



Gruppo FS

The Mobility Leader

Analysis of HSR passengers at Firenze S. Maria Novella Station in 2024

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De Cicco, Zamengo | Motion Analytica; Zaramella, Mancino, Di Sorte | Vodafone Italy.



About us

FASTWEB +  **vodafone**



Motion Analytica

Insights from people & things in motion

FS Research Centre

Il Centro Studi di Ferrovie dello Stato Italiane

Fastweb and Vodafone, part of the Swisscom Group, are driving digital transformation in Italy through investments in fiber and 5G networks, and innovation in AI, Cloud, and Cybersecurity — enhancing service quality for households, businesses, and public sector.

Motion Analytica, expert in advanced data science and artificial intelligence, leveraging evidence-based approaches to support strategic and operational decision-making.

FS Research Centre, the internal centre of excellence of the FS Group dedicated to advanced studies and research on mobility and related topics.



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How does the supply chain work?

Everyone's expertise combined towards a common goal

I. Data, technology, computing power, algorithmic know-how:

- data cleaning
- data anonymization and aggregation
- trips extraction
- expansion to the population level

Raw data extraction

Data processing
through standardised
algorithms

Utilisation of data for
mobility studies and
analyses

II. Transportation expertise, contextualisation and interpretation of results:

- define the purpose of the algorithms used to process data
- choice of parameters for trip extraction



The data

- ✓ Crowdcells DAS and AGPS radio **technology**
- ✓ Data from **20+ million** SIM cards
- ✓ **260k** telephone cells
- ✓ **99%** of the population covered with 4G
- ✓ **30 billion** detections per day



- ✓ Identification of **mobility governance** needs.
- ✓ Variable **definitions**: travel, transport mode, systematicity, ...
- ✓ Creating a **common language** with zoning.
- ✓ Setting up methodological and operational **approaches**.

Distributed Antenna Systems (DAS) are installed in buildings to amplify radio signals.
Assisted Global Positioning System (A-GPS) is a radio technology that improves GPS performance by using cell phone towers to help devices find satellites.



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Two types of Mobile Big Data

Mobile Network Data (MND)

- Mobile Network Data (MND), or Signal Data, consists of the sequences exchanged at very close frequencies between the SIM cards inserted into a device and the antennas that spread the signal, which are generated regardless of the occurrence of active events, such as calls, messages, or Internet connections.
- MND have the advantage of being very frequent and thus allow the movements of individuals to be tracked more continuously but are less precise in terms of localisation.



Mobile Phone Data (MPD)

- Mobile Phone Data (MPD), or Event-Generated Data consists of the set of SIM-related data generated by the occurrence of active events such as calls, messages, or Internet connections.
- MPD, although less frequent, allow for more precise localisation.



Big data to feature people urban mobility

- ❖ The primary goal in using Big Data for mobility analysis is to ensure the quantification of the fundamental **elements of mobility behaviour**, such as origin and destination, daily hourly distribution, seasonal distribution, mode and purpose of the travel.
- ❖ Compared to conventional surveys, the use of Big Data generates **sample sizes** that are a several orders of magnitude greater, which would suggest a clear advantage.
- ❖ However, it is necessary to address certain **limitations** relating to the interpretation of the raw data.
- ❖ In order to handle the Big Data sample sizes, the elaboration process does not allow for the analysis of individual cases, as can be done with small scale surveys, but must necessarily be standardised according to **algorithms**.



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From assets to outcomes

Station attendance

Roma Termini

Choose station and period
 Choose period: December 2024
 Choose station: Roma Termini

Total
8.4 millions

15.4% 84.6%
 Foreigners Italians

2.3 milioni
 Number of visitors*
 6.1 milioni
 Passengers

Types of travelers

35% Commuters 65% Occasional

	Commuters	Occasional
Sunday	18%	82%
Monday	39%	61%
Tuesday	41%	59%
Wednesday	44%	56%
Thursday	40%	60%
Friday	35%	65%
Saturday	22%	79%

*Travelers present at the station who do not use train services.
 **Arrival or departure from the station by private transportation, public services (except train) or on foot.

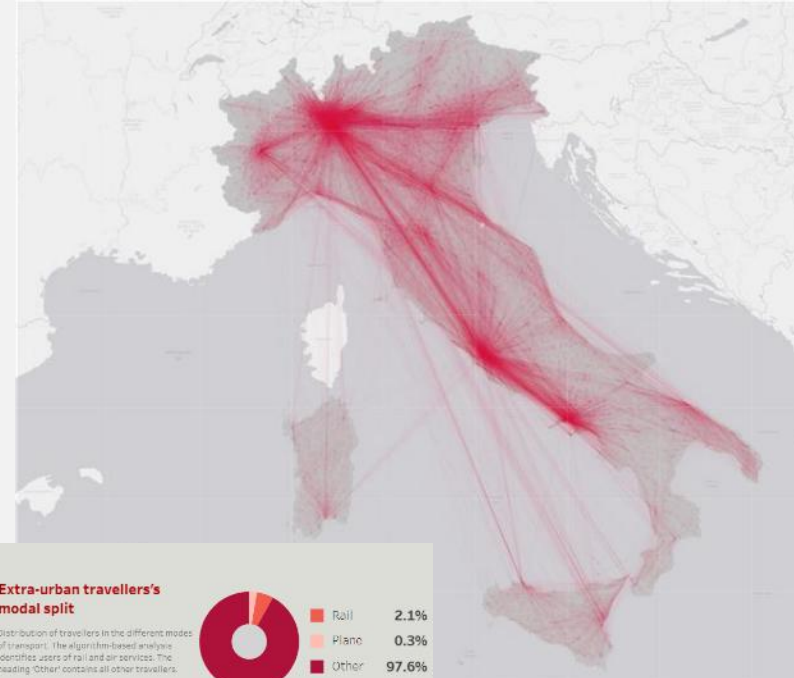
Analysis of the presence of people in the station through the processing of Vodafone Analytics (non-personal telephone Big Data, anonymized and aggregated in absolute compliance with the privacy requirements of the GDPR).

Time in station

average time **34 min**

Analysis of the average waiting time of people arriving and departing from the station

	High speed	Airport transfer	Regional, Intercity	Other services**
Arrival	28'	33'	35'	27'
High speed	28'	33'	35'	27'
Airport transfer	48'	46'	26'	
Regional, Intercity	42'	36'	41'	26'
Other services**	51'	34'	40'	34'



Distribuzione degli utenti giornalieri

Selezione periodo: luglio 2025
 Tipo giorno: (Tutti)

Classe distanza (km)	utenti medi giorno	% del totale di utenti m...
0 - 5	1.950.487	5,31%
5 - 10	3.205.642	8,73%
10 - 25	9.119.905	24,84%
25 - 50	9.007.448	24,54%
50 - 100	7.477.003	20,37%
100 - 250	4.457.562	12,14%
250 - 500	919.866	2,51%
> 500	245.907	0,67%
non disponibile	326.717	0,89%
Totale compless...	36.710.437	100,00%



Elaborazione su dati Vodafone

July 2025

Select period and geographical area
 Choose period: July 2025
 Choose region: (Tutti)

Travellers' daily average (month)

Working day: 37.0 millions (72% of the total)
 Non-Working day: 35.8 millions (71% of the total)

Extra-urban travellers' modal split

Distribution of travellers in the different modes of transport. The algorithm-based analysis identifies users of rail and air services. The heading 'Other' contains all other travellers.



Mobility rate by day of the week

Day	Mobility rate
Sunday	69.8%
Monday	71.0%
Tuesday	71.8%
Wednesday	71.9%
Thursday	72.1%
Friday	72.7%
Saturday	72.2%

Daily average travelled distance

Working day: 64.3 km
 Non-Working day: 72.3 km

From January 2024, a new, more effective algorithm was adopted for the calculation of the indicators in the report FS. The numbers reported are therefore no longer comparable with those of previous years.

* The analysis considers only Italian SIM cards. Processing of Vodafone Analytics (non-personal telephone Big Data, anonymized and aggregated in absolute compliance with the privacy requirements of the GDPR).



What we did



Travellers

Unique foreign travelers who concluded a holiday in Italy by 31/03/2024, and who made a train trip to or from Florence railway station in **January 2024**, were analyzed.



Tour of Italy

The analysis of the Tour of Italy reveals the main chains of tourist **accommodation destinations** during the holiday in Italy.

The tourist's overnight stay is associated with the municipality where he spent most of the day.

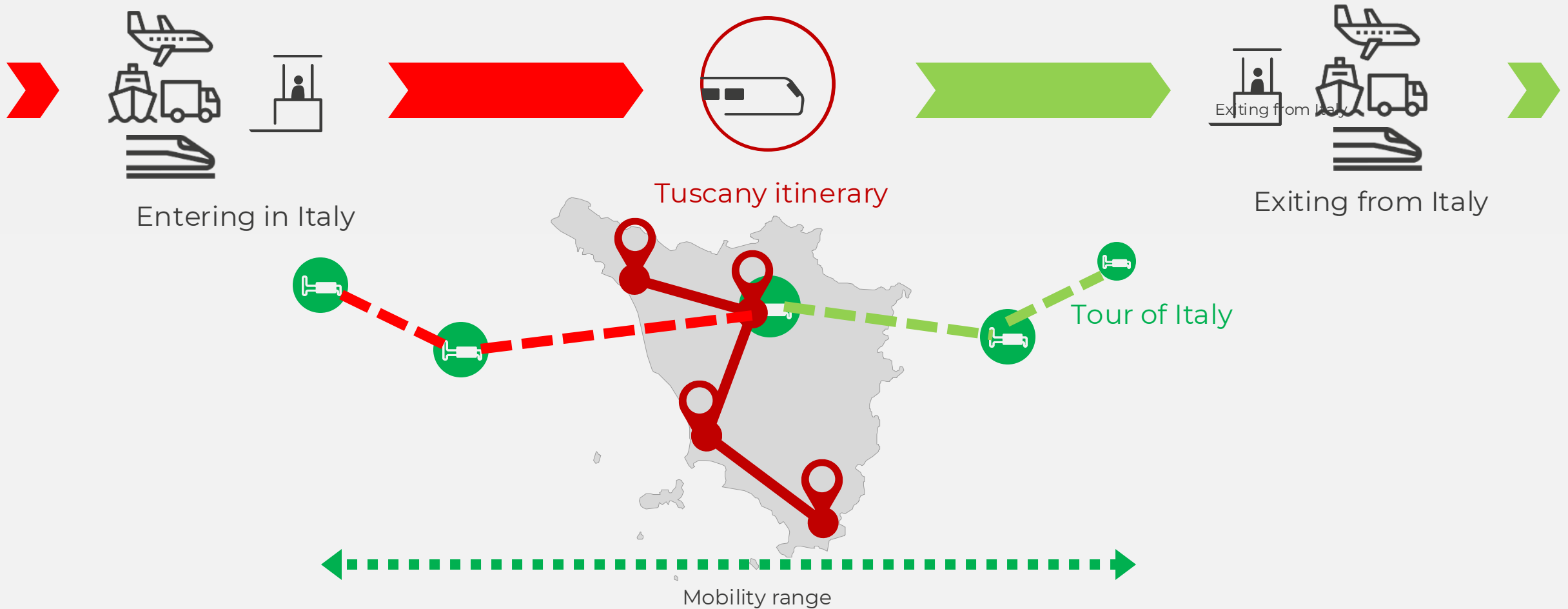


Tuscany itinerary

The Tuscan itinerary is an in-depth look at excursions in Tuscany, (the municipalities where a day visitor spent at least one hour in January 2024).

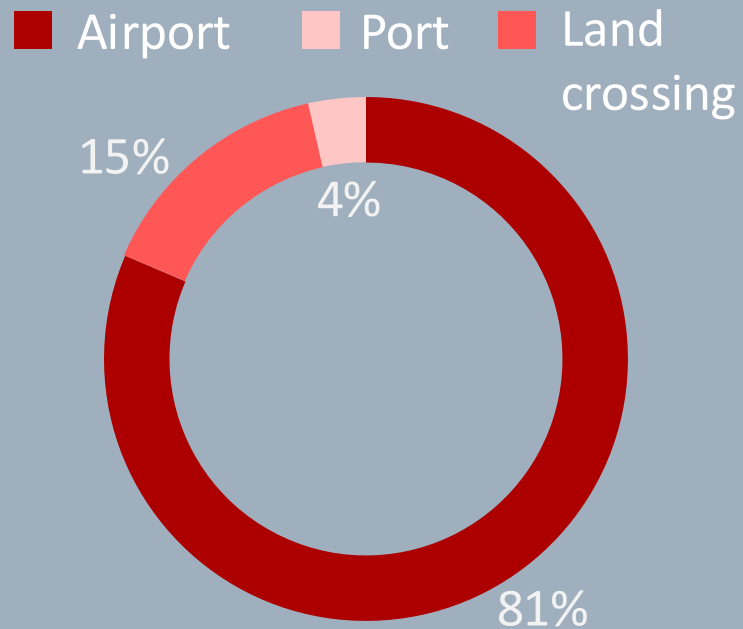
The study of the itineraries in Tuscany reveals the **main tour chains**.

Methodological aspect

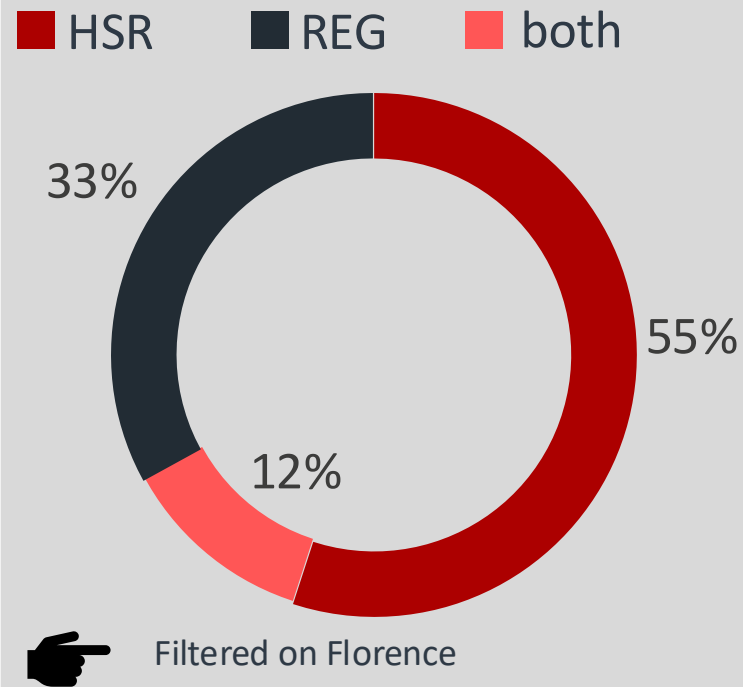


How foreigners have traveled in Italy?

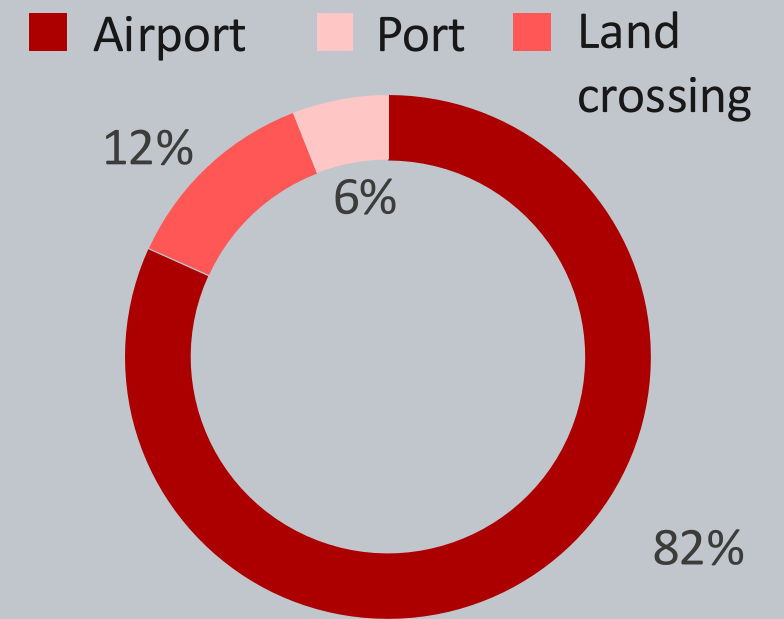
Entering in Italy



During the travel in Italy



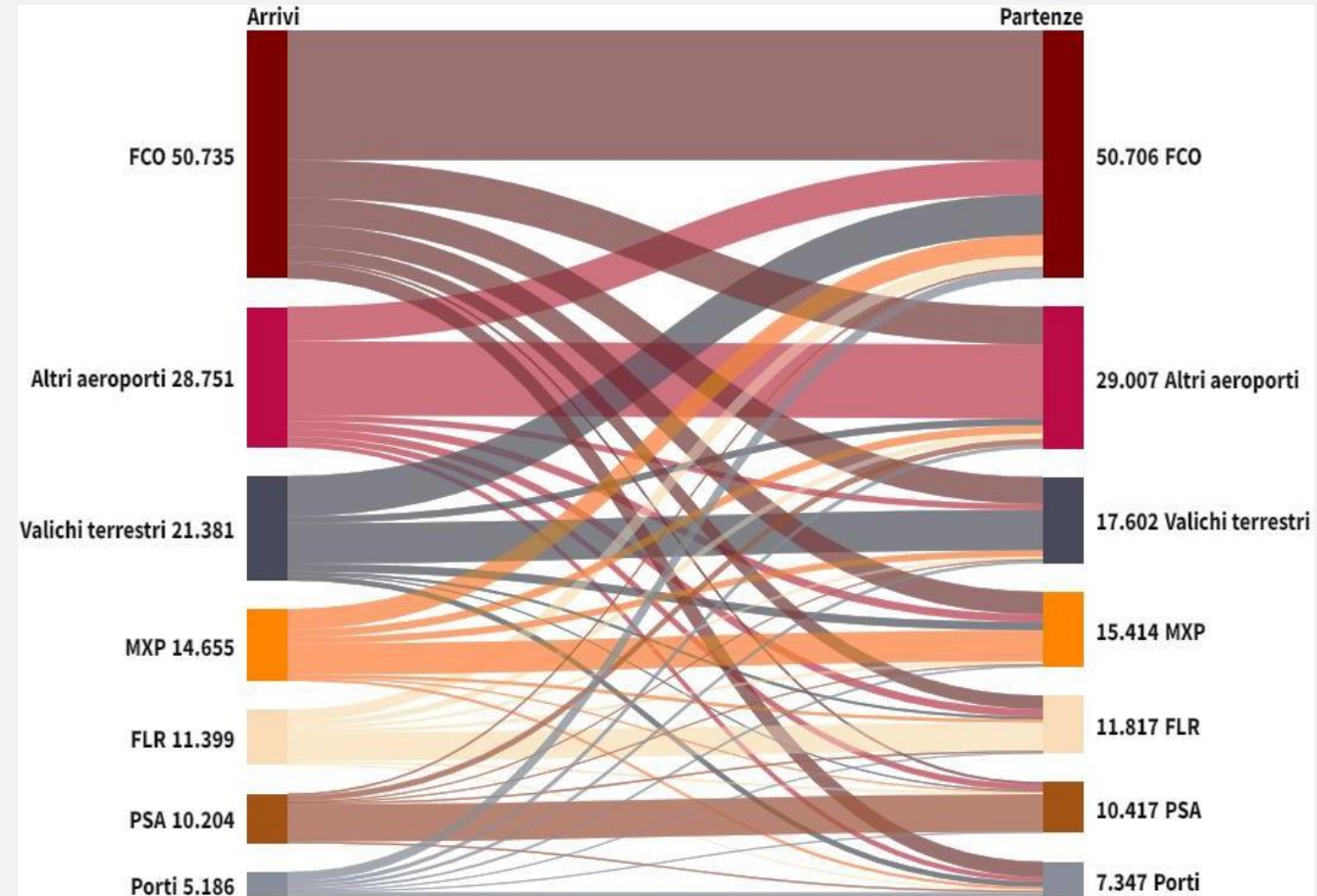
Exiting from Italy



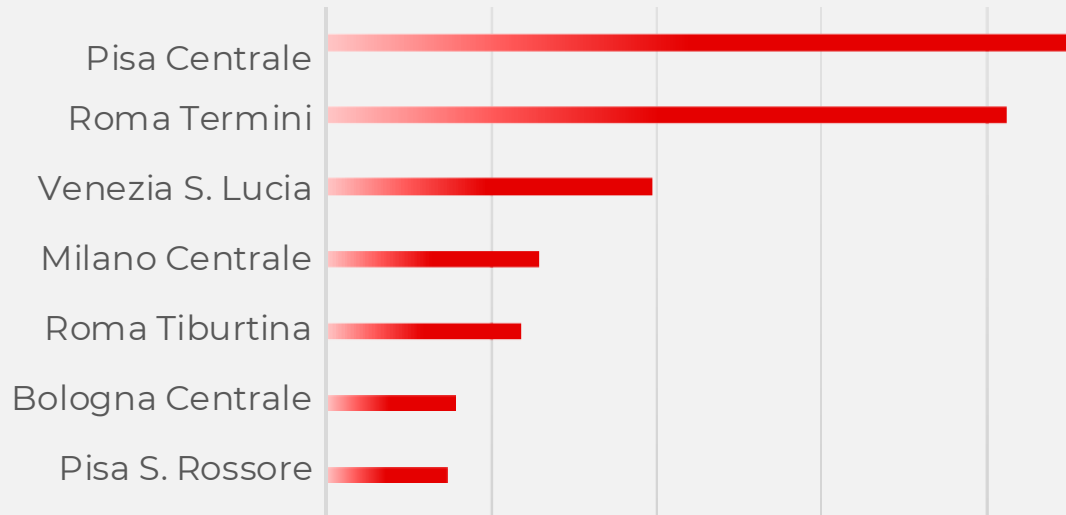
How travelers enter/leave Italy



Most travelers reach and leave the country from one of the main airports, more than one in three from Fiumicino. Half of travelers leave Italy from a **different border** than the one of entry.



Main railway destinations from Firenze



Pisa centrale

44.789

viaggiatori

Roma termini

41.167

viaggiatori

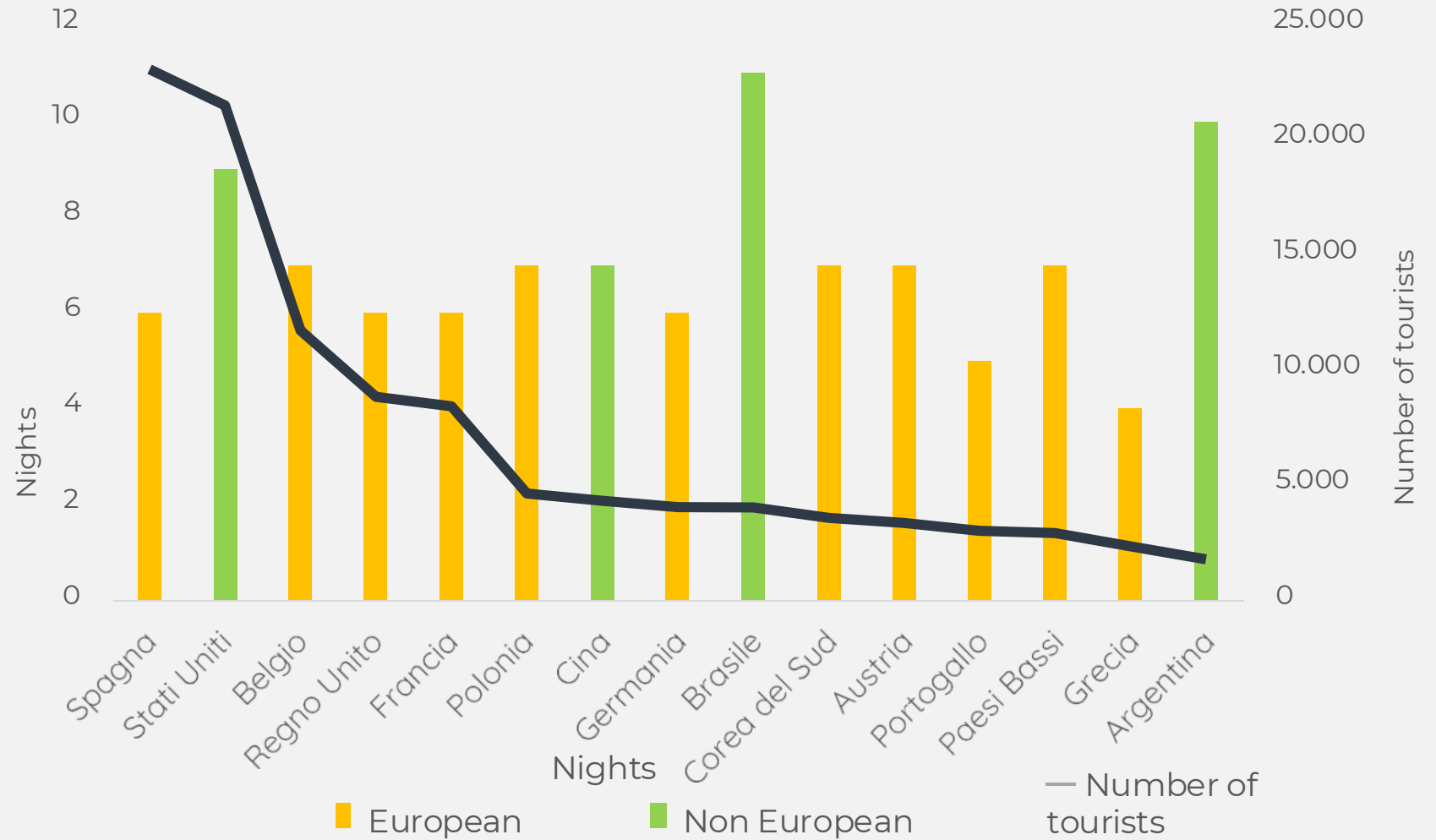
Venezia S. Lucia

19.714

viaggiatori

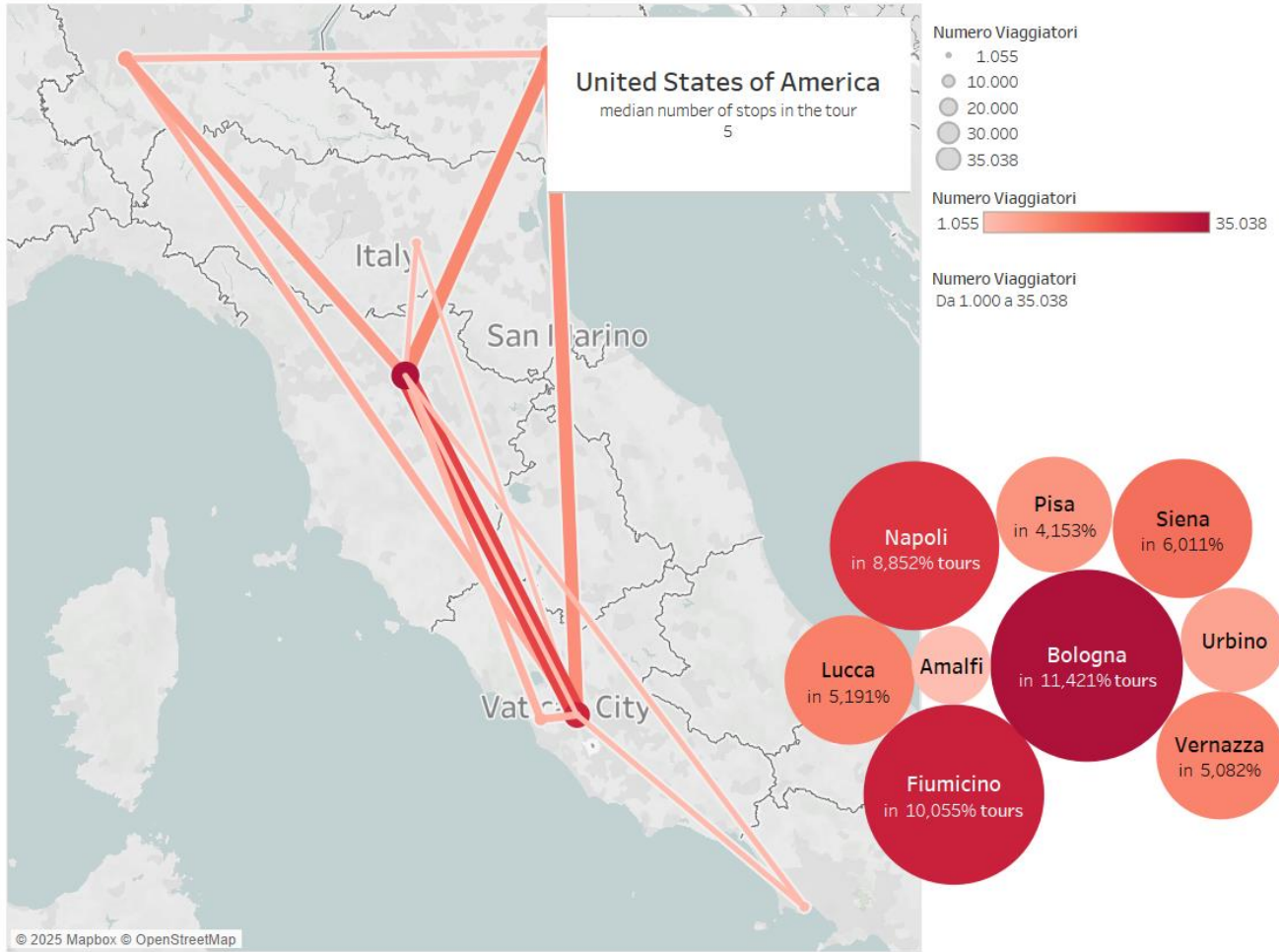


Holidays in Italy



Grand Tour of Italy

Mobility patterns by nationality



The Grand Tour of Italy, for foreigners who have traveled by train to/for Florence railway station, includes mainly Rome, Venice and Milan, touching many other destinations such as Naples and its gulf, Verona, Bologna and Pisa.

The tours shown at least 250 tourists. The thickness of the arch represents the number of tourists who have stopped in the two connected municipalities; the size of the node the number of tourists who stayed overnight in the city.

Predicting is possible?

Itineraries in Tuscany, for foreigners who have traveled by train arriving at the Florence station. They have not only visited Florence but Pisa, Lucca, San Gimignano, Siena and Reggello

Of those who stop by

**FIRENZE,
MONTERIGGIONI
and other 3
Municipalities**

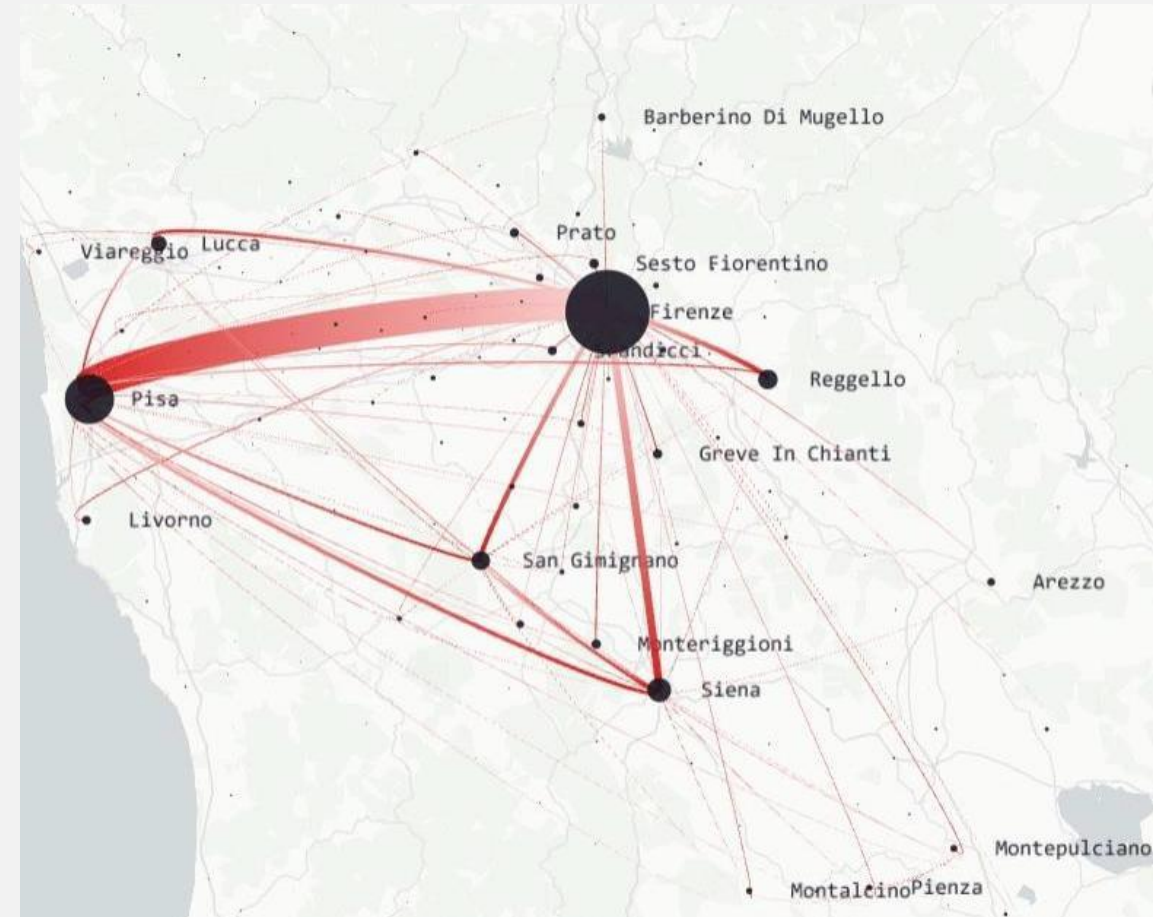
72%

**PISA, SAN-
GIMIGNANO e
SIENA**

**SAN GIMIGNANO
and
MONTALCINO**

93%

also makes a
stop
At **SIENA**



Of the 140,346 itineraries recorded, half end with a visit to Florence, half includes at least one other city in Tuscany



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Limitations, applications and future development

How can we improve?





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Thank you

