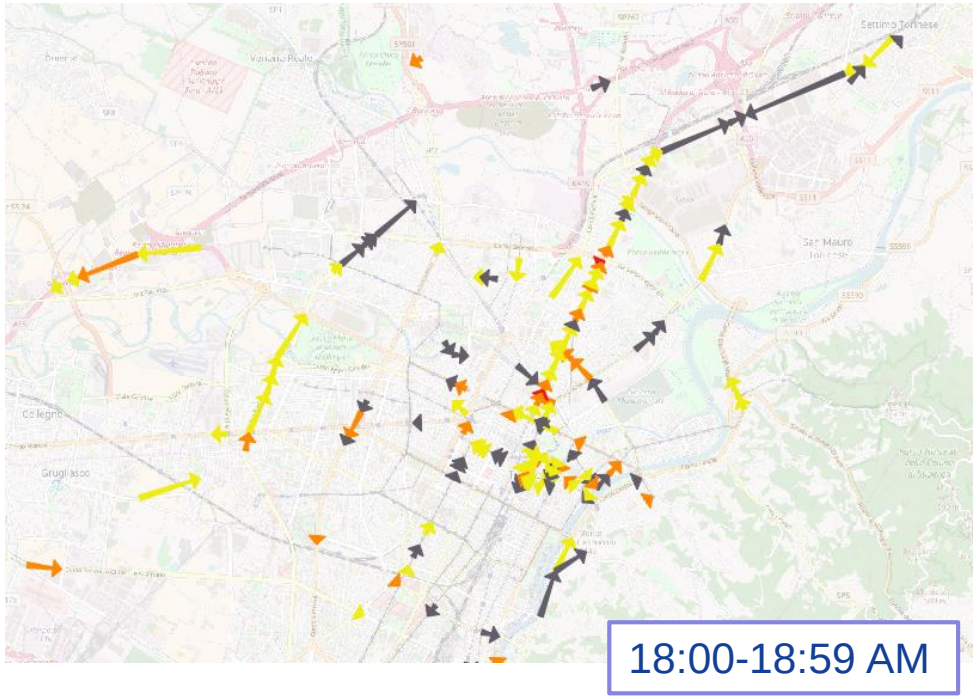
Results: network performance

- Focus on the **whole network**: which is the **worst arc** for the fleet of vehicles (maximum time lost)?





Maps show where the vehicles lose time due to congestion, with the most critical arcs identified in red and purple. Different direction during the day are found.

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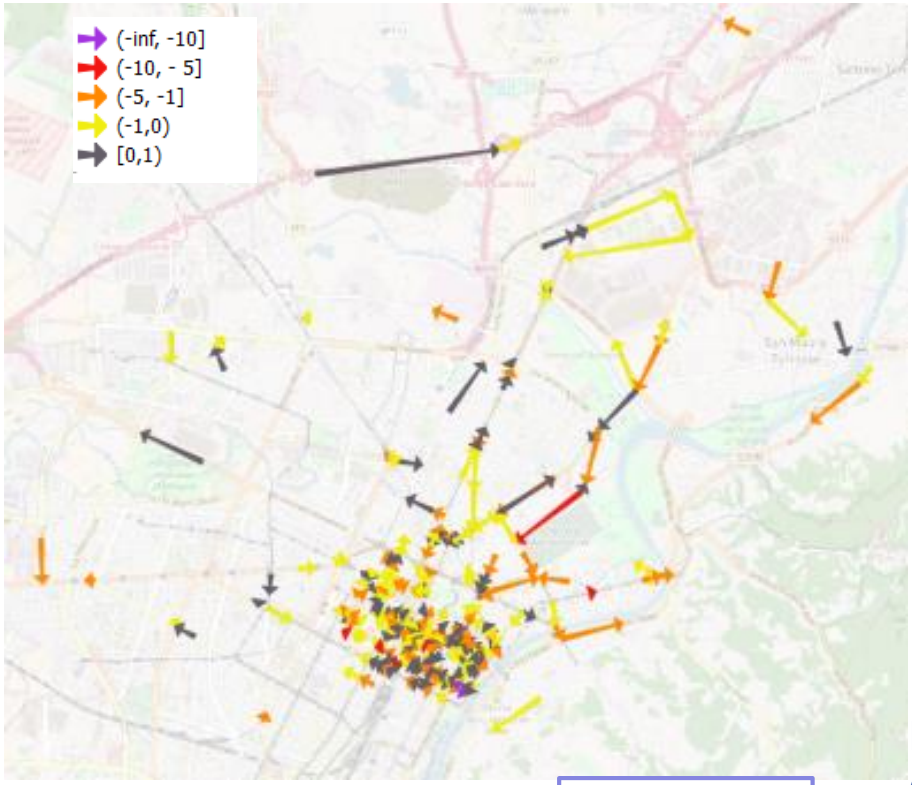
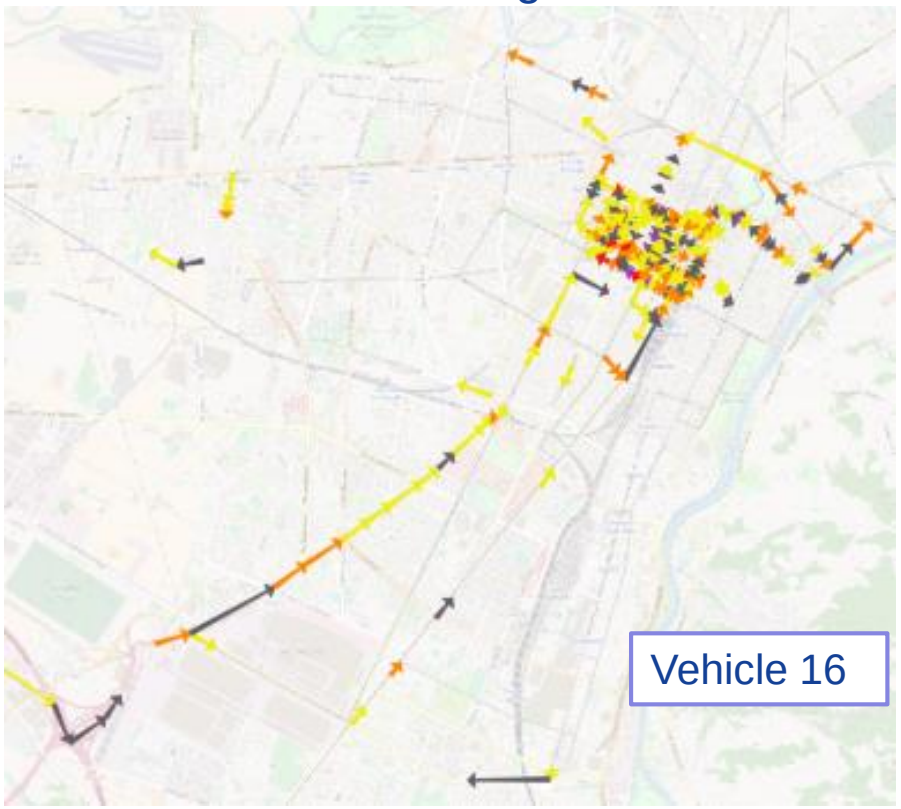
Results: vehicle performance

- Focus on the vehicles of the **fleet**: which **vehicle** is loosing most time in congestion?



Vehicle 31



Vehicle 16

Maps show how the vehicles travelled in different part of the city and where the vehicles lose time due to congestion

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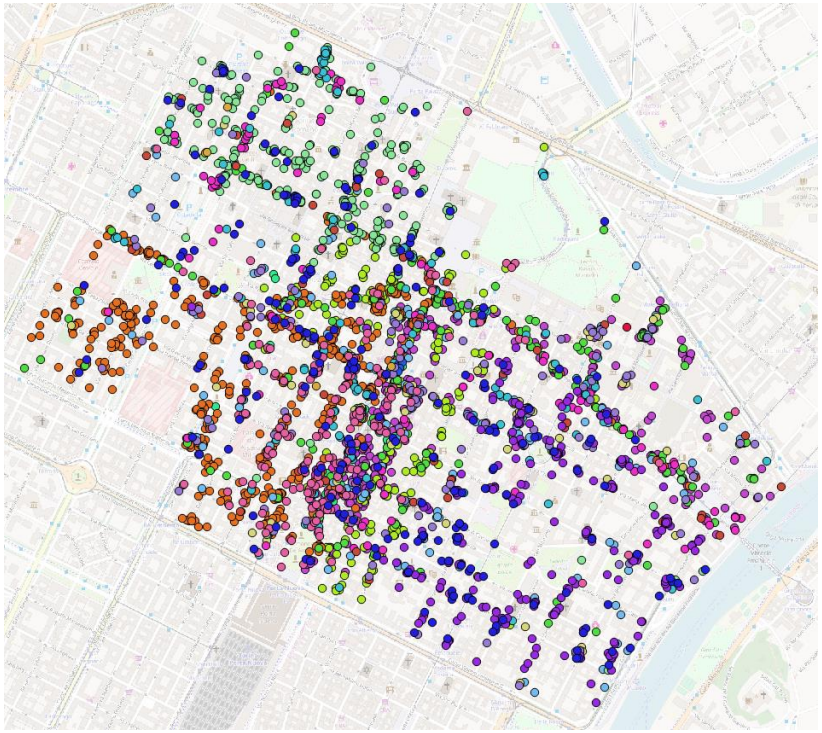
Tool testing in Torino: Freight flow from demand side

- It is important to analyse when the vehicle is **not moving** (due to reasons as deliveries, stops at crossings or traffic…) and the **duration** of these stops
- Different reasons and duration of **stops**:
  - ≤ 120 seconds (2 minutes) → due to normal traffic condition, yielding, red phase of traffic light
  - > 120 seconds (2 minutes) → due to deliveries and proper stops

https://corrieredelmezzogiorno.corriere.it

https://www.mintel.com



Turin Limited Traffic Zone
3336 stops with duration > 120 sec.
19 **vehicles** - different colours-

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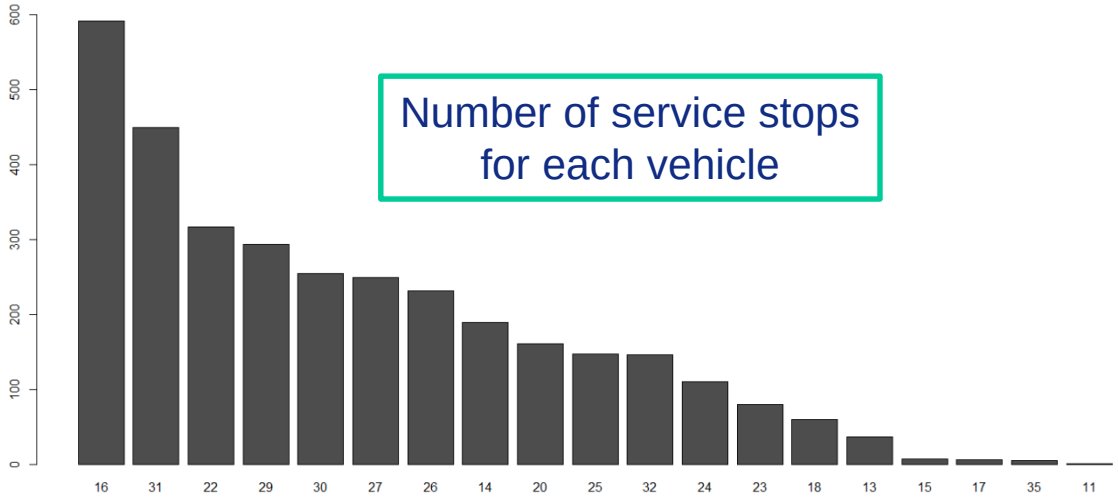
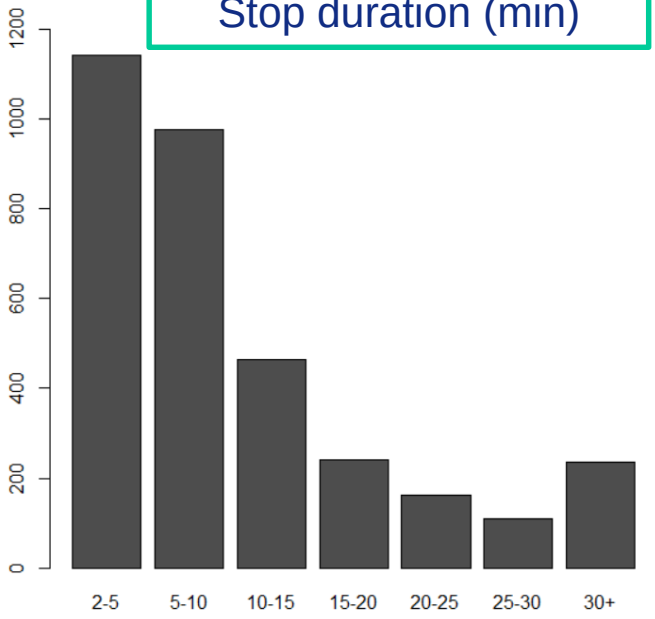
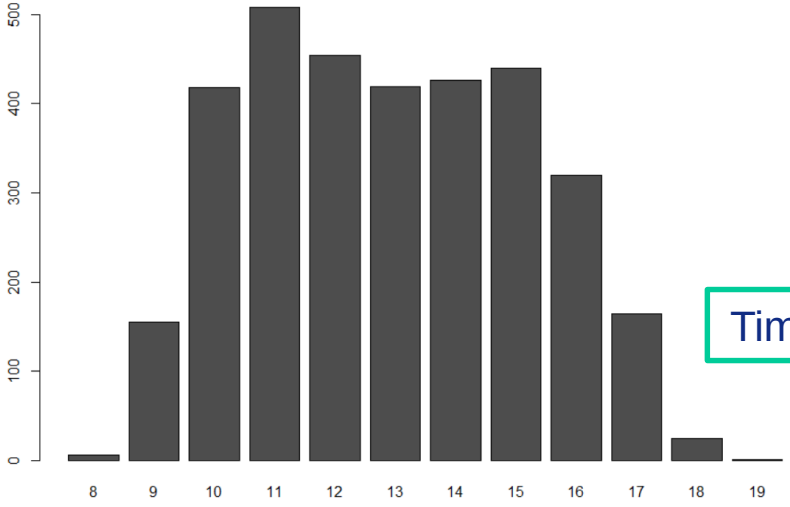
Preliminary results



Number of service stops for each vehicle



Stop duration (min)



Time ranges distribution

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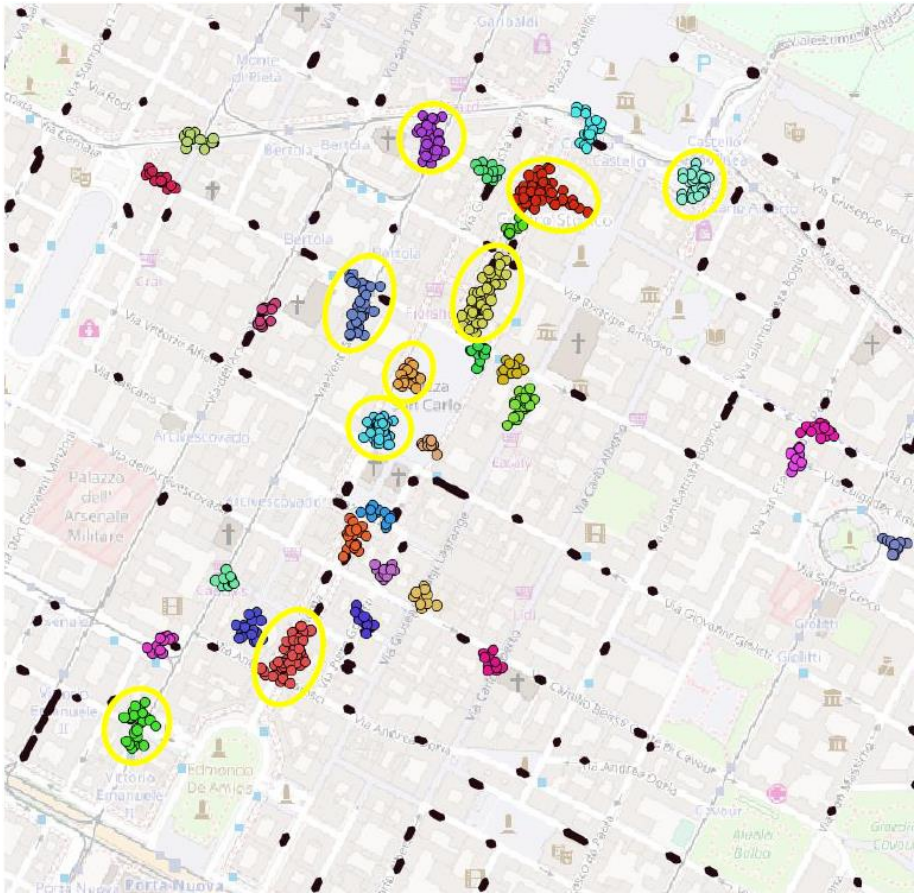
Identification of load/unload areas to focus on

A **clustering algorithm** extracts areas more used to delivery (Figure)

Other **aspects** considered to define the test sites for the tool:

- Presence of **load/unload areas**
- Number and duration of **stops**
- Number of **vehicles** delivering
- Specific selection of vehicles (those more affected by congestion according to the **KPI**)
- **Street characteristics** (not pedestrian, restricted to traffic…)



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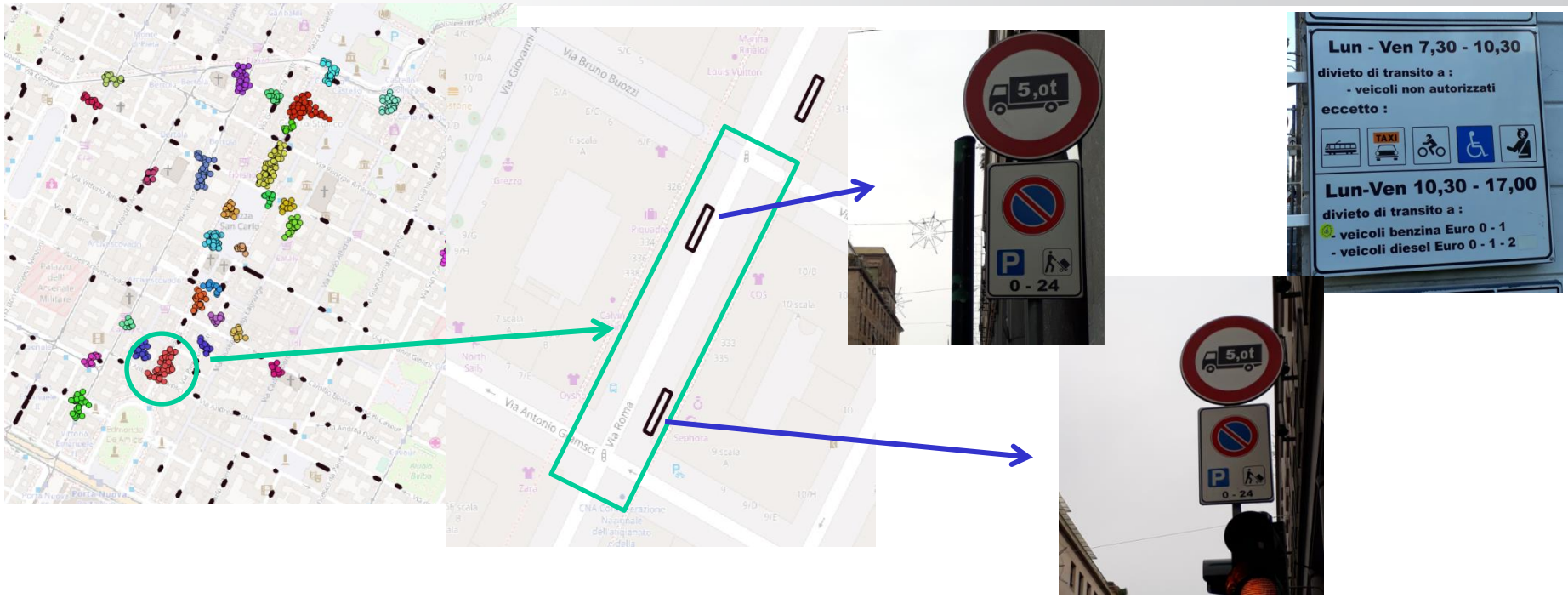
Area to run the pilot



	Location:		Time range:	H 10.00-13.00	H 13.00-16.00	Day:	
	Operator (SDA, GLS, UPS…)	Kind of vehicle - make & model (Ducato, Traffic, Boxer…)	Fuel (if available)	Plate number	Exact address stop	Initial time of stop (HH:MM:SS)	Final time (HH:MM:S
1							
2							
3							

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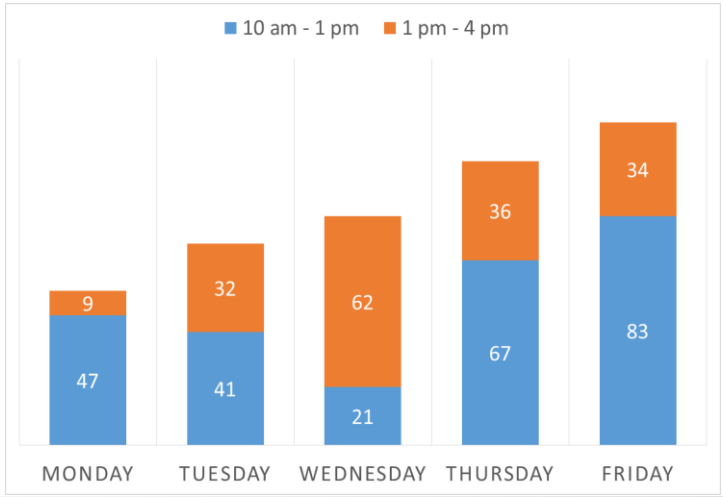
Results of the pilot

Stop events duration in minutes intervals

Stops events recorded in hour intervals



Number of packages delivered in each of the day monitored and in the two different time ranges

Diana M., Pirra M., Woodcock A. Freight distribution in urban areas: A method to select the most important loading and unloading areas and a survey tool to investigate related demand patterns, Transport Research Arena 2020, Helsinki, Finland. (Conference canceled)

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Summing up

- Identification of a policy-relevant KPI: **average time lost in congestion** to measure how congestion selectively affects different traffic streams / user groups
- **Integration** of different data sources: infrastructure-based (traffic flows) + GPS traces of fleets
- Understanding the **effectiveness** and **impacts** of delivering operations in key areas of the city
  - assessing the already available **unload/load parking** spots
  - understanding which **actions** LA should address to ameliorate urban freights policies at specific locations through looking at **deliveries** in a specific street and at the retailers and shops exploitation of express couriers' services

https://mole24.it

https://image.shutterstock.com

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Exploitation

- **Innovative** data integration method (no examples found so far in the scientific literature or in previous projects)
- Rather **flexible**: it can work also with different datasets according to local availability of data. The basic idea is to integrate traffic flows (e.g. from cell phones traces if no traffic counts are available) with GPS traces from fleets of vehicles
- Potentially useful inform a wide range of **policy actions**:
  - most **critical arcs** for given travel purposes (parcel services, commuting)
  - most **congested areas** in relation with specific user groups (if related metadata are associated with GPS traces)
  - most **congested lines** in a public transport network
  - possibility for LA to have a better **knowledge of freight distribution** patterns at the more disaggregated individual loading/unloading area
- Insights relevant for **different stakeholders:** city administrations, transport services operators, social groups…

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